Oklahoma
Comprehensive Wildlife Conservation Strategy

Oklahoma Department of Wildlife Conservation

Planning for the Future for Oklahoma's Wildlife

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Appendices:

Roadmap to the Eight Federal Required Elements

(Specific crosswalk between elements and the Comprehensive Wildlife Conservation Strategy)

This chapter is provided for those who are evaluating this document for the purpose of determining if Oklahoma's Comprehensive Wildlife Conservation Strategy process meets the eight Congressionally required elements.

Please refer to the following chapters and page numbers to examine how each required element was addressed in the development of the Comprehensive Wildlife Conservation Strategy. *The references to Regions/Conservation Landscapes are examples; please refer to the Table of Contents for page numbers to determine how those elements were addressed for each Region/Conservation Landscape.*

Element 1:

Information on the distribution and abundance of species of wildlife, including low and declining populations as the state deems appropriate, that are indicative of the diversity and health of the state's wildlife:

Note: Each Conservation Landscape chapter within each Region contains a list of the species of greatest conservation need found in that habitat type. Each species population status is indicated in relative terms of low, medium, abundant, and unknown. Each species population trend is indicated in terms of relative terms of declining, stable, increasing, and unknown. Species are prioritized in tiers (i.e., sets) of I, II, and III based on their scores.

A. The Strategy indicates sources of information (e.g., literature, data bases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.

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Each Conservation Landscape chapter contains wording referring to best professional judgment as described in the Approach and Methods Chapter and Appendix D as the primary source of information rather than literature searches and data base searches. For example: Shortgrass Prairie Region: Conservation Landscape: Shortgrass Prairie	16
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B. The Strategy includes information about both abundance and distribution for species in all major groups to the extent that data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.

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Each Conservation Landscape chapter contains a table listing the species of greatest conservation need found in that region's habitat as well as the population status and trend for each species. For example: Shortgrass Prairie Region: Conservation Landscape: Small Rivers and Sloughs/Ponds	28

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C. The Strategy identifies low and declining populations to the extent data are available.

	Chapter	Page
	Each Conservation Landscape chapter contains a table listing the species of greatest conservation need found in that region's habitat as well as the population status and trend for each species. For example: Tallgrass Prairie Region: Conservation Landscape: Small River	58-59
	Appendix D: Oklahoma's Species of Greatest Conservation Need Selection and Scoring Criteria (all species were weighed against population status criteria; Appendix D lists only those selected as species of greatest conservation need)	352-358

D. All major groups of wildlife have been considered or an explanation is provided as to why they were not (e.g., including reference to implemented marine fisheries management plans). The State may indicate whether these groups are to be included in a future Strategy revision.

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E. The Strategy describes the process used to select the species in greatest need of conservation. The quantity of information in the Strategy is determined by the State with input from its partners, based on what is available to the State.

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	Appendix D: Oklahoma's Species of Greatest Conservation Need Selection and Scoring Criteria	352-358

	Chapter	Page
	(all species were weighed against the selection criteria; Appendix D lists only those selected as species of greatest conservation need)	

Element 2:

Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1):

Note: Key habitats are located within six geographic regions. "Conservation Landscape" in this Strategy is the term used to convey the concepts of "key habitats and community types" identified by Congress, and is considered to be synonymous with "habitat type," "vegetation communities," and "aquatic communities." Each Conservation Landscape chapter defines the habitat's relative condition in terms of poor, good, excellent, and unknown.

A. The Strategy provides a reasonable explanation for the level of detail provided; if insufficient, the Strategy identifies the types of future actions that will be taken to obtain the information.

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Each Region introduction page contains prioritized sets of key habitats found in that region. For example: Shortgrass Prairie Region	15
Each Conservation Landscape chapter contains a statement about the relative condition and trend of that habitat. For example: Tallgrass Prairie Region: Conservation Landscape: Bottomland Hardwood Forest	76
Each Conservation Landscape chapter contains conservation issues and actions addressing incomplete data/information about that habitat. For example: Tallgrass Prairie Region: Conservation Landscape: Sandy (soft)-bottom Streams and Associated Riparian Forests	91-92

B. Key habitats and their relative conditions are described in enough detail such that the State can determine where (i.e., in which regions, watersheds, or landscapes within the State) and what conservation actions need to take place.

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Each Region introduction page contains a prioritized list of key habitats (Conservation Landscapes) found in that region. For example: Shortgrass Prairie Region	15
Each Conservation Landscape chapter contains a statement about the relative condition and trend of that habitat. For example: Mixedgrass Prairie Region: Conservation Landscape: Gypsum or Sandstone Canyonlands and Gypsum Caves	112
Each Conservation Landscape chapter contains conservation issues and	125-126

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	actions addressing incomplete data/information about that habitat. For example: Mixedgrass Prairie Region: Conservation Landscape: Herbaceous Wetland	

Element 3:

Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats:

Note: Each Conservation Landscape chapter contains issue (i.e., problem) statements relative to managing the species of greatest conservation need in that habitat. Issues are listed in general order of priority.

A. The Strategy indicates sources of information (e.g., literature, databases, agencies, or individuals) used to determine the problems or threats.

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Each Conservation Landscape chapter contains wording referring to best professional judgment as described in the Approach and Methods Chapter and Appendix D as the primary source of information rather than literature searches and data base searches. For example: Mixedgrass Prairie Region: Conservation Landscape: Streams and Associated Riparian Forests	139
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B. The threats/problems are described in sufficient detail to develop focused conservation actions (for example, “increased highway mortalities” or “acid mine drainage” rather than generic descriptions such as “development” or “poor water quality”).

Chapter	Page
Each Conservation Landscape chapter contains conservation issue statements. For example: Mixedgrass Prairie Region: Conservation Landscape: Juniper Savannah or Woodlands	140-141

C. The Strategy considers threats/problems, regardless of their origins (local, State, regional, national and international), where relevant to the State’s species and habitats.

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D. If available information is insufficient to describe threats/problems, research and survey efforts are identified to obtain needed information.

Chapter	Page
Each Conservation Landscape chapter contains conservation issues addressing incomplete data/information about that species of greatest conservation need and the habitat that is necessary for determining effect conservation actions. For example: Crosstimbers Region: Conservation Landscape: Post Oak Blackjack Oak/Hickory Woodland and Forest	171

E. The priority research and survey needs, and resulting products, are described sufficiently to allow for the development of research and survey projects after the Strategy is approved.

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Each Conservation Landscape chapter contains conservation issues addressing priority research and survey needs to provide incomplete data/information about that species of greatest conservation need and the habitat that is necessary for determining effective conservation actions. For example: Crosstimbers Region: Conservation Landscape: Herbaceous Wetlands	186

Element 4:

Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions:

Note: Each Conservation Landscape chapter contains action statements relative to addressing specific conservation issues. Actions are listed in general order of priority.

A. The Strategy identifies how conservation actions address identified threats to species of greatest conservation need and their habitats.

Chapter	Page
Each Conservation Landscape chapter contains conservation action statements immediately following conservation issue statements. For example: Crosstimbers Region: Conservation Landscape: Limestone Cave	202-203

B. The Strategy describes conservation actions sufficiently to guide implementation of those actions through the development and execution of specific projects and programs.

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Each Conservation Landscape chapter contains conservation action	219-222

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	statements immediately following conservation issue statements. For example: Ouachita Region: Conservation Landscape: White Oak/ Hickory Mesic Forest	

C. The Strategy links conservation actions to objectives and indicators that will facilitate monitoring and performance measurement of those conservation actions (outlined in Element #5).

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Each Conservation Landscape chapter contains a list of potential indicators for monitoring the effectiveness of the conservation actions; project writers may select from these lists and/or develop indicators more suitable to their proposed projects. For example: Ouachita Region: Conservation Landscape: Shortleaf Pine Woodland and Forest	242

D. The Strategy describes conservation actions (where relevant to the State's species and habitats) that could be addressed by Federal agencies or regional, national or international partners and shared with other States.

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Each Conservation Landscape chapter contains conservation actions that may be addressed independent of the Oklahoma Department of Wildlife Conservation. For example: Ouachita Region: Conservation Landscape: Springs and Seeps	253-255

E. If available information is insufficient to describe needed conservation actions, the Strategy identifies research or survey needs for obtaining information to develop specific conservation actions.

Chapter	Page
Each Conservation Landscape chapter contains conservation actions addressing priority research and survey needs to provide incomplete data/information about that species of greatest conservation need and the habitat that is necessary for determining effective conservation actions. For example: Ouachita Region: Conservation Landscape: Post Oak/ Blackjack Oak Woodland	272
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F. The Strategy identifies the relative priority of conservation actions.

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Each Conservation Landscape chapter contains conservation actions listed in general priority order. For example: Ozark Region: Conservation Landscape: Springs	291-293

Element 5:

Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions:

Note: Monitoring is addressed in the Approach and Methods chapter. Project writers may submit project proposals to monitor species of greatest conservation need and/or habitats. The primary source of monitoring is that of utilizing the best professional judgment available. This Strategy was built upon the best professional judgment available and will be reviewed and updated in future years utilizing the best professional judgment available.

A. The Strategy describes plans for monitoring species identified in Element #1, and their habitats.

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Each Conservation Landscape chapter ends with a list of potential measurable objectives for monitoring the effectiveness of conservation actions. For example: Ozark Region: Conservation Landscape: Shortleaf Pine-Oak-Hickory Woodlands	309

B. The Strategy describes how the outcomes of the conservation actions will be monitored.

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Each Conservation Landscape chapter contains a list of potential measurable objectives for monitoring the effectiveness of conservation actions. For example: Ozark Region: Conservation Landscape: Post Oak/ Blackjack Oak-Hickory Woodlands and Forests	324

C. If monitoring is not identified for a species or species group, the Strategy explains why it is not appropriate, necessary or possible.

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Monitoring for species is identified	n/a

D. Monitoring is to be accomplished at one of several levels including individual species, guilds, or natural communities.

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(i.e., monitoring of species populations, project deliverables, progress and effectiveness of conservation actions, and overall effectiveness of the Comprehensive Wildlife Conservation Strategy)	
Each Conservation Landscape chapter contains a list of potential measurable objectives for monitoring the effectiveness of conservation actions. For example: Ozark Region: Conservation Landscape: Tallgrass Prairie	329

E. The monitoring utilizes or builds on existing monitoring and survey systems or explains how information will be obtained to determine the effectiveness of conservation actions.

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Each Conservation Landscape chapter contains a list of potential measurable objectives for monitoring the effectiveness of conservation actions. For example: Ozark Region: Conservation Landscape: Large River	332
Appendix C: Management Plans and Habitat Plans Relevant to Oklahoma's Comprehensive Wildlife Conservation Strategy (project writers are encouraged to review other management plans and utilize available monitoring systems)	345-351

F. The monitoring considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation actions.

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G. The Strategy is adaptive in that it allows for evaluating conservation actions and implementing new actions accordingly.

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Element 6:

Descriptions of procedures to review the Comprehensive Wildlife Conservation Strategy at intervals not to exceed 10 years:

Note: Reviewing and updating the Strategy is addressed in the Approach and Methods chapter. The Strategy will be updated in five to seven year intervals.

A. The State describes the process that will be used to review the Strategy within the next ten years.

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Element 7:

Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Comprehensive Wildlife Conservation Strategy with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats:

Note: In keeping with the partnership theme of developing this Strategy and for implementing conservation actions, the Strategy will be reviewed and updated utilizing the best professional advice available. We will also continue to seek input from the general public and specific interest groups.

A. The State describes the extent of its coordination with and efforts to involve Federal, State and local agencies, and Indian Tribes in the development of its Strategy.

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B. The State describes its continued coordination with these agencies and tribes in the implementation, review and revision of its Strategy.

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Element 8:

Provisions to ensure public participation in the development, revision, and implementation of projects and programs. Congress has affirmed that broad public participation is an essential element of this process:

Note: In keeping with the partnership theme of developing this Strategy and for implementing conservation actions, the Strategy will be reviewed and updated utilizing the best professional advice available and broad public input.

A. The State describes the extent of its efforts to involve the public in the development of its Strategy.

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B. The State describes its continued public involvement in the implementation and revision of its Strategy.

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Foreword

From Horny Toads to Bobwhites

History tells us that the Oklahoma Department of Wildlife Conservation has made great strides in fish and wildlife conservation since statehood. Oklahoma's fisheries resources, from Paddlefish to Largemouth Bass to Crappie and Catfish, are probably more abundant and more available to anglers than ever before. Likewise, White-tailed Deer and Wild Turkey are also more abundant today than possibly anytime in history.

These accomplishments were made possible by conservationists (i.e., anglers and hunters) who were willing to fund scientific management and provide resources for fish and wildlife habitat. However, some areas of the conservation effort have been historically under funded.

While White-tailed Deer, Wild Turkey and Largemouth Bass have benefited from sportsmen's dollars, their funding support has not been enough to address the needs of all 800-plus wildlife species in the state. That is why it has been so important for us to develop this Comprehensive Wildlife Conservation Strategy. This Strategy will serve as the blueprint for successfully establishing habitat management strategies that ensure the viability of all our native fish and wildlife.

We have endeavored to involve stakeholders in the process (e.g., state and federal agencies, Indian tribes, farm and ranch groups, conservation and sportsmen's groups, academic professionals, and other Oklahomans with an interest in wildlife). As a result, this Strategy is not about regulations. It is about positive ways to conserve wildlife and habitat, thus passing on a healthy wildlife legacy to future generations.

In Oklahoma we have:

- 18 Federally threatened or endangered animal species (U.S. Fish and Wildlife Service, 2004),
- four species in the pipeline as "candidate species" for listing (U.S. Fish and Wildlife Service,2004),
- 29 percent of our fish species are rare or declining, according to the Oklahoma Department of Wildlife Conservation,
- 32 percent of our freshwater mussel species are considered species of conservation concern, according to the American Fisheries Society in 1996, and
- 26 species of our breeding land birds that have experienced population declines of 45 percent or more over the past 35 years, according to the U.S. Geological Survey Breeding Bird Survey in 2003.

> *"As soon as we take one thing by itself, we find it hitched to everything in the Universe."*
> *John Muir*

Instead of focusing on single species in isolated areas, the conservation strategy focuses on the steps needed to protect, restore, and enhance habitat types (Conservation Landscapes) such as our native prairies thereby benefiting many species. We are looking at this strategy and subsequent funding as the key to our future successes as stewards and caretakers of Oklahoma's wildlife. And although the Department of Wildlife Conservation was responsible for preparing this Strategy, it was done for all Oklahomans and all of Oklahoma's wildlife resources.

Executive Summary and Statewide Perspective

Keeping Oklahoma's Common Species Common

The development of Oklahoma's Comprehensive Wildlife Conservation Strategy is based upon guidance provided by Congress, the U.S. Fish and Wildlife Service, and the International Association of Fish and Wildlife Agencies. This Strategy is designed to not only meet the Congressional requirements but also to provide a menu of choices for wildlife conservation partners. Partners may choose between Oklahoma's regions, species of greatest conservation need, Conservation Landscapes (key habitats), issues, actions, monitoring mechanisms, and partnerships. Because elements in the Strategy are generally prioritized, conservation partners are encouraged to focus their attention to top priorities.

This is a Conservation Strategy for the State of Oklahoma, not just for the Department of Wildlife Conservation. Therefore at the earliest stages in the development of the Strategy, other stakeholders were brought into the process. Fifty individuals representing 35 state and federal agencies and non-governmental organizations formed an Advisory Group to the Oklahoma Department of Wildlife Conservation Planning Team. Technical input was sought from over 450 technical experts in fish and wildlife conservation from both within and outside the Department. The public was invited to participate in Strategy development through two rounds of statewide meetings (five meetings held in each round) and through interaction via the Internet. Internal stakeholders of the Oklahoma Department of Wildlife Conservation were also invited to participate through two rounds of statewide employee meetings (five meetings held in each round), through interaction via the Internet and through various internal communications.

Oklahoma's Comprehensive Wildlife Conservation Strategy is not a traditional scientific/research study by a single scientist. It is based on the professional judgment and the best available existing information contributed by more than 150 technical experts representing various aspects of the Oklahoma's ecology and land management. Stakeholder and technical information were gathered through:

- public and Department staff input meetings,
- a questionnaire that captured the species distribution and abundance information and habitat status and trend information,
- a two-day conference that brought together more than 100 experts to review and confirm the technical information (that was gathered through a questionnaire) and to identify relevant issues, conservation actions, monitoring strategies, and potential partners for each of the Conservation Landscapes within each geographic region, and
- two rounds of public reviews that were conducted on the draft Comprehensive Wildlife Conservation Strategy.

The results of stakeholder and technical expert participation produced multiple lists of conservation issues that eventually evolved into those addressed in this Strategy. The initial meetings (i.e., Advisory Group, public and Department staff) identified broad priority issues about the conservation of Oklahoma's wildlife including (1) habitat, (2) constituent needs, (3) funding, (4) personnel needs, and (5) exotic and invasive species that are either too abundant or in the wrong locations. The technical experts and stakeholders participating in the two-day conference identified a more focused level of priority issues about the management of Oklahoma's species of greatest conservation need and key habitats (i.e., Conservation Landscapes) including: (1) existing data gaps impede effective conservation planning and implementation, (2) land management practices that over time have changed the structure of habitats over large areas, (3) fragmentation and conversion of habitat, (4) invasive exotic plants and animals, and (5) water quality and quantity changes that affect habitat conditions. As a result of public and technical expert reviews on drafts of the Strategy, practically all of the issues can now be placed under one of the following subject headings:

- incomplete data/information regarding species of greatest conservation need and key habitats that are necessary to determine the most effective conservation actions,
- invasive and exotic species that negatively impact species of greatest conservation need and key habitats,
- land and water uses that do not consider impacts on species of greatest conservation need and key habitats, and

- the impacts of water quantity (i.e., loss of water) and quality (i.e., pollution) on species of greatest conservation need and habitats.

In addition, a common theme evolved throughout the development of this Strategy that encourages conservation actions being implemented with consideration for building partnerships, operating with open communications, and utilizing all available land management programs. Through on-going communication and coordination among all stakeholders, Oklahoma's Comprehensive Wildlife Conservation Strategy will remain a vital adaptive template for future fish and wildlife conservation efforts. Federal agencies and regional, national and international partners are encouraged to use this Strategy as a guide for their own activities and are encouraged to share the results of their efforts with other States.

We would be remiss to complete this Comprehensive Wildlife Conservation Strategy without addressing three critical aspects of wildlife management: education and outreach, recreation, and law enforcement. Congress has made it clear that the intent of the State Wildlife Grant Program is to deliver "on-the-ground" conservation actions. While this approach is commendable, major support functions are unfunded.

Education and outreach:

Education and outreach is a necessary component of successful wildlife conservation and Congress has allowed up to 10 percent of each State Wildlife Grant project to be spent in this area.

Congress has affirmed that broad public participation is an essential element in developing the state's Comprehensive Wildlife Conservation Strategies, requiring of the states "public participation in the development, revision, and implementation of projects and programs." There is federal funding for public interaction during the development of the strategies but there is no consistent funding mechanism within the State Wildlife Grants program for continued public awareness of project implementation. The State Wildlife Grants program is lacking a necessary component for conservation success: education and outreach.

It is difficult to accomplish conservation changes without public support of conservation projects and programs on both the behavioral and philosophical levels. More than 97 percent of Oklahoma's land area is owned by private citizens. Wildlife research and management on public lands alone are not enough to bring about significant conservation changes necessary to keep species and habitats healthy. It is vital to the success of conservation efforts in the state of Oklahoma that our citizens are not only aware of conservation projects but take action to support conservation projects, be it through on-the-ground implementation on private lands or through more intangible support methods such as adopting the mindset of a wildlife conservation steward. A number of partnerships should be pursued to raise awareness of conservation issues among the public. These partnerships could include working with the Oklahoma Department of Education to incorporate conservation education materials into school curricula, or collaborating with museums, nature centers, zoological parks and state parks to provide conservation information that is relevant to Oklahoma.

Oklahoma successfully melded conservation, education, and outreach through the creation of the non-profit Oklahoma Wildlife and Prairie Heritage Alliance in northwestern Oklahoma. The Alliance was made possible by the federal Wildlife Conservation and Restoration Program, a pre-cursor to the State Wildlife Grants program. The Alliance encourages conservation of Oklahoma's wildlife and prairie heritage by increasing landowners' awareness of incentive funding, technical assistance, education, and rangeland program guidance. The Alliance is helping involve landowners with conservation programs to restore playa wetland habitats, Short-grass Prairie habitats and in the development of a road based, wildlife-viewing trail, which is projected to increase state revenue by a minimum of $114 million by increasing domestic travel in Oklahoma. With so much of Oklahoma's land under private management, the Alliance's outreach and education has been more instrumental than anything the Wildlife Department alone could have achieved through only research and conservation management. The Alliance is an example of unquantifiable returns received from investing conservation funds into public outreach and education efforts.

The State Wildlife Grants Program exists as a solution to the nation's ever-growing number of threatened and endangered species, which often require costly and intrusive recovery efforts. Congress recognizes the importance of public support and education to proactively manage the nation's wildlife. Oklahoma recommends allowing a portion of the State Wildlife Grants to be spent on achieving such support.

Recreation:

Oklahomans take great pride in their wildlife heritage. In 2001, over 1.1 million people participated in wildlife watching activities in Oklahoma (U.S. Department of the Interior, et al. 2002). The number of wildlife watching enthusiasts outnumbered participants in both hunting (261,000) and fishing (774,000). Twenty-seven percent of Oklahomans enjoyed birding activities, surpassing other states in the West South Central U.S. Fish and Wildlife Service administrative region (Texas 14 percent, Louisiana 16 percent, and Arkansas 24 percent) as well as the national average of 22 percent (USFWS 2003b).

Wildlife watching contributes significantly to Oklahoma's economy as well. Participants spent $193.2 million in wildlife-watching activities during 2001, yielding 6,141 jobs, and a total economic impact of $370 million (USFWS 2003a). Wildlife observation, feeding, and photography were popular activities away from home, while wildlife feeding, observation, and habitat enhancement were important activities for participants around their home.

Despite the popularity of wildlife watching activities in Oklahoma, very little funding is available to the Department for enhancement of non-consumptive recreational opportunities. It is appropriate for all wildlife enthusiasts to contribute financially to the management of Oklahoma's wildlife, not just hunters and anglers. In the long-term it will be necessary to secure funding from wildlife watching enthusiasts at both the federal and state level, mirroring the Sport Fish and Wildlife Restoration Programs. Future funding for State Wildlife Grants (or a similar program) should allow up to 10 percent of funds to be spent on enhancement of wildlife recreation activities related to species of greatest conservation need.

Law Enforcement:

The success of the Sport Fish and Wildlife Restoration Programs cannot be disputed. Fish and game are perhaps more abundant in the United States today than in any time during the last century. However, one limitation to the Sport Fish and Wildlife Restoration programs is the prohibition against grant funding of routine law enforcement activities. Although the exclusion of field investigations was logical during the early years when funding for conservation, research, and habitat management were scarce, it is time to reconcile the U.S. Fish and Wildlife Service Federal Assistance programs with the current needs of state fish and wildlife agencies. It is undeniable that routine patrol activities conducted in the enforcement of hunting and fishing regulations are a valuable contribution to wildlife conservation. It is appropriate for Congress to consider additional funding sources and appropriations to include some level of wildlife law enforcement as eligible grant activities.

Using the same logic, it would be short-sighted to invest in the management of species of greatest conservation need but make no provisions for protection of those species. Yet that is just what may happen if State Wildlife Grants receives permanent funding but continues to designate law enforcement activities as ineligible. Enforcement of fish and wildlife laws is just as important as the management of populations and their habitat. Without an effective regulatory field presence, increased management of species of greatest conservation need will be inefficient at best, ineffective at worst. Future federal funding for State Wildlife Grants (or a similar program) should allow up to 10 percent of funds to be spent on law enforcement activities related to species of greatest conservation need.

Introduction and Purpose

For years, fish and wildlife conservation in Oklahoma and in the Nation has been funded primarily by sportsmen and sportswomen. Funds are generated by two main sources: (1) the sale of state fishing and hunting licenses and (2) federal excise tax revenue from the sale of fishing and hunting equipment (i.e., apportioned back to states through the U.S. Fish and Wildlife Service according to set formulas). This system has been very effective at funding conservation of species that are hunted or fished. Under a separate funding mechanism, conservation of federally endangered and threatened species has also been possible through the Endangered Species Act. However, a reliable funding mechanism had not been established to adequately address the approximate 80 percent of species that are not hunted, fished, endangered, nor threatened.

In the latter part of the 20th Century, visionary leaders in the field of fish and wildlife conservation sought to provide a new source of funding for all species. In Oklahoma alone, a coalition of 175 sportsmen and women and conservation-minded agencies and organizations lobbied for passage of the necessary legislation at the national level.

The results have been encouraging. The Commerce, Justice and State Appropriations Act of FY 2001, Title IX, Public Law 106-553, created the Wildlife Conservation and Restoration Program. Although this act provided only one year's appropriation of funds for fish and wildlife conservation, it identified the elements required to be included in the "Wildlife Conservation Strategy and Plan" that states committed to develop by October 2005. A second act, the Department of the Interior and Related Agencies Appropriations Act of 2002, Public Law 107-63, Title 1, created a "State Wildlife Grants Program" and required the states to develop a "Comprehensive Wildlife Conservation Plan" by October 2005.

Oklahoma's Comprehensive Wildlife Conservation Strategy meets the requirements of both federal acts. This Strategy is not a traditional scientific/research study by a single scientist. It is based on the best available existing information contributed by more than 150 technical experts and numerous publics representing various aspects of Oklahoma's ecology and land management. It is truly a Strategy for Oklahoma, not just for the Oklahoma Department of Wildlife Conservation.

The enabling legislation, along with regulations governing the State Wildlife Grants and related programs, requires that Comprehensive Wildlife Conservation Strategies include the following elements:

1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the Oklahoma Department of Wildlife Conservation deems appropriate, that are indicative of the diversity and health of Oklahoma's wildlife;
2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1);
3. Descriptions of issues which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;
4. Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions;
5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions;
6. Descriptions of procedures to review the Comprehensive Wildlife Conservation Strategy at intervals not to exceed 10 years;
7. Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Comprehensive Wildlife Conservation Strategy with federal, state, and local agencies and Indian tribes that manage significant land and water areas within Oklahoma or administer programs that significantly affect the conservation of identified species and habitats; and

8. Provisions to ensure public participation in the development, revision, and implementation of projects and programs. Congress has affirmed that broad public participation is an essential element of this process.

This Strategy is the result of a process that was specifically designed to meet the above required elements. Although this Strategy is required in order for Oklahoma to participate in the State Wildlife Grants Program, its purpose is far more basic. This Strategy began with species of greatest conservation need for Oklahoma and quickly transformed into a plan that identifies the key habitats (i.e., Conservation Landscapes) of the state and the most significant issues/threats to those habitats. The essence of this document is the identification of priority conservation actions that can and must be taken by all individuals, agencies, and organizations in order to conserve Oklahoma's wild heritage. The job of preserving and managing all of Oklahoma's fish and wildlife is too big for any one group or agency to achieve alone. This Strategy identifies a roadmap of actions that can be used by everyone for years into the future.

Approach and Methods

Organizational structure:

The Oklahoma Department of Wildlife Conservation chose to partner with a contractor (Dynamic Solutions Group, LLC) to develop the Comprehensive Wildlife Conservation Strategy. Once the necessary contract documents were in place, Oklahoma Department of Wildlife Conservation and Dynamic Solutions Group personnel met in Oklahoma to form a Planning Team (members are listed in Appendix L: Acknowledgements) and to develop a detailed workplan. This meeting occurred November 17-19, 2003, and was also attended by Bob Anderson, U.S. Fish and Wildlife Service, Albuquerque, as an observer. The Planning Team shared all responsibilities for project design and communicated through a special email distribution list. In the early stages and intermittently as needed after that, the Oklahoma Department of Wildlife Conservation and Dynamic Solutions Group project leaders held regular telephone conversations.

An Advisory Group (members are listed in the Appendix L: Acknowledgements) was formed of agencies and organizations best suited to assist with the process of developing the Comprehensive Wildlife Conservation Strategy. This group met once in person on January 8, 2004 and communicated continuously via email. A charter (see Appendix I: Advisory Group Charter) defined and detailed the roles and responsibilities of the Advisory Group, Oklahoma Department of Wildlife Conservation, and Dynamic Solutions Group.

Oklahoma's Comprehensive Wildlife Conservation Strategy was not to be a traditional scientific/research study by a single scientist. It was to be based on the best available existing information from a wide variety of publics and technical experts representing various aspects of the Oklahoma's ecology and land management. As such, the Planning Team chose an aggressive approach to public involvement based on the axiom of "early and often," including offering opportunities for early and continual input through websites and in an early round of internal and external public meetings. The March 1-5, 2004, public meetings and a website were publicized through three news releases, the Outdoor Oklahoma magazine (Oklahoma Department of Wildlife Conservation product), through the Advisory Group (they were asked to spread the news in their own organizations and publications), twice in the Oklahoma Department of Wildlife Conservation monthly employee newsletter (Wildlife-O-Gram), on the Oklahoma Department of Wildlife Conservation website, on the Outdoor Oklahoma television show (Oklahoma Department of Wildlife Conservation product), in a direct letter to Tribal leaders, in The Wild Side newsletter (Oklahoma Department of Wildlife Conservation product to approximately 15,000 wildlife enthusiasts), in a special postcard mailing to The Wild Side newsletter recipients, as well as interviews with several influential media personalities in the state. Each evening public meeting was preceded by an afternoon voluntary-staff meeting in the same city. These sessions provided early input on issues and strategies related to management of Oklahoma resources.

Although the Planning Team decided not to create an official technical committee, more than 450 technical experts were invited to provide distribution and abundance information on the species of greatest conservation need. Early communication with these experts was conducted almost entirely by email. After several rounds of review and revision, the technical information on species, regions, habitats, population status and trend, and habitat status and trend was compiled into a 99-page workbook that served as a handout for the "Oklahoma's Wildlife Future Conference," held on the campus of Oklahoma State University, July 13-14, 2004. Recognized Oklahoma dignitaries who helped stimulate attendance and motivate thoughtful participation in the conference included Oklahoma Department of Wildlife Conservation Director Greg Duffy, Oklahoma Secretary of the Environment Miles Tolbert, and Oklahoma State University President David Schmidly. Attendance was open to all, as well as those specifically invited. Conference publicity included two news releases, Advisory Group contacts, the Wildlife-O-Gram, the website, The Wild Side newsletter, Your Side of the Fence (an Oklahoma Department of Wildlife Conservation newsletter to

landowners), Outdoor Oklahoma magazine, and individual contacts. The conference purpose was to help produce the first draft Comprehensive Wildlife Conservation Strategy. Over two days, the approximately 110 conference participants resolved remaining data discrepancies, but mainly focused on conservation issues, conservation actions, research and survey needs, monitoring mechanisms, plus identifying partnerships important in implementation. This conference ended the intensive data-gathering phase.

The writing phase began as soon as the conference adjourned, with the first draft of the Comprehensive Wildlife Conservation Strategy completed in September 2004. The Internet again proved highly useful in the several rounds of review and modifications, leading to a second round of internal (i.e., Oklahoma Department of Wildlife Conservation) and external (i.e., technical experts, specific interests, and other stakeholders) meetings in March 2005. The final report was produced in July 2005.

Public involvement and partnerships:

Our approach to the two important topics of public involvement and partnerships was based on the twin premises that (1) the public must be involved for an endeavor such as this to be successful and (2) that fish and wildlife conservation in the future is simply too big a job for any one agency or organization (i.e., mandating an emphasis on partnerships). Immediately following completion of the project workplan in November 2003, work began on public involvement and partnership development. A portion of the initial workplan development meeting was devoted to stakeholder identification that started with the Conservation and Reinvestment Act Coalition list (which contained over 300 names). News releases announcing the inauguration of the Strategy development process, television and radio interviews, notices on the Department website, letters to targeted stakeholder groups, postcards to literally thousands of potential partners, the first round of internal and external public meetings, the creation and use of the Advisory Group, the work over the Internet with the hundreds of technical experts (i.e., conservation partners), the Oklahoma's Wildlife Future conference, several iterations of the draft report, and the second round of internal and external public meetings were all part of the concentrated public involvement and partnership development effort.

A complete chronological log of public involvement, partnership development, and communication throughout this project can be found in Appendix H: Public Outreach, Oklahoma Department of Wildlife Conservation In-reach, and Coordination with Land Managers.

As important as public involvement and partnerships have been in the development of this Strategy, nothing could be as important as their role in implementing specific conservation actions, monitoring progress, and revising the Strategy as needed.

Coordination with other agencies and tribes:

Other agencies were notified by letter of the process for strategy development almost as soon as it began. A partial list of cooperators is contained in the listing of Advisory Group members in Appendix L: Acknowledgements. Potential partnerships with other agencies are also listed on the last page of each region chapter.

Tribes were given special consideration. They were specifically, directly, and individually notified of the process, invited to participate in public meetings, invited to provide technical expertise, invited to the conference, invited to comment on the various drafts, and invited to the second round of public review meetings. Assistance in communicating with tribes was provided by tribal coordinators in the U.S. Fish and Wildlife Service in Albuquerque and in Bureau of Indian Affairs in Washington, D.C. Tribal members or representatives participated in public meetings, providing technical input, attended the conference, and reviewed draft documents.

Assigning species of greatest conservation need to key habitats:

Oklahoma's species of greatest conservation need were assigned to habitats (referred to in the text as Conservation Landscapes) by technical stakeholders. Methods to gather the data were a technical questionnaire, an Oklahoma's Wildlife Future Conference, and reviews of the Comprehensive Wildlife Conservation Strategy. Only the Big Cedar Grasshopper (*Eximacris phenax*) has not been assigned to a habitat.

Identifying priorities, issues, actions:

The planning model followed in Oklahoma included the identification of species of greatest conservation need, geographic regions, Conservation Landscapes, conservation issues, conservation actions, potential indicators to monitor to evaluate progress, and partners who may help with implementation. The Comprehensive Wildlife Conservation Strategy was developed with an understanding that it is Oklahoma's Strategy, not just a Strategy for the Oklahoma Department of Wildlife Conservation. The priorities identified in the Strategy are meant to serve as guidance and to help focus the efforts of all conservation agencies and partners working in Oklahoma.

In the planning model used to develop this Comprehensive Wildlife Conservation Strategy, priorities were set for species of greatest conservation need, Conservation Landscapes within regions, and issues and actions within Conservation Landscapes. This means that when fiscal and human resources are allocated in the implementation phase, resources will be allocated first to higher ranked actions.

Prioritizing species of greatest conservation need:

Using the following set of six selection criteria, all species in Oklahoma were evaluated as candidates for being listed as species of greatest conservation need:

- Species which are listed as federal candidate, threatened or endangered species under the ESA.
- Species which are classified as state species of special concern, threatened or endangered species (OAC Title 800).
- Species which have been assigned global ranking scores of G1, G2 or G3 by the network of state Natural Heritage Inventory programs.
- Species which have been identified as conservation priorities through a range-wide status assessment, or assessment of large taxonomic divisions. Examples of these include: assessments of freshwater fish, freshwater mussels and crayfish by the American Fisheries Society, and bird conservation plans such as the national Partners In Flight Conservation Plan, the North American Waterfowl Conservation Plan and the U.S. Shorebird Conservation Plan.
- Reptile, amphibian, fish and mussel species which are subject to commercial harvest in Oklahoma but are not eligible for funding under existing Federal Assistance Programs in order to monitor or periodically assess their status.
- Species which are regionally endemic regardless of their conservation status.

Once selected, species of greatest conservation need were then ranked according to the following five ranking criteria:

- Natural Heritage Global Rank.
- Availability of Other Federal Assistance Funding Sources.
- Percent of population size or geographic range within Oklahoma.
- Trend in population size or geographic range over the past 40 Years.
- Availability of existing data to support inclusion of the species as a species of greatest conservation need.

A detailed explanation of the selection criteria and the scoring criteria is located in Appendix D: Oklahoma's Species of Greatest Conservation Need Selection and Scoring Criteria. For priorities see Appendix E: Oklahoma's Species of Greatest Conservation Need Grouped by Priority Sets.

Prioritizing research and survey needs:

Conservation landscapes or habitat types were identified based upon the vegetation communities identified in the draft Oklahoma Gap Analysis Project (Fisher et. al. 2002) and the game types identified in the Game Type Map of Oklahoma (Duck and Fletcher 1943). Key habitat types were those that occurred naturally in Oklahoma and supported a suite of species on the list of species of greatest conservation need. Twenty-four habitat types were identified, and a description of each is provided in the regions(s) where it occurs. As part of the habitat description, we have listed the recognized plant communities that are associated with each habitat type. These lists of plant communities are based upon the Oklahoma Natural Heritage Inventory publication "The Vegetation of Oklahoma: A Classificiation for Landscape Mapping and Conservation Planning" by Bruce Hoagland, 2000.

Conservation landscapes (habitats) were prioritized by a group process involving technical experts, specific interests, and other stakeholders within each geographic region. The six geographic regions were not prioritized. The species of greatest conservation need were prioritized according to their score and tier designation as detailed in Appendix D: Oklahoma's Species of Greatest Conservation Need Selection and Scoring Criteria. For priorities see Appendix E: Oklahoma's Species of Greatest Conservation Need Grouped by Priority Sets.

Research and survey efforts (e.g., State Wildlife Grants) should first address the needs identified for the highest priority Conservation Landscapes (i.e., those listed first within each geographic region); and secondly, according to the species of greatest conservation need tier/score designations. Those species of greatest conservation need having an "unknown" status/trend are of particular priority for research and/or survey efforts. Also, in each Conservation Landscape chapter, the first (i.e., top priority) conservation issue addresses the need for providing more complete data on species of greatest conservation need and their habitats.

Prioritizing key habitats (Conservation Landscapes), issues and actions:

Within each region, key Conservation Landscapes were ranked based upon four factors: 1) the uniqueness of each Conservation Landscape to that region, 2) the number of tier I species of greatest conservation need occurring within each Conservation Landscape, 3) the number of tier II species of greatest conservation need occurring within each Conservation Landscape, and 4) the number of tier I and tier II species of greatest conservation need that were unique or endemic to that Conservation Landscape. Once evaluated, the Conservation Landscapes within each region were grouped into three categories of conservation priority: 1) very high, 2) high, and 3) moderate. Conservation Landscapes were not ranked further with each of the three categories of conservation priority; therefore the order in which Conservation Landscapes are listed within each priority category does not imply rank or importance. For purposes of the Comprehensive Wildlife Conservation Strategy, no attempt was made to prioritize regions or Conservation Landscapes across regions.

"Conservation issues" in this Strategy is the term used for the "conservation problems" identified by Congress (i.e., required element 3). Issues and conservation actions were identified and prioritized by a group process involving technical experts, specific interests, and other stakeholders according to their impact on conservation and management of the species of greatest conservation need.

Adaptive management and monitoring:

Adaptive Management:

Adaptive management has been used by planners and managers for decades. Adaptive management involves four essential pieces: (1) developing plans, (2) implementing those plans, (3) monitoring the effects of management actions, and (4) adjusting future plans. This approach is being applied in Oklahoma.

Monitoring:

Potential monitoring approaches are identified for conservation actions within each Conservation Landscape. Monitoring is crucial to employing adaptive management approaches and assuring that conservation actions are having the desired results.

In keeping with the concepts behind the design of the Comprehensive Wildlife Conservation Strategy approach and advice from U.S. Fish and Wildlife Service, and International Association of Fish and Wildlife Agencies, at first Oklahoma's monitoring will employ existing surveys and inventories, including monitoring being done by conservation partners. Monitoring will initially be keyed to priority research and survey needs to obtain basic information. Monitoring will also be used to determine when conservation actions have adequately ameliorated conservation issues. When conservation success is not what was anticipated, monitoring will allow plans to be updated and altered so that new actions can be developed and implemented – the "adaptive" part of adaptive management. In a number of cases, monitoring or research will need to be the first step to determine existing conditions where this basic knowledge does not now exist.

As implementation of the Comprehensive Wildlife Conservation Strategy proceeds and knowledge builds, monitoring (i.e., through the actions and approaches identified for individual actions, issues and habitats) will shift to tracking tangible achievement of resource conservation. Again, in many cases, monitoring will rely heavily on conservation partners. As knowledge accumulates and conservation issues are solved, or managed significantly, new conservation actions will become possible.

In summary, the following items have been identified for monitoring purposes:

- **Species of greatest conservation need population status and trends and key habitat status and trends**: Although there are very effective efforts (e.g., Natural Heritage Inventory) currently in place for tracking species populations, providing species of greatest conservation need data specific to Conservation Landscapes are incomplete. Likewise, key habitat data (i.e., quantity, quality, and trends) are also incomplete. In each Region/Conservation Landscape chapter of this Strategy are monitoring actions to guide project writers. Monitoring of species will also incorporate the best professional advice available during the Strategy review and update process (i.e., a process similar to the July 2004, Wildlife Future Conference).

- **Project deliverables and connection to conservation actions addressed**: The operational aspect of this Strategy is the development and implementation of projects (e.g., State Wildlife Grants). The required elements for developing this Strategy do not specifically address implementation (i.e., operational actions). Never-the-less, the overall effectiveness of the Strategy will greatly depend on the success of projects funded. Operationally, each individual project agreement will identify specific deliverables addressing specific conservation actions outlined in the Strategy. Projects will be monitored to insure deliverables are received within the guidelines and purchasing regulations of the state of Okalahoma and grant requirements of the Federal Assistance Division of the U.S. Fish and Wildlife Service.

- **Progress on conservation actions**: Each Conservation Landscape chapter contains a list of potential measurable objectives for monitoring the effectiveness of conservation actions. The lists are provided so that project writers may choose and/or add their own measurements. Progress on conservation actions will entail at least two processes. The Department of Wildlife Conservation will monitor projects (i.e., State Wildlife Grants and other Department funded projects) and results that address specific conservation actions. Conservation partners will be periodically surveyed about their activities toward specific conservation actions. The survey of conservation partners will be incorporated into the Strategy review and revision process (i.e., a process similar to the July 2004, Wildlife Future Conference) outlined below in the "Strategy review and revision" section.

- **Overall effectiveness of the Comprehensive Wildlife Conservation Strategy (i.e., impact by projects funded and actions/issues addressed)**: The overall effectiveness of the Strategy will be incorporated into the Strategy review process (i.e., similar to the July 2004, Wildlife Future Conference) as outlined below. Using the best professional advice available, this process will include a review of the projects funded (i.e., State Wildlife Grants and conservation partnership efforts), changes in species of greatest conservation need status and trends, changes in Conservation Landscape status and trends, changes in priority conservation issues and changes in priority conservation actions.

Strategy review and revision:

The Comprehensive Wildlife Conservation Strategy, as with any planning document, will require periodic review and revision (i.e., updating). New information will become available, implemented actions will resolve issues, and new situations or circumstances (i.e., unforeseen when the Comprehensive Wildlife Conservation Strategy was first developed) will occur.

As a normal part of Oklahoma Department of Wildlife Conservation operations, information will be accumulated continuously on Comprehensive Wildlife Conservation Strategy elements for such things as status and trends of species of wildlife, including their current distribution within Oklahoma. This monitoring will also involve habitat condition and trends.

Communication and coordination with the conservation partners involved in preparation of this initial Comprehensive Wildlife Conservation Strategy will continue. This will help track progress (i.e., monitor) and identify new circumstances or changing situations. It is anticipated that many of these conservation partners will contribute information gained through their normal operations which will be vital to the review and revision of the Comprehensive Wildlife Conservation Strategy.

It most cases, several years of actions may be needed before real conservation progress can be demonstrated. Allowing for this time lag between planning, implementation of strategies, and responses of natural systems will influence Oklahoma's schedule for review and revision of their Comprehensive Wildlife Conservation Strategy.

At five to seven-year intervals, Oklahoma's Comprehensive Wildlife Conservation Strategy will be thoroughly and completely reviewed and revised as needed. This will include something considerably less than the level of effort put into the initial Comprehensive Wildlife Conservation Strategy development but will involve all conservation partners and all eight of the required elements. It is thought that evaluation of all eight required elements can be accomplished by ongoing interactive communication with conservation partners, stakeholders, and the general public. As new conservation partners are identified, they will be integrated into the process.

State Overview and Ecological Framework

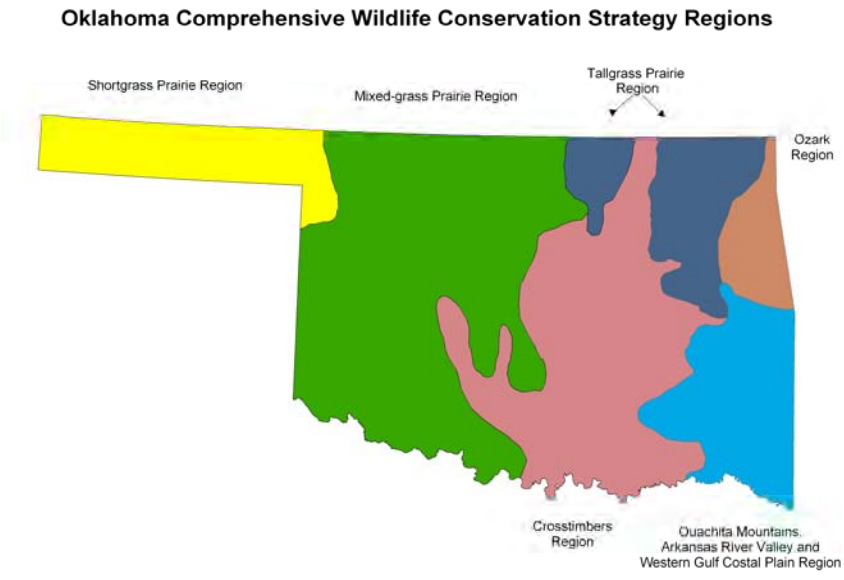
Oklahoma is very diverse geologically and ecologically. Depending upon the classification system used, Oklahoma encompasses portions of 11 to 15 ecological regions. It spans the transition between the eastern deciduous forests to the shortgrass prairie/High Plains, and from the West Gulf Coastal Plain to the foothills of the Rocky Mountains in the Black Mesa area. Rainfall ranges from an average of 55 inches in portions of the Ouachita Mountains to only 18 inches at the western end of the panhandle. This diversity in rainfall, elevation and soil conditions results in a dramatic richness of plant and animal communities.

The Oklahoma Comprehensive Wildlife Conservation Strategy is organized into six regional chapters. These six regions were identified during a process to reconcile the two most widely used ecological classification systems in the United States - Bailey's Ecological Regions developed by the U.S. Forest Service and Omernick's Ecoregions developed by the Environmental Protection Agency. Both of these systems are hierarchical (meaning that they operate at multiple spatial scales) and are based upon a combination of climate, soils and dominate vegetation. The classification system of Bailey / USFS divides Oklahoma into 15 Ecological Sections, while the system of Omernick / EPA divides the state into 11 Ecoregions. While these two ecological classification systems are similar, they use different nomenclature and boundaries for their ecological regions. In eastern Oklahoma, there is a high degree of similarity between Omernick's Ecoregions and Bailey's Ecological Sections, but only a modest degree of similarity in western Oklahoma. The designation of ecological region boundaries is complicated because landscape changes are gradual and occur over a large area. Therefore ecological boundaries are not exact cut-off lines but wide bands of interdigitated habitats.

For purposes of the Comprehensive Wildlife Conservation Strategy, the state of Oklahoma has been divided into six large regions. Each of these regions encompasses one to three of Bailey's Sections and one to three of Omernick's Ecoregions. We have attempted to reconcile the differences between the ecological regions proposed by Bailey / USFS with those proposed by Omernick / EPA by grouping together similar regions. In so doing, we have produced a Conservation Strategy that we believe can be applied by agencies using either ecological classification system. Additionally, these regions are similar to the Bird Conservation Regions recently developed under the North American Bird Conservation Initiative. The Bird Conservation Regions were adapted from Omernick's classification system and are used widely by the U.S. Fish and Wildlife Service, Joint Ventures and other conservation partners.

Shortgrass Prairie Region: This region is often referred to as the High Plains. It encompasses the panhandle counties and the northwestern corner of the main body of the state, and includes all or portions of Cimarron, Texas, Beaver, Harper, Woodward and Ellis Counties. It is equivalent to the combination of the Southern High Plains, Arkansas Tablelands and Texas High Plains sections of Bailey's ecological classification system, and to the Western High Plains and a portion of the Southwestern Tablelands under Omernick's classification system.

Mixed-grass Prairie Region: This is a large and diverse ecological region that encompasses much of western Oklahoma including all or portions of Harper, Ellis, Woods, Woodward, Major, Alfalfa, Grant, Kay, Noble, Logan, Garfield, Kingfisher, Canadian, Blaine, Dewey, Custer, Washita, Roger Mills, Beckham, Harmon, Greer, Jackson, Kiowa,



Tillman, Caddo, Comanche, Cotton, Oklahoma, Grady, Cleveland, McClain, Stephens, and Jefferson counties. Within Bailey's classification system, it is equivalent to the combination of the Red Bed Plains and the South-central Great Plains sections. Using Omernick's ecoregion classification system, it is equivalent to a portion of the Southwestern Tablelands Ecoregion and the entire Central Great Plains Ecoregion.

Crosstimbers Region: This region encompasses a mosaic of oak woodlands and tallgrass prairies in approximately the central one-third of Oklahoma. All or portions of the following counties are part of Crosstimbers Region: Kay, Noble, Pawnee, Payne, Logan, Lincoln, Oklahoma, Cleveland, McClain, Grady, Caddo, Stephens, Jefferson, Garvin, Murray, Carter, Love, Marshall, Johnston, Pontotoc, Coal, Atoka, Bryan, Choctaw, Pittsburg, McIntosh, Hughes, Seminole, Pottawatomie, Okfuskee, Creek, Okmulgee, Tulsa, Osage and Washington. It is equivalent to the combination of the Crosstimbers and Prairies Section and the Blackland Prairies Section in Bailey's classification system. It is also equivalent to Omernick's Central Oklahoma/Texas Plains Ecoregion.

Tallgrass Prairie Region: This region encompasses two portions of the state that were historically dominated by tallgrass prairie landscapes. One of these areas is commonly referred to as the Flint Hills and includes portions of Osage, Kay, Pawnee and Payne counties. The other region is often called the Osage Plain and includes portions of Washington, Nowata, Rogers, Wagoner, Tulsa, Okmulgee, Muskogee, Mayes, Craig, and Ottawa counties. The Tallgrass Prairie Region is equivalent to the combination of Bailey's Flint Hills and Osage Plains sections. It also is equivalent to Omernick's Flint Hills and Central Irregular Plains ecoregions.

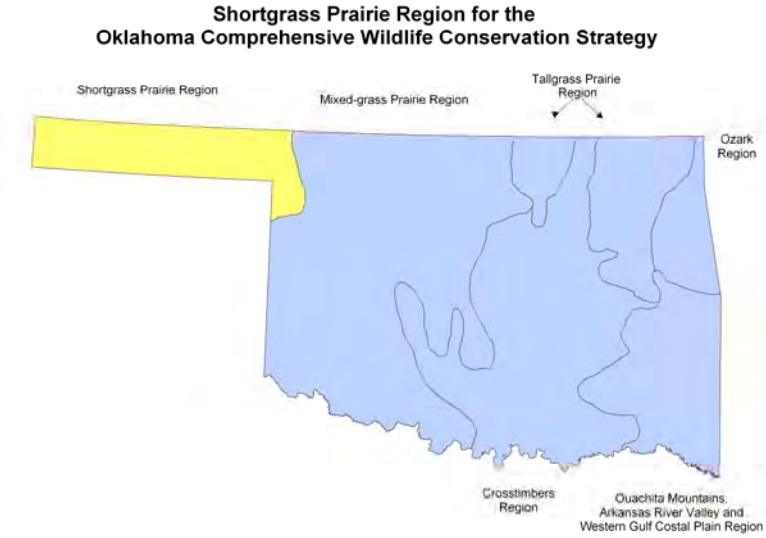
Ozark Region: Often referred to as the Ozark Highlands, this region encompasses all or portions of six counties in northeastern Oklahoma: Ottawa, Delaware, Mayes, Cherokee, Adair, and Sequoyah. It is equivalent to the Ozark Highlands and the Boston Mountains in both Bailey's and Omernick's ecological classification systems.

Ouachita Mountains/West Gulf Coastal Plain Region: This is a large and diverse region that encompasses three subregions: the Ouachita Mountains, Arkansas River Valley and the Western Gulf Coastal Plain. It includes all or portions of the following southeastern counties: Sequoyah, Muskogee, Haskell, LeFlore, Latimer, Pittsburg, Atoka, Pushmataha, Choctaw, and McCurtain. It is equivalent to the combination of Bailey's Ouachita Mountains, Western Mid-coastal Plains and Arkansas Valley sections. Under Omernick's ecological classification system, it is equivalent to the Arkansas Valley, Ouachita Mountains and South Central Plains ecoregions.

Additional maps are located in Appendix B: Maps used in the Development of the Oklahoma Comprehensive Wildlife Conservation Strategy.

- CWCS Regions Compared to Duck and Fletcher Game Types
- CWCS Regions Compared to Soil Class
- CWCS Regions Compared to Soils
- Central Mixed-grass Prairie Ecoregion, The Nature Conservancy
- Ouachita Mountains and Upper West Gulf Coastal Plain Ecoregions, The Nature Conservancy
- Osage Plains/Flint Hills Prairie Ecoregion, The Nature Conservancy
- Ozark Ecoregion, The Nature Conservancy
- Southern Shortgrass Prairie Ecoregion, The Nature Conservancy
- Southern/Central Shortgrass Prairie Ecoregion, The Nature Conservancy

Shortgrass Prairie Region



This region is often referred to as the High Plains. It encompasses the panhandle counties and the northwestern corner of the main body of the state, and includes or portions of Cimarron, Texas, Beaver, Harper, Woodward and Ellis counties. It is equivalent to the combination of the Southern High Plains, Arkansas Tablelands and the Texas High Plains sections in Bailey's ecological classification system; and to the Western High Plains and a portion of the Southwestern Tablelands under Omernick's ecoregion classification system.

The best professional judgment of the advisory group and technical experts was used to identify each Conservation Landscape's status and trend. And, even though some issues and actions apply to multiple Regions, each Region chapter is designed to stand-alone.

Conservation Landscapes listed in general priority order:

- Very High priority Conservation Landscapes:
  - Shortgrass Prairie
  - Pinyon Pine/Juniper Woodland or Savannah and Juniper/Pinyon Pine Woodlands
- High priority Conservation Landscapes:
  - Herbaceous Wetland
  - Small Rivers and Sloughs/Ponds
  - Sand Sagebrush/Bluestem Shrublands
  - Mixed-grass Prairie
- Moderate priority Conservation Landscapes:
  - Sandy-bottom Streams and Associated Riparian Forest
  - Sand Plum/Sumac Shrubland
  - Springs

Conservation Landscape: Shortgrass Prairie

The relative condition of Shortgrass Prairie habitat within the Shortgrass Prairie Region is currently good with a stable trend. This is the most abundant habitat type found in the Shortgrass Prairie Region. Approximately 91 percent of the Shortgrass Prairie habitat in Oklahoma occurs in this Region, where it is widespread and often forms the habitat matrix within which other habitat types occur. Shortgrass Prairies are comprised of several herbaceous plant associations including Sideoats Grama (*Bouteloua curtipendula*), Blue Grama (*Bouteloua gracilis*), and Buffalograss (*Buchloe dactyloides*) on well drained soils or rocky slopes, Blue Grama / Hairy Grama (*Bouteloua hirsuta*) on loamy or sandy soils, and Blue Grama/Buffalograss on clay soils. Other grasses and forbs include Scarlet Globemallow (*Sphaeralcea coccinea*), Plains Blackfoot (*Melampodium leucanthum*), Prairie Zinnia (*Zinnia grandiflora*), Muhly Grass (*Muhlenbergia torreyi*), Pricklypear Cactus (*Opuntia humifusa*) and Yucca (*Yucca glauca*). Vine Mesquite (*Panicum obtusum*) and Western Wheatgrass (*Pascopyrum smithii*) grow in more mesic sites such as the margins of playas. As much as 747,399 acres of Shortgrass Prairie may remain in Oklahoma, but this is less than half of what occurred historically. Much of the original Shortgrass Prairie has been converted to crop production, particularly dryland wheat or irrigated corn, soybeans, or alfalfa. Many crop fields have been enrolled in the Conservation Reserve Program during the past 20 years because of the potential for soil loss due to wind erosion. However, most of the Conservation Reserve Program acreage has been planted to exotic grasses such as Yellow (Old World) Bluestem (*Bothriochloa ischaemum*) or Mixed-grass Prairie species such as Little Bluestem (*Schizachyrium scoparium*) instead of to native Shortgrass Prairie species.

Recognized vegetation associations within this habitat type include:

Blue Grama – Broom Snakeweed Grassland
Blue Grama – Buffalograss Grassland
Blue Grama – Galleta Grassland
Blue Grama – Hairy Grama Grassland
Buffalograss Grassland
Hairy Grama – Sideoats Grama Grassland
Sideoats Grama – Blue Grama-buffalograss Grassland
Sideoats Grama Grassland
Western Wheatgrass – Blue Grama Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Baird's Sparrow	X							X
Bird	Barn Owl	X							X
Bird	Burrowing Owl	X							X
Bird	Cassin's Sparrow		X						X
Bird	Chestnut-collared Longspur	X							X
Bird	Ferruginous Hawk	X							X
Bird	Loggerhead Shrike		X			X			
Bird	Long-billed Curlew	X							X
Bird	McCown's Longspur				X				X
Bird	Mountain Plover	X							X
Bird	Peregrine Falcon	X							X
Bird	Prairie Falcon	X							X
Bird	Sandhill Crane		X				X		
Bird	Scaled Quail		X			X			
Bird	Short-eared Owl				X				X
Bird	Swainson's Hawk		X						X
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Desert Shrew				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Mountain Lion	X						X	
Mamm	Swift Fox		X				X		
Rept	Round-tailed Horned Lizard				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need and examine possible causes of suspected population declines.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct field studies on species of greatest conservation need to establish baseline population data/information.
- Conduct studies to verify the accuracy of existing data.
- Use surveys, workshops and data acquisition to monitor status and to update the Comprehensive Wildlife Conservation Strategy.
- Develop long-term funding to provide ongoing, comparative studies of population status, distribution, and habitat condition.
- Identify and prioritize core areas of habitat and corridors that need to be connected in order to provide complete conservation areas for species of greatest conservation need.
- Develop descriptions of quality habitat, based on research and empirical evidence.
- Develop and distribute information for landowners on several topics including grazing ecology, natural systems and exotic invasive species.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Conversion of shortgrass prairie habitat to cropland and similar land uses results in the direct loss of habitat and the fragmentation of the remaining habitat.
4. Increased use of center-pivot irrigation and the related conversion of Shortgrass Prairie habitat to corn or soybean crops produces fragmentation and reduced habitat quality.
5. Conversion of shortgrass prairie and dryland wheat to irrigated corn increases the acreage of tall vegetation which is avoided by swift fox, Mountain Plover and other species endemic to the shortgrass prairie habitat.
6. Excessive fencing presents numerous obstacles to the movement of wildlife and facilitates the encroachment of woody vegetation into prairies along fence lines.
7. Under the Conservation Reserve Program, conversion of Shortgrass Prairie to Mixed-grass Prairie habitat has reduced both quantity and quality of the original habitat.
8. Currently, most lands enrolled in the Conservation Reserve Program in the Region have been planted to exotic Old World Bluestem or to Mixed-grass Prairie grasses that do not meet the ecological requirements of Shortgrass Prairie species such as Mountain Plover and Swift Fox.
9. Wind power development is thought by some people to threaten some species of greatest conservation need in this habitat.

Conservation Actions:

- Work with Natural Resources Conservation Service and others to modify their guidance/specifications to reduce undesirable species and increase desirable forbs and grasses.
- Work with Natural Resources Conservation Service to eliminate the use of Old World Bluestem or Lovegrass in Conservation Reserve Program fields and replant existing Conservation Reserve Program lands to native short grasses such as grama grasses and Buffalo Grass.
- Develop and distribute information to landowners on topics including grazing ecology, natural systems and exotic invasive species.
- Encourage conversion of existing Conservation Reserve Program fields to native Shortgrass Prairie grasses and forbs.
- Encourage the development of perpetual easement programs, leases or land acquisitions.

- Encourage expansion of the Conservation Reserve Program in the Farm Bill as well as increasing funding from the subsidy side of the Farm Bill.
- Encourage the use of tax incentives and tax relief to motivate landowners to maintain good quality prairie that meets the needs of Shortgrass Prairie species of greatest conservation need.
- In cooperation with the agriculture community and other conservation-minded partners, develop demonstration areas that show grazing and fire regimes that are beneficial for species of greatest conservation need.
- Conduct literature reviews and field studies to understand the impacts of wind power development on species of greatest conservation need in this habitat.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

10. Introduced species and introduced species such as Old World Bluestem and Russian Thistle have become widespread throughout this habitat in this Region.

Conservation Actions:

- Work with Natural Resources Conservation Service and others to modify guidance and specifications that will result in a reduction of undesirable species and increase desirable forbs and grasses.
- Work with Natural Resources Conservation Service and others to modify guidance needed to eliminate the use of Old World Bluestem or Lovegrass in Conservation Reserve Program fields and replant existing Conservation Reserve Program to native short grasses such as grama grasses and Buffalo Grass.
- Develop and distribute information to landowners on several topics including grazing ecology, natural systems and exotic invasive species.
- Develop and implement management plans to control or eliminate invasive and exotic plant species.

Conservation Issue: Black-tailed Prairie Dog habitat related issues:

11. Prairie Dog control can have detrimental impacts on the habitat for a number of species of greatest conservation need.
12. Loss of Prairie Dog town communities can impact the total health of the ecosystem.
13. Fragmentation of Prairie Dog complexes can put a number of species of greatest conservation need at added risk.

Conservation Actions:

- Identify and encourage development of incentives for Black-tailed Prairie Dog conservation, restoration and enhancement.
- Encourage ecotourism in the Shortgrass Prairie Region to make it economically advantageous for landowners to provide for complete, intact Shortgrass Prairie ecosystems.
- Encourage the development of Prairie Dog control regulations that minimize negative impacts on Shortgrass Prairie ecosystems.
- Develop and distribute information to landowners on several topics including grazing ecology, natural systems and exotic invasive species.
- Working with a variety of partners in the Shortgrass Prairie Region, encourage the maintenance – and possibly expansion – of programs like the Landowner Incentive Program for the conservation of Black-tailed Prairie Dogs and other species.
- Support legislation that will enable large ranches to remain in single family ownership.
- Consider land acquisition and conservation easements (e.g., land trusts and non-governmental organizations such as The Nature Conservancy) for the preservation of important tracts of Shortgrass Prairie habitat in the Shortgrass Prairie Region.

- Support increased funding from the subsidy side of the Farm Bill for the Conservation Reserve Program.
- Encourage and support ranch diversification for lower grazing rates and off set by lease hunting, fishing access, and ecotourism viewing.
- Support, encourage and assist with development or updating of Best Management Practices for agricultural development.
- Identify and prioritize core areas of Prairie Dog colonies to enhance complex development.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres enrolled in conservation programs, including Landowner Incentive Program.
- Changes in acreage/coverage of native and exotic vegetation communities.
- Easements secured and acreage enrolled in conservation programs.
- Develop GIS datasets to monitor rates of land cover change.
- Numbers of acres of native plant communities restored / Conservation Reserve Program fields converted from Old World Bluestem to native Shortgrass Prairie.
- Population sizes and distributions of species of greatest conservation need, Prairie Dog - associated species, and indicator species (e.g., Mountain Plover, Burrowing Owl, Long-billed Curlew, Swift Fox, Texas Horned Lizard, and Cassin's Sparrow).
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Pinyon Pine/Juniper Woodland or Savannah and Juniper/Pinyon Pine Woodlands

The relative condition of Pinyon Pine/Juniper Woodland or Savannah and Juniper/Pinyon Pine Woodlands habitat is currently good with a stable trend. In Oklahoma, this habitat type is unique to the Shortgrass Prairie Region. It is found on rocky soils in the Black Mesa area in the northwestern corner of the Oklahoma panhandle. The dominant woody plants in this woodland community are One-seeded Juniper (*Juniper monosperma*) and Pinyon Pine (*Pinus edulis*). The understory of this woodland is dominated by short grasses including Sideoats Grama, Hairy Grama, Blue Grama, Buffalograss and Silver Bluestem. Other less common woody plants include clump-forming shrubs such as Skunkbrush (*Rhus aromatica*), Mountain Mahogany, Gamble Oak (*Quercus gambelii*), and several cacti including Tree Cholla (*Opuntia immbricata*) and Prickly Pear (*Opuntia sp*.). Ponderosa Pine (*Pinus ponderosa*) occurs in one location within this habitat in Oklahoma.

Recognized vegetation associations within this habitat type included:

Oneseed Juniper – Pinyon Pine/Grama Woodland
Oneseed Juniper/Grama Woodland
Ponderosa Pine/Grama – Little Bluestem Woodland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Cassin's Sparrow		X			X			
Bird	Juniper Titmouse	X							X
Bird	Lewis's Woodpecker	X							X
Bird	Loggerhead Shrike		X			X			
Bird	Pinyon Jay	X							X
Bird	Prairie Falcon	X							X
Bird	Scaled Quail		X			X			
Bird	Swainson's Hawk	X							X
Mamm	Colorado Chipmunk				X				X
Mamm	Desert Shrew				X				X
Mamm	Hog-nosed Skunk				X				X
Mamm	Mountain Lion	X							X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mamm	Ringtail	X							X
Mamm	Western Big-eared Bat	X				X			
Rept	Common Checkered Whiptail	X				X			
Rept	Common Lesser Earless Lizard	X							X
Rept	Round-tailed Horned Lizard	X							X
Rept	Texas Horned Lizard	X				X			
Rept	Western Diamond-backed Rattlesnake			X					X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies on species of greatest conservation need to establish baseline population data/information.
- Conduct field studies to verify existing data.
- Use surveys, workshops and data acquisition to monitor species and update the Comprehensive Wildlife Conservation Strategy.
- Develop long-term funding sources to enable continuation of studies that will allow tracking of populations of species of greatest conservation need and habitat trends into the future.
- Develop methods to accurately identify and map the distribution and the condition of this habitat.
- Identify/prioritize core areas of habitat and corridors to connect.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Fragmentation of forest tracts has resulted from conversion of these habitats to other uses.
4. Fire suppression and heavy grazing pressure have resulted in an increase in juniper density and abundance within this habitat type in the Shortgrass Prairie Region resulting in increased soil erosion.
5. In some places intensive grazing by cattle has resulted in a reduction of tall grasses, forbs, and deciduous shrubs.

Conservation Actions:

- Consider land acquisition, conservation easements, and leases to conserve especially valuable tracts of this habitat.
- Demonstrate the potential for restoration of this habitat type on public lands.
- Encourage and facilitate the development a program to assist landowners with proper fire management.
- Encourage the development of incentive programs for landowners to enable restoration of habitat through prescribed burning and deferred grazing.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired and number of acres in conservation programs.
- Amount of technical assistance being provided.
- Increased use of prescribe fire on the landscape.
- Landowners participating in landowner incentive programs.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Vegetation response to fire (e.g., grasses and woody plants).

Conservation Landscape: Herbaceous Wetland

The relative condition of the Herbaceous Wetland habitat in the Shortgrass Prairie Region of Oklahoma is currently poor with a declining trend. The majority of herbaceous wetlands in the Shortgrass Prairie Region are found in playas. Playas are round, clay-lined depressions that occur on flat terrain within Shortgrass Prairie habitat. They collect surface runoff after heavy rains to form small seasonally wet wetlands. Playa wetlands are small (i.e., average about 17 acres in size) and often separated from the next nearest wetland/playa by several miles. Other seasonal wetlands occur in the floodplains of streams and the Beaver and Cimarron rivers. These floodplain wetlands often form small complexes of strings of wetlands tied together. Wetland plant communities are diverse as a result of variations in length of time the soil is saturated. Widespread wetland plants in the Shortgrass Prairie Region include: Common Spikerush (*Elocharis palustris*), Pink Smartweed (*Polygonum pensylvanicum*), Three-square Bulrush (*Schoenplectus pungens*), and Sand Spikerush (*Elocharis montevidensis*). In saline or alkaline wetlands, inland Saltgrass (*Distichlis spicata*) and Alkali Sacaton (*Sporobolus airoides*) may be the dominant plants. Other common wetland plants include Saltmarsh Aster (*Aster sublatus*), Barnyard Grass (*Echinochloa crus-galli*), Plains Coreopsis (*Coreopsis tinctoria*), and Marshelder (*Iva sp*.).

Though wetlands are widespread in the Region, they comprise less than two percent of the total acreage. Many wetlands are in poor condition as a result of sedimentation due to exposed soil from surrounding crop fields being carried to and deposited into the wetlands in storm water runoff. Many playas and other seasonal wetlands have been plowed and converted to agricultural uses.

Recognized vegetation associations (Hoagland 2000) within this habitat type include:

Broadleaf Cattail Marsh
Common Spikerush – Hairy Waterclover Marsh
Inland Saltgrass – Alkali Sacaton Temporarily Flooded Grassland
Inland Saltgrass – Three-square Bulrush Temporarily Flooded Grassland
Pennsylvania Smartweed – Curlytop Smartweed Wetland
Prairie Cordgrass Marsh
Three-square Bulrush Marsh
Water Smartweed Wetland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Baird's Sparrow	X							X
Bird	Bald Eagle	X						X	
Bird	Barn Owl	X							X
Bird	Black Rail	X							X
Bird	Buff-breasted Sandpiper	X				X			
Bird	Canvasback	X							X
Bird	Hudsonian Godwit				X				X
Bird	Interior Least Tern	X							X
Bird	LeConte's Sparrow		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Long-billed Curlew	X							X
Bird	Northern Pintail		X			X			
Bird	Piping Plover	X							X
Bird	Prairie Falcon	X							X
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Upland Sandpiper				X		X		
Bird	Western Sandpiper	X							X
Bird	Whooping Crane	X						X	
Bird	Wilson's Phalarope				X				X
Bird	Yellow Rail				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete information about the distribution, ecology and abundance of the flora/fauna of wetlands, and of the wetlands.
3. Incomplete data regarding both the historic and current distribution and condition of this habitat type.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need, and to monitor changes over time.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population size, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations.
- Verify the accuracy of existing data.
- Use surveys, workshops, and data acquisition to monitor the status of species and to update the Comprehensive Wildlife Conservation Strategy.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Identify/prioritize core areas of habitat and corridors to connect.
- Develop studies to deal with data gap items.
- Form partnerships to jointly pursue habitat/species knowledge.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

4. Some irrigation practices result in impacts including lowering of the water table and disruption of the normal hydrological cycle.
5. Certain farming practices cause sedimentation problems, including failure to provide buffer vegetation around wetlands to control sediment in storm water runoff.

Conservation Actions:

- Work with the agricultural community to improve the technology and application of irrigation.
- Develop and distribute information about the ecological value of wetlands.
- Encourage the increased use of Farm Bill programs to create vegetative buffers around wetlands.
- Encourage landowners to enroll wetlands into the Wetlands Reserve Program.
- Develop and distribute information about how landowners can reduce soil erosion and movement of sediment into wetlands.

Conservation Issue: Habitat loss and fragmentation from land management practices:

6. Draining or filling of wetlands for cropland development causes reduced habitat quantity and quality in herbaceous wetland habitat in the Shortgrass Prairie Region.
7. Fire suppression and heavy cattle grazing sometimes cause conditions favorable to invasion of wetlands in floodplains by Salt Cedar and other introduced plant and animal species.
8. Herbaceous wetlands can be maintained, enhanced or restored by using ground water to flood dry playas and basins.

Conservation Actions:

- Encourage landowners to enroll wetlands in the Wetlands Reserve Program.
- Develop and distribute information about playas and the value of wetlands.
- Develop descriptions of quality herbaceous wetland habitats in the Shortgrass Prairie Region.
- Encourage legislation to designate pumping for wetlands as a beneficial use of groundwater.
- Consider land acquisition and conservation easements for conserving especially valuable or critical tracts.

- Recognize conservationists and landowners practicing land stewardship through registration and certification programs.
- Develop financial or tax incentives to cover the cost of maintenance and preservation of herbaceous wetlands.
- Encourage and support fencing playas to control cattle and land tillage.
- Conduct field studies to evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species.
- Identify those exotic species causing the greatest impact to this habitat and to species of greatest conservation need.
- Develop and implement control or management plans for the exotic species that cause the greatest ecological damage.
- Develop and implement monitoring programs to measure and evaluate the effectiveness of control measures.
- Develop and distribute educational materials about the playa habitat, fire ecology in the Shortgrass Prairie, and the dangers of invasive species.
- Encourage implementation of controlled burning regimes.
- Develop an Oklahoma Department of Wildlife Conservation policy to appropriately protect employees conducting prescribed fires.
- Develop funding mechanisms for private lands prescribed fire assistance.
- Develop and distribute information related to the value of wetlands and the benefits of flood irrigation increasing and sustaining some of these habitats.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acreages enrolled in the Wetlands Reserve Program.
- Acreages fenced and burned.
- Acreages of Salt Cedar in floodplains.
- Acres either acquired or under conservation easements.
- Amounts of money devoted to baseline studies.
- Development of information and education materials and their delivery to land managers.
- Evaluation of effectiveness of educational material production and distribution.
- GIS evaluation of the location and distribution of wetlands.
- GIS or aerial survey tracking of buffers around wetlands.
- GIS tracking of irrigated acreages.
- Legislation related to water use.
- Numbers of ecological studies.
- Numbers of partnerships involved.
- Periodical checks of the U.S. Geological Survey water table measurements.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Small Rivers and Sloughs/Ponds

The relative condition of Small Rivers and Sloughs/Ponds habitat is currently poor with a declining trend. Small rivers and sloughs/ponds habitats include the Cimarron and Beaver Rivers.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
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Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Interior Least Tern	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Mountain Plover	X							X
Bird	Northern Bobwhite		X			X			
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Sandhill Crane		X				X		
Bird	Snowy Plover	X							X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Whooping Crane	X						X	
Fish	Arkansas Darter	X							X
Fish	Arkansas River Shiner	X				X			
Fish	Arkansas River Speckled Chub	X				X			
Fish	Flathead Chub	X				X			
Fish	Plains Minnow			X		X			
Fish	Red River Shiner			X			X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Western Big-eared Bat	X							X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.
3. Incomplete biological resource monitoring.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need in this habitat.
- Conduct field investigations to establish baseline conditions for the current distributions, abundances and habitat affinities for species of greatest conservation need in this habitat.
- Conduct field research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct studies to verify existing data.
- Use surveys, workshops and data acquisition to monitor species status and to update the Comprehensive Wildlife Conservation Strategy.
- Develop long-term funding mechanisms for baseline studies to allow comparisons of populations and habitats under a variety of conditions.
- Develop and distribute information to landowners and the general public about the ecology and value of intact ecosystems in small rivers and sloughs/ponds within the Shortgrass Prairie Region.
- Database development and updating such that ecological condition and progress can be measured and monitored.
- Develop a description of what quality small river and sloughs/ponds habitat is in the Shortgrass Prairie Region.
- Develop and implement a monitoring program to track changes in habitat condition/quality and the population status of species of greatest conservation need.
- Encourage and facilitate the development of local watershed councils, citizen's groups or stream teams to address local concerns and to help monitor wildlife populations.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

4. Irrigation has changed water availability and distribution within small rivers and sloughs/pond habitats in the Shortgrass Prairie Region.
5. Dams and water diversions have altered hydrology of small rivers and sloughs/ponds within this Region, reducing flows and periodic scouring..
6. Pumping of shallow groundwater in floodplains have decreased flows, including natural flooding and scouring of the river channel during the spring.
7. A variety of activities have decreasing groundwater quality and amount.
8. Lack of headwaters protection results in compounding of both water quantity and quality issues downstream.

Conservation Actions:

- Support Farm bill incentives for practices favorable to the conservation of small rivers and sloughs/ponds.
- Consider land acquisition, conservation easements, and leases to protect the most important tracts or stream sections and especially to protect headwaters.
- Support and facilitate the development and functioning of local watershed councils, citizen's groups or stream teams to address local concerns and to help monitor wildlife populations and habitat condition.
- Develop and implement procedures to restore river channel morphology, flow patterns and the structure of riparian vegetation.
- Develop and distribute information for landowners regarding riparian habitat, grazing concerns within riparian habitats, Best Management Practices, and existing Farm Bill programs.
- Promote erosion control incentives and programs such as the stream buffer program of the Farm Bill.
- Identify areas that are of quality habitat, and reward those landowners and showcase those properties to let others know how the dedication to quality management has resulted in recognition and awards without diminished economic returns to the landowner.
- Encourage the protection of riparian areas from grazing using fencing.
- Support and encourage the development of landowner incentive payments to restore riparian vegetation structure.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

9. Non-native Salt Cedar has invaded many of the riparian areas along small rivers and sloughs/ponds in the Shortgrass Prairie Region.
10. A variety of plant and animal species have invaded or encroached into natural communities in small rivers and sloughs/ponds in the Shortgrass Prairie Region.
11. Periodic fires were historically part of the natural condition in riparian areas along small rivers and sloughs/ponds in the Shortgrass Prairie Region. The exclusion of fire has resulted in altered conditions.

Conservation Actions:

- Re-evaluate burning laws to see if there is a way to protect personal property and at the same time allow fire to be used to restore and maintain healthy riparian areas in this habitat.
- Encourage the development of Farm Bill incentives that will result in healthy riparian areas in this habitat.
- Encourage and facilitate the creation of prescribed burn cooperatives.
- Use all available mechanisms to control invasive plant and animal species.
- Consider the use of land acquisition, conservation easements, and leases to protect the most valuable tracts and sections of this habitat, especially headwaters.
- Develop and implement exotic and invasive species management plans.
- Develop and distribute educational materials for anglers about the ecological problems associated with the introduction of fish from other watersheds through bait bucket releases.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

12. Lack of control of livestock in channels and floodplains results in increased nutrients in the water, reduced riparian vegetation and contributes to bank erosion.
13. Concentrated farming operations/hog farms increase nutrient inputs into rivers due to increased nutrients in storm water runoff from the land application areas around such facilities.

14. Endocrine disruptors related to agricultural runoff/discharges associated with poultry, hogs, cattle, and crop pesticides disrupt the development and reproduction of invertebrates, fish and amphibians.

Conservation Actions:

- Support the use of Farm Bill incentives that provide habitat protection for riparian areas.
- Consider land acquisition, conservation easements, and leases to protect important riparian areas.
- Develop and/or improve Best Management Practices for grazing to protect watersheds.
- Encourage more effective cost sharing for landowners who reduce inputs of agricultural chemicals and animal waste products into streams.
- Facilitate the development of local watershed councils, citizen's groups or stream teams to address local concerns and to help monitor wildlife populations.
- Develop and distribute information to landowners regarding riparian habitat, grazing concerns within riparian habitats, Best Management Practices, and existing Farm Bill programs.
- Identify and help provide alternative water sources for livestock to get them out of the river.
- Promote erosion control incentives and programs such as the stream buffer program of the Farm Bill.
- Encourage the strengthening of Confined Animal Feeding Operation regulations that limit the volume of animal waste that can be applied on the land.
- Identify limits to chemicals such as phosphorous at the watershed level.
- Encourage the protection of riparian areas from grazing using fencing and landowner incentives payments to restore riparian vegetation structure.

Conservation Issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

15. Uncontrolled use of off-road vehicles can result in reduction of the quantity and quality of this habitat.

Conservation Actions:

- Conduct research to better understand the impacts of off-road vehicles in this habitat.
- Determine and monitor the impacts of off-road vehicles by monitoring wildlife populations (especially indicator species) and by monitoring water quality.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres degraded and restored.
- Acres under easements or conservation practices.
- Creation of new local conservation groups and their effectiveness.
- Groundwater level and surface flow rates, using U.S. Geological Survey data.
- Landowners participating in conservation practices.
- Playa Lakes Joint Venture Wetland datasets – periodic review.
- Pubic opinion toward conservation actions.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Riparian acres acquired or proportion of acres protected/acquired within a given watershed.
- U.S. Geological Survey groundwater levels check.
- U.S. Geological Survey monitoring stations.
- Water quality.

Conservation Landscape: Sand Sagebrush/Bluestem Shrublands

The relative condition of Sand Sagebrush/Bluestem Shrublands habitat is currently good with a stable trend. Sand Sagebrush (*Artemisia filifolia*) shrublands are found in scattered locations across most of the Shortgrass Prairie Region, but are most common in the eastern third of the Region and restricted to sites with deep sandy soils and stabilized dunes, primarily in the vicinity of the Beaver/North Canadian and Cimarron rivers. Sand sagebrush is typically associated with Sand Dropseed (*Sporobolus cryptandrus*) and Little Bluestem (*Schizachyrium scoparium*). In these plant communities, Sand Sagebrush may comprise 5 to 50 percent of the canopy cover depending upon factors such as grazing pressure which tends to decrease grass coverage and increase sagebrush, or fire frequency which tends to decrease sagebrush and increase the coverage by grasses. Other grasses and forbs found in this community include Sand Bluestem (*Andropogon hallii*), Sideoats Grama (*Bouteloua curtipendula*), Prairie Sandreed (*Calamovilfa longifolia*), Sand Lovegrass (*Eragrostis trichodes*), Sand Paspalum (*Paspalum stramineum*), Prairie Sunflower (*Helianthus petiolaris*), Mentzelia (*Mentzelia sp.*), Hairy Goldenaster (*Chrysopsis villosa*), Halfshrub Sundrops (*Calylophus serrulatus*), Annual Buckwheat (*Eriogonum anuum*), Indian Blanket (*Gaillardia pulchellum*), Western Spiderwort (*Tradescantia occidentalis*) and Yucca (*Yucca glouca*). The Shortgrass Prairie Region encompasses approximately half of the sand sagebrush shrublands that occur in Oklahoma.

Recognized vegetation associations within this habitat type include:
Sand Sagebrush/Sand Dropseed – Little Bluestem Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Burrowing Owl	X							X
Bird	Cassin's Sparrow		X						X
Bird	Ferruginous Hawk	X							X
Bird	Harris's Sparrow		X						X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Red-headed Woodpecker		X			X			
Bird	Scaled Quail		X			X			
Bird	Swainson's Hawk		X						X
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Western Big-eared Bat	X							X
Rept	Common Lesser Earless Lizard				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies of species of greatest conservation need to establish baseline population data/information.
- Conduct studies to verify existing data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Identify/prioritize core areas of habitat and corridors to connect.

Conservation Issue: Black-tailed Prairie Dog habitat related issues:

3. Prairie Dog control practices often impact non-target species.
4. Land conversion has resulted in the loss of large Prairie Dog complexes (i.e., those in excess of 5,000 acres) thought to be critical to the long-term sustainability of Black-tailed Prairie Dogs and symbiotic species.
5. Conversion of large blocks of land to other land uses has resulted in fragmentation of Prairie Dog complexes.

Conservation Actions:

- Encourage and facilitate the development of programs to provide incentives for landowners to practice Black-tailed Prairie Dog colony/complex enhancement and restoration.
- Encourage ecotourism, lease hunting and lease fishing as a supplemental economic benefit to landowners in order that they can manage large complexes of Black-tailed Prairie Dogs and symbiotic species.
- Develop and distribute information to landowners on several topics including grazing ecology, natural systems and exotic invasive species.
- Maintain or possibly expand programs like the Landowner Incentive Program for the conservation of Black-tailed Prairie Dogs and other species, focusing on restoration and enhancement.
- Support and encourage inheritance legislation to enable large ranches to remain in single family ownership.
- Consider land acquisition and conservation easements (e.g., by land trusts and non-governmental organizations such as The Nature Conservancy) for conserving important tracts of this habitat in the Shortgrass Prairie Region.
- Increase funding for the Conservation Reserve and Grassland Reserve Programs from the subsidy side of the Farm Bill.
- Encourage and facilitate the development and updating of Best Management Practices for grazing practices, fire management and other subjects.
- Develop and modify as needed the existing Prairie Dog control regulations to minimize undesirable impacts on species of greatest conservation need in this habitat.
- Identify and prioritize core areas of Black-tailed Prairie Dog colonies to enhance complex development.
- Employ the natural areas registry.

Conservation Issue: Habitat loss and fragmentation from land management practices:

6. Fragmentation of the habitat has occurred for a variety of reasons, including that which is caused by smaller land ownership sizes due to inheritance tax laws.
7. Conversion of this habitat to cropland has resulted in diminished capacity of the habitat to support species of greatest conservation need.
8. In some areas, heavy grazing has reduced both the quantity and the quality of this habitat in the Shortgrass Prairie Region; this is especially true of the reduction in bluestem cover.
9. Heavy applications of herbicides to reduce sand sagebrush reduce the amount of cover and the abundance of native forbs.
10. Unneeded or abandoned fences produce obstacles for Lesser Prairie Chickens.
11. Areas that have been cleared for road construction or pipeline/well construction are especially susceptible to wind erosion.
12. Energy exploration and development can produce impacts that include the loss of habitat quantity and quality in this habitat in the Shortgrass Prairie Region.
13. Fire suppression can result in a local over-abundance of Sand Sagebrush or Eastern Redcedar.

Conservation Actions:

- Encourage and facilitate the production and distribution of information materials for landowners that increase landowner knowledge of, access to and use of Farm Bill programs.
- Identify/prioritize core areas of habitat and corridors to connect to get the most efficient use of funds.
- Consider land acquisition or conservation easements to conserve important tracts of this habitat in the Shortgrass Prairie Region.

- Support and encourage inheritance legislation to enable large ranches to remain in single family ownership.
- Encourage and promote alternative grazing practices that use patch burning and mineral blocks to control the movement of cattle rather than relying entirely on fencing.
- Support increasing funding from the subsidy side of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Encourage the development and use of tax incentives and tax relief for landowners who maintain good quality habitat.
- Encourage or cost share the development of demonstration areas that show and describe grazing and fire regimes that benefit species of greatest conservation need in the Shortgrass Prairie Region.
- Encourage and support ranch diversification for lower grazing and off set by lease hunting, fishing access, and ecotourism viewing.
- Encourage an economic study for profitability and nutrition of diverse forbs pasture.
- Encourage the development and updating of Best Management Practices for grazing and pesticide/herbicide usage in this habitat.
- Encourage and support the development and distribution of information that increases landowner knowledge of, access to and use of Farm Bill programs.
- Facilitate prescribed burning as a tool to control Eastern Redcedar.
- Facilitate the development of controlled burn cooperatives.
- Support increasing the cost share for tree clipping (i.e., Eastern Redcedar) and changing ranking factors in the Conservation Reserve Program.
- Support efforts to develop or update fire-related Best Management Practices.
- Subsidize burn schools for cooperatives and contractors in the Shortgrass Prairie Region.
- Encourage fire management contractors and laws that reduce the liability for fire contractors.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

14. Much of the Conservation Reserve Program within or adjacent to this habitat type has been planted to exotic invasive species such as Old World Bluestem.
15. The quality and quantity of this habitat has been decreased by invasive species - particularly the native Eastern Redcedar and the exotic Old World Bluestem and Russian Thistle.

Conservation Actions:

- Encourage and support the development and distribution of informational materials to increase landowner knowledge of, access to and use of Farm Bill programs.
- Support increase funding from the subsidy side of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Encourage increasing the cost share for tree clipping (i.e., Eastern Redcedar) and support changing ranking factors in the Conservation Reserve Program.
- Encourage and facilitate the development or updating of Best Management Practices for dealing with invasive species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of native plant communities restored.
- Changes in acreage/coverage of exotic vegetation.
- Develop GIS datasets to monitor changes in land cover.
- Numbers of acres burned/treated.
- Numbers of acres enrolled in conservation programs, including Landowner Incentive Program.

- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Mixed-grass Prairie

The relative condition of Mixed-grass Prairie habitat in the Shortgrass Prairie Region is currently good with an increasing trend. This is a relatively uncommon habitat type found in the eastern portion of the Shortgrass Prairie Region. Mixed-grass Prairies in this Region are dominated by Little Bluestem (*Schizachyrium scoparium*), Sideoats Grama (*Bouteloua curtipendula*) and Blue Grama (*Bouteloua gracilis*). Silver Bluestem (*Bothriochloa saccharoides*) and Prairie Threeawn (*Aristida oligantha*) occur in disturbed sites. Other common grasses and forbs include Sneezeweed (*Helenium anarum*), Heath Aster (*Aster ericoides*), Roundleaf Bladderpod (*Lesquerella ovalifolia*), and Foxtail Barley (*Hordeum jubatum*). This habitat type seems more common today than is was historically in the region because of the large acreage which has been enrolled into the Conservation Reserve Program and planted to bluestem grasses. These fields resemble Mixed-grass Prairie in structure but most of these are dominated by exotic grasses such as Yellow (i.e., Old World) Bluestem and have been planted in areas that were historically Shortgrass Prairie.

Recognized vegetation associations within this habitat type include:

Little Bluestem – Blue Grama Grassland
Little Bluestem – Sideoats Grama – Blue Grama Grassland
Silver Bluestem Grassland
Vine Mesquite – Buffalograss Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Baird's Sparrow	X							X
Bird	Barn Owl	X							X
Bird	Buff-breasted Sandpiper	X				X			
Bird	Burrowing Owl	X							X
Bird	Cassin's Sparrow		X						X
Bird	Chestnut-collared Longspur	X							X
Bird	Ferruginous Hawk	X							X
Bird	Harris's Sparrow		X						X
Bird	LeConte's Sparrow		X						X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Long-billed Curlew	X							X
Bird	McCown's Longspur				X				X
Bird	Northern Bobwhite		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prairie Falcon	X							X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Scaled Quail		X			X			
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		
Bird	Whooping Crane	X						X	
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Desert Shrew				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Swift Fox		X				X		
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to determine baseline conditions for distributions, abundances, and habitat affinities of species of greatest conservation need, to verify the accuracy of existing data, and to assess changes over time.

- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct studies to identify and prioritize core areas of habitat and corridors to connect.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Fragmentation in this habitat is frequently caused by smaller land ownership sizes due to inheritance tax laws.
4. Heavy grazing in some areas has reduced the quantity and quality of this habitat.
5. Some herbicide treatments reduce the abundance of native forbs, reducing the quality of this habitat.
6. Prairie Chicken collisions with fences can be substantial in some areas.
7. Conversion of native prairie to crop fields has reduced the quantity of this habitat in some areas.
8. Energy exploration and development, including wind power development, can reduce the suitability of this habitat for species of greatest conservation need.

Conservation Actions:

- Consider land acquisition and conservation easements for acquiring some of the most important tracts of this habitat.
- Encourage and support private land acquisition to protect important tracts in this habitat (e.g., by land trusts and non-governmental organizations such as The Nature Conservancy).
- Encourage and support inheritance legislation to enable large ranches to remain in single family ownership.
- Encourage and support the development or updating of Best Management Practices for fire use and management.
- Encourage and support modification of existing laws and regulations increase the cost share for tree clipping (e.g., Eastern Redcedar) and changing ranking factors.
- Encourage or cost share the development of demonstration areas that show and describe grazing and fire regimes in the Region that benefit species of greatest conservation need.
- Encourage and facilitate burn schools for fire cooperatives and contractors.
- Develop and distribute informational materials that increase landowner knowledge of, access to and use of Farm Bill programs.
- Encourage and assist with the development and updating of Best Management Practices for practices including grazing management, crop selection, and herbicide application.
- Encourage the conversion of cropland to Grassland Reserve or Conservation Reserve Programs planted to native grasses.
- Increase funding from the subsidy portion of the Farm Bill for practices that maintain or improve this habitat.
- Support adjustments in the Grassland Reserve and Conservation Reserve Programs which make it more favorable to maintain and enhance this habitat.
- Encourage the removal of residual fences.
- Encourage and promote alternative grazing practices that use patch burning and mineral blocks to control the movement of cattle rather than using fencing.
- Encourage and support ranch diversification for lower grazing off set by lease hunting, fishing access, and ecotourism viewing.
- Cooperate with appropriate entities (e.g., energy companies, federal and state agencies, and individual landowners) to site energy developments in a way that will minimize restrictions on species of greatest conservation need use of this habitat.
- Encourage both on-site and off-site mitigation for energy development.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

9. Introduced species (particularly Old World Bluestem) and invasive species (particularly the native Eastern Redcedar and the exotic Russian Thistle), along with conversion to cropland or to Conservation Reserve Program which has been planted to exotic or invasive species such as old world bluestems, have reduced the quantity and quality of this habitat.

Conservation Actions:

- Encourage and facilitate conversion of cropland or Conservation Reserve Program dominated by Old World Bluestem to native prairie species.
- Support the development and use of tax incentives and tax relief for maintaining good quality prairie.

Conservation Issue: Black-tailed Prairie Dog habitat related issues:

10. Black-tailed Prairie Dog colonies have been reduced and their habitat has been fragmented.

Conservation Actions:

- Encourage and support economic incentives for landowners who preserve and restore Black-tailed Prairie Dog colonies.
- Encourage and support ranch diversification for lower grazing and off set by lease hunting, fishing access, and ecotourism viewing.
- Develop and distribute informational materials for landowners on grazing ecology that minimizes reduction in species of greatest conservation need.
- Encourage programs like the Landowner Incentive Program for the conservation of Black-tailed Prairie Dog habitat.
- Encourage and support inheritance legislation to enable large ranches to remain in single family ownership.
- Encourage private land acquisition and conservation easements (e.g., by land trusts and non-governmental organizations such as The Nature Conservancy) to maintain or enhance the quality of this habitat.
- Increase funding from the subsidy portion of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Identify and prioritize core areas of habitat and corridors to connect to get the efficient use of funds.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Acres of native plant communities (species composition) restored.
- Acres of wind farms occupied and impacted.
- Acres under easements or enrolled in conservation programs, including Landowner Incentive Program.
- Changes in acreage/coverage of exotic vegetation.
- Develop GIS datasets to measure/calculate an index of habitat fragmentation and land cover changes.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Sandy-bottom Streams and Associated Riparian Forest

The relative condition of Sandy-bottom Streams and Associated Riparian Forest habitat is currently poor with a declining trend in the Shortgrass Prairie Region. Only a small number of streams are found in this relatively arid Region of the state. Most streams have a sandy or silty substrate except for a few locations in the Black Mesa area where streams may have a rocky or gravel substrate. Many streams are not perennial and water may cease to flow above ground during the driest periods in the summer. Many stream channels are lined with semi-aquatic vegetation such as Cattails (*Typha angustifolia*), Three-square Bulrush (*Schoenoplectus pungens*) and Spikerushes (*Eleocharis sp*.). The riparian areas along these streams are often open woodlands dominated by Eastern Cottonwood (*Populus deltoides*), Sandbar Willow (*Salix exigua*), Peachleaf Willow (*Salix amygdaloides*), and Sand Plum (*Prunus angustifolia*). Herbaceous plants include Switchgrass (*Panicum virgatum*), Sweetscent (*Pluchea odorata*), and Germander (*Teucrium canadense*).

Recognized vegetation associations in this habitat type include:

Eastern Cottonwood – Black Willow Woodland
Eastern Cottonwood – Sandbar Willow Woodland
Sandbar Willow/Switchgrass Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Bald Eagle	X						X	
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Bullock's Oriole		X						X
Bird	Interior Least Tern	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Peregrine Falcon	X							X
Bird	Red-headed Woodpecker		X			X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Sandhill Crane		X				X		
Fish	Arkansas Darter	X							X
Fish	Plains Minnow			X		X			
Fish	Red River Shiner			X			X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Mountain Lion	X						X	
Mamm	Western Big-eared Bat	X							X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Information is incomplete to help determine and to evaluate the best management strategies for riparian flora and fauna.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct field studies of species of greatest conservation need to establish baseline conditions for the current distributions, abundances and habitat affinities, and examine possible causes of suspected population declines.
- Conduct studies to verify existing data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Identify and prioritize core areas of habitat and corridors to connect them.
- Work with the agriculture community and other stakeholders to develop descriptions of what a quality example of this habitat is.
- Conduct field studies to determine beaver impacts on this habitat.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

3. Irrigation practices that involve groundwater pumping and lowering of the water table have reduced the quantity and quality of this habitat.
4. Dams and water diversions which reduce flows and scouring have diminished the quantity and quality of this habitat.
5. Upstream impoundments have modified the rivers' hydrology (Stinnett, Smith, and Conrady, 1987).

Conservation Actions:

- Encourage the adoption of minimum stream flow requirements to include flushing flows (Stinnett, Smith, and Conrady, 1987).
- Encourage increased access to and participation in Farm Bill programs including those providing economic incentives to landowners for habitat management.
- Develop and distribute informational materials to landowners and others concerning water conservation practices.
- Encourage no-till and low-till farming practices that help keep water on the land and curb soil erosion.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

6. Cottonwood regeneration has been reduced or eliminated in some areas of this habitat.
7. There is widespread woody vegetation encroachment within this habitat.
8. Because of the exclusion of fire there has been encroachment by Eastern Redcedar and Salt Cedar.

Conservation Actions:

- Conduct field studies to determine the factors responsible for the lack of Cottonwood regeneration within this habitat.
- Develop and distribute informational materials to landowners and others concerning mechanisms for managing fire and for invasive species control.
- Encourage and facilitate the creation of burn cooperatives.
- Encourage practices that control invasive species.
- Conduct field studies to determine the most efficient and effective methods of controlling Salt Cedar.
- Encourage and facilitate the establishment of demonstration plots showing successful techniques for the removal of Salt Cedar and Redcedar.
- Encourage the control of Redcedar through prescribed burning.

Conservation Issue: Habitat loss from land management practices:

9. Heavy grazing within riparian areas during the growing season reduces understory vegetation and hinders cottonwood regeneration.

Conservation Actions:

- Develop and distribute informational materials to landowners and others concerning ways to successfully preserve, protect, and enhance this valuable habitat.
- Encourage increased access to and participation in Farm Bill programs including use of those provisions that provide economic incentives to landowners.
- Encourage use of erosion control incentives such as the stream buffer program provided by the Natural Resources Conservation Service through the Farm Bill.
- Encourage and support programs that provide tax relief for riparian owners who engage in practices that protect and enhance this habitat (Stinnett, Smith, and Conrady, 1987).
- Encourage practices that protect riparian areas from grazing.
- Encourage fencing of riparian corridors to control access by cattle during the summer months.
- Encourage use of alternative shading for livestock to reduce impacts to riparian habitat.
- Encourage replacing of livestock ponds with alternative water sources.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

10. In some situations large concfined animal feeding operations/hog farms increase nutrients in waterways and increase the potential for ammonia or algae-related fish kills.

Conservation Actions:

- Develop and distribute informational materials to landowners and others concerning ways to minimize or eliminate environmental problems in this habitat related to confined animal feeding operations.
- Encourage and support strengthening the regulations dealing with limits on the amount of animal waste that can be applied on the land.
- Encourage making limits more restrictive and managing phosphorous at the watershed level.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Analysis of change in land use cover measured by aerial photography or remote imaging.
- Maturing component; numbers of acres and distribution can be monitored using GIS.
- National Wild Turkey Federation GIS data sets.
- Partnerships with local governments.
- Periodically assess the number of acres and distribution of wetlands using GIS datasets.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- U.S. Geological Survey monitoring stations.
- Water quality monitoring.

Conservation Landscape: Sand Plum/Sumac Shrubland

The relative condition of Sand Plum/Sumac Shrubland habitat is currently poor with a declining trend in the Shortgrass Prairie Region. This shrub-dominated habitat is uncommon and occurs locally in the eastern portion of the Region on deep sandy soils and stabilized dunes associated with the Beaver/North Canadian and Cimarron rivers. This habitat type is dominated by Skunkbrush (*Rhus aromatic*) and smaller numbers of Sand Plum (*Prunus angustifolia*). Other woody plants that occur in small numbers include Sand Sagebrush (*Artemesia filifolia*), and Netleaf Hackberry (*Celtis reticulata*). Common grasses and forbs include Little Bluestem (*Schizachyrium scoparium*), Indian Blanket (*Gaillardia pulchellum*), Sideoats Grama (*Bouteloua curtipendula*) and Switchgrass (*Panicum virgatum*). The historic and current acreages for this habitat type have not been measured, but neither is likely to exceed more than a few 10,000s of acres.

Recognized vegetation associations within this habitat type include:

Sand Plum/Little Bluestem Shrubland
Skunkbrush (Aromatic Sumac) Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Black-capped Vireo	X				X			
Bird	Cassin's Sparrow		X						X
Bird	Harris's Sparrow		X						X
Bird	Kentucky Warbler		X						X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Scaled Quail		X			X			
Bird	Short-eared Owl				X				X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mamm	Eastern Spotted Skunk				X				X
Mamm	Mountain Lion	X						X	
Mamm	Western Big-eared Bat	X							X
Rept	Common Lesser Earless Lizard				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Diamond-backed Rattlesnake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to determine baseline conditions for distributions, abundances, and habitat affinities of species of greatest conservation need, to verify the accuracy of existing data, and to assess changes over time.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Analysis of change in land use cover measured by aerial photography or remote imaging.
- Maturing component; numbers of acres and distribution can be monitored using GIS.
- Partnerships with local governments.
- Periodically assess the number of acres and distribution of wetlands using GIS datasets.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Springs

The relative condition of Springs habitat is currently poor with a declining trend in the Shortgrass Prairie Region. Only a small number of springs and seeps are found in this Region. Most are found in the area around Black Mesa or in proximity of streams. The ground around springs and seeps is often vegetated with herbaceous wetland plants such as Three-square Bulrush, Spikerushes and cattails. From the perspective of species of greatest conservation need, the most biologically significant springs occur in the Cimarron River watershed, where a few springs support populations of the Arkansas Darter (*Etheostoma cragini*) which is a candidate for federal listing under the Endangered Species Act.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Fish	Arkansas Darter	X					X		
Mamm	Western Big-eared Bat	X				X			

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Inadequate data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Data are incomplete about spring locations.
3. Springs are difficult to monitor because of their small size and because habitat is mostly privately owned.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.

- Conduct field studies to determine baseline conditions for distributions, abundances, and habitat affinities of species of greatest conservation need, to verify the accuracy of existing data, and to assess changes over time.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Create a springs/stream data base to track location, land ownership, and biological data.
- Work with individual landowners to gain permission to conduct biological inventories of animals (e.g., mussels, fish, amphibians, and crayfish) and plants.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

4. Agricultural runoff produces elevated nutrient levels that affect springs by increasing algae.
5. Heavy livestock grazing can degrade spring habitats.
6. Springs are sometimes modified by being made into concrete ponds for watering cattle.

Conservation Actions:

- Support and encourage economic incentives for landowners who protect and restore habitat and water quality.
- Encourage and support restoring vegetation around springs and removing human modifications such as small impoundments.
- Encourage fencing springs to control access by livestock.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

7. This is an especially fragile habitat. It is easily disturbed or modified by exotic plant invasion.

Conservation Actions:

- Encourage and support restoring vegetation around springs and removing human modifications such as small impoundments.
- Encourage fencing springs to control access by livestock.
- Encourage and support programs that control or stop introduction of exotic species such as Salt Cedar.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

8. Groundwater withdrawal is reducing spring and stream flow.

Conservation Actions:

- Encourage and support delineation of recharge areas for springs to protect water quality and quantity.
- Encourage management of water withdrawals to have the least impact on spring flows.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Number of easements obtained.
- Number of protected springs/streams.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stream and spring flow.
- Water quality.

Potential partnerships to deliver conservation for Shortgrass Prairie Region:

State Government

- Natural Areas Registry Program
- Oklahoma Commissioners of the Land
- Oklahoma Conservation Commission
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Wildlife Conservation
- Oklahoma Energy Resources Board
- Oklahoma Legislature
- Oklahoma Renewable Energy Council
- Oklahoma State University, Cooperative Extension Service
- Oklahoma State University, Department of Forestry
- Oklahoma Tourism and Recreation Department
- Oklahoma Water Resources Board
- Other state universities and departments
- University of Oklahoma, Oklahoma Biological Station
- University of Oklahoma, Oklahoma Natural Heritage Inventory

Federal Government

- Federal Regulation and Oversight of Energy
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Department of Agriculture, Farm Service Agency
- U.S. Department of Agriculture, Forest Service
- U.S. Department of Agriculture, Forest Service, Rita Blanca National Grasslands
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Agriculture, Resource Conservation and Development Councils
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

Local Government

- Conservation Districts
- Municipalities
- Tribal governments

Businesses, Citizens and Citizen Groups

- Black-tailed Prairie Dog Conservation Team
- Chambers of Commerce
- Ducks Unlimited and local Oklahoma chapters
- Electric Utilities
- Farm Bureau
- Farm organizations
- Farmers Union
- High Plains Partnership
- Individual farmers
- International Association of Fish and Wildlife Agencies
- Local citizen's groups
- National and Oklahoma Wind Power Initiative
- National Wild Turkey Federation and local Oklahoma chapters
- North American Grouse Partnership
- Oklahoma Cattlemen's Association
- Oklahoma Wildlife and Prairie Heritage Alliance

- Other sportsmens groups
- Playa Lakes Joint Venture
- Private landowners
- Producer Cooperatives
- Quail Unlimited and local Oklahoma chapters
- Rocky Mountain Bird Observatory
- Sutton Avian Research Center
- Swift Fox Conservation Team
- The Nature Conservancy
- Western Association of Fish and Wildlife Agencies
- Wind energy groups

Tallgrass Prairie Region

This region encompasses two portions of the state that were historically dominated by tallgrass prairie landscapes. One of these is commonly referred to as the Flint Hills and includes portions of Osage, Kay, Pawnee, and Payne counties. The other region is often called the Osage Plain and includes portions of Washington, Nowata, Rogers, Wagoner, Tulsa, Okmulgee, Muskogee, Mayes, Craing and Ottawa counties. The Tallgrass Prairie Region is equivalent to the combination of Bailey's Flint Hills and Osage Plains sections. In Omernick's classification system, it is equivalent to the Flint Hills and Central Irregular Plains ecoregions.

Historically, tallgrass prairies spanned portions of 14 states and covered nearly 150 million acres. Today, the largest unbroken tracts of tallgrass prairie exist in the Flint Hills of Oklahoma and Kansas. To the east, Tallgrass Prairie merges into oak savannahs and deciduous forests, and to the west it merges into Mixed-grass Prairie. Early settlers described grass reaching as high as a horse's back and often described it as a sea of endless grass. Today this habitat may cover only 1 percent of its former range. Intensive fires once maintained the habitat, but after European settlers arrived, they suppressed the fires and trees invaded the grasslands. The settlers also converted the rich prairie soil to a working landscape of agricultural areas and settlements. This is one of the greatest alterations of any ecosystem type in North America. The Tallgrass Prairie Region may never again sustain huge herds of free roaming bison and the natural grazing and fire patterns may no longer function on the same massive scale as historically, but large tracts still function as ecological units for many native species.

The best professional judgment of the advisory group and technical experts was used to identify each Conservation Landscape's status and trend. And, even though some issues and actions apply to multiple Regions, each Region chapter is designed to stand-alone.

Conservation Landscapes listed in general priority order

- Very High priority Conservation Landscapes:
  - Tallgrass Prairie
  - Small River
- High priority Conservation Landscapes:
  - Large River
  - Herbaceous Wetland
- Moderate priority Conservation Landscapes:
  - Post Oak and Black Jack Savannah and Woodland
  - Bottomland Hardwood Forest
  - Springs
  - Gravel-bottom Streams and Associated Riparian Forests
  - Sandy (soft)-bottom Streams and Associated Riparian Forests

Conservation Landscape: Tallgrass Prairie

Relative condition of Tallgrass Prairie habitat is currently good with a declining trend. Tallgrass Prairies are herbaceous plant communities dominated by four common, tall grass species: Big Bluestem (*Andropogon gerardi*), Indian Grass (*Sorghastrum nutans*), Switchgrass (*Panicum virgatum*) and Little Bluestem (*Schizachyrium scoparium*). The structure of this habitat type is maintained by the occurrence of natural fires that limit the growth of woody plant species and favor grasses and some forbs. All four of the dominant grass species are present in most Tallgrass Prairie sites; however Big Bluestem and Indian Grass tend to be most prevalent in mesic sites, while Big Bluestem and Little Bluestem are most common on drier sites. In mesic loamy soils such as those found in floodplains and bottomlands, Switchgrass and Big Bluestem are often the dominant grasses. Other widespread or common grasses include Prairie Dropseed (*Sporobolus hetrolepis*), Sideoats Grama (*Bouteloua curttipendula*), and Eastern Gamagrass (*Tripsacum dactyloides*). Common forbs include Rosinweed (*Silphium integrifolium*), Compass Plant (*Silphium laciniatum*), Lead Plant (*Amorpha canescens*), Wild Alfalfa/Scurf Pea (*Psoralea tenuifolia*), Illinois Bundleflower (*Desmanthus illinoensis*), Blazing Star (*Liatris sp.*), Goldenrod (*Solidago sp.*), Roundhead Lespedeza (*Lespedeza capitata*), Indian Paintbrush (*Castillega coccinea*) and Maximillian Sunflower (*Helianthus maximilliani*). Prairie Cordgrass (*Spartina pectinata*) is often the dominant grass in wet prairie sites which we discuss as a wetland type covered in the herbaceous wetland habitat type.

Tallgrass Prairie is the most abundant and widespread habitat type in the Tallgrass Prairie Region. Tallgrass Prairie habitat remains widespread in the Flint Hills section of this Region, where the shallow rocky soils are unsuitable for conversion to crop agriculture and ranching is the most common land use. The Flint Hills Section in Oklahoma and Kansas is one of the largest remaining concentrations of Tallgrass Prairie habitat in the country. In contrast, much of the native prairie in the Osage Plains Section has been converted to crop production or to Fescue (*Festuca sp.*) pasture. The extent of remnant prairies is unknown, but most tracts of native prairie appear to be scattered and relatively small. Where prairie habitat remains, decades of continuous grazing, fire suppression and encroachment of native and non-native plants has resulted in changes in the plant community composition and structure. These changes include greater woody plant cover, increased proportions of exotic grasses and decreased abundance of native forbs.

Recognized plant associations within this habitat type include:

- Big Bluestem – Switchgrass Grassland
- Big Bluestem – Little Bluestem – Indian Grass Grassland
- Switchgrass – Eastern Gamagrass Grassland
- Little Bluestem – Indian Grass Grassland
- Little Bluestem – Big Bluestem Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Golden Plover		X						X
Bird	Bald Eagle	X						X	
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Burrowing Owl	X							X
Bird	Greater Prairie Chicken	X				X			
Bird	Harris's Sparrow		X						X
Bird	Henslow's Sparrow	X							X
Bird	LeConte's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Peregrine Falcon	X							X
Bird	Prairie Falcon	X							X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		
Inve	American Burying Beetle		X						X
Inve	Byssus Skipper	X							X
Inve	Dotted Skipper	X				X			
Inve	Iowa Skipper	X				X			
Inve	Prairie Mole Cricket	X				X			
Inve	Regal Fritillary				X				X
Mamm	Eastern Harvest Mouse				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Meadow Jumping Mouse				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.

Conservation Actions:

- Focus research efforts on identifying the primary population reducing factors and what can be done to reduce, stop, and reverse these impacts to the populations.
- Conduct research to determine why species of greatest conservation need are low or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Create a long-term statewide systematic and scientifically proven resource monitoring system. Use representative habitats and begin taking photo points to create a database of historical pictures. Locate existing historic photographs and their exact location of every type of habitat in Oklahoma and use those sites as the continuing long-term photo sites for resource monitoring.

Conservation Issue: Habitat loss and fragmentation from land management practices:

2. Incomplete data, information, and inappropriate federal cost-share programs lead to the loss of habitat diversity. Special concerns are intact blocks of native prairie where cost-share programs should not add to landscape fragmentation or degradation of native species diversity.
3. Fragmentation of the habitat by actions such as oil and gas production, highways, wind farms, agriculture conversion, utilities, private land ownership, decreasing tract size, and hay biomass production.
4. Encroachment through urban sprawl.
5. Herbicide applications that harm wildlife.
6. Conversion of native Tallgrass Prairie to non-native pasture grasses and Bermuda grass and Fescue.
7. Inappropriate fire and grazing regimes that harm wildlife.

Conservation Actions:

- Actions for addressing incomplete data and information, and inappropriate federal cost-share programs:
    - Encourage accountability for Farm Bill conservation practices.
    - Update Best Management Practices for many practices.
    - Conduct management pilot studies to determine successful management strategies including:
        - Develop fire-grazing management programs that promote landscape heterogeneity (i.e., habitat diversity) such as patch-burning, rather than the common past practices that promoted landscape homogeneity (e.g., uniformity or evenness of use and thus low natural diversity).
        - Discourage practices and programs that fragment native landscapes and cause negative impacts to native grassland species (e.g., fencing, aerial application of herbicides, wildlife food plots, and tree planting).
        - All cost-share programs should carefully consider native biodiversity conservation.
    - Improve the knowledge needed to deliver appropriate fire programs.
    - Provide burning information to land managers.
    - Subsidize burn schools for cooperatives and contractors in many locations.
- Provide tax reform to keep people on the land and to be able to pass land between generations.

- Support tax shelters for ranch businesses like other businesses are currently receiving.
- Acquire public land through perpetual easements.
- Encourage private acquisition by livestock organizations, land trusts, and non-governmental organizations such as The Nature Conservancy with Best Management Practices applied.
- Increase funding for the Conservation Reserve and Grassland Reserve Programs from the subsidy side of the Farm Bill.
- Identify and remove federal and state involvement in projects that cause fragmentation.
- Use impact fees and tax disincentives for harmful practices that cause fragmentation.
- Encourage complete implementation of Best Management Practices.
- Support the Natural Resources Conservation Service in its implementation of non-subsidy programs.
- Support ranch diversification for lower grazing and off set by lease hunting, fishing access, and ecotourism viewing.
- Restore native Tallgrass Prairie whenever and wherever possible, especially by converting Fescue pastures back to native warm season grasses and forbs.
- Develop a targeting process that primarily focuses upon protecting the vast, intact Tallgrass Prairie landscapes that can still be found in Kay, Osage, Washington, Nowata, and Craig Counties.
- Actions for addressing encroachment through urban sprawl:
    - Support and fund regional planning organizations to address agricultural land, fragmentation, urban sprawl, open space and watershed protection.
    - Develop regional landowner organizations that provide a forum for working partnerships between ranchers and conservationists to address issues that threaten both the ranching culture and the natural heritage on privately owned landscapes.
    - Work with the Council of Governments and use existing ecoregional plans to provide ecological and sustainability information and knowledge to their private and public clients.
    - Encourage the placement of wind farms outside of intact native prairie landscape using the effective tax credits and other incentives, as the species of greatest conservation need seem to be detrimentally affected by the windmills, disturbance and infrastructure.
    - Acquire conservation easements on both public and private land.
    - Acquire fee title to essential land and habitat for species of greatest conservation need protection and restoration.
    - Use new urban development (i.e., sustainable development) techniques that minimize impacts such as cluster development that integrate and protect open space.
    - Encourage the statewide development of regulations and development guidelines to redirect development efforts in existing developments and place more value on open, unfragmented space.
    - Encourage and support the development of partnership models in Oklahoma like the Tallgrass Legacy Alliance of the Kansas Flint Hills and the Nebraska Sand Hills.
- Actions for addressing the development and implementation of Best Management Practices for pesticide applications:
    - Provide alternatives to herbicide application through outreach education to landowners and farm organizations.
    - Provide information comparing the economic benefits vs. losses due to the use of herbicides.
    - Identify and remove or alter federal subsidies for inappropriate spraying methods.

  - Encourage ecologically correct methods and market them to landowners.
  - Support the study of economic analysis and nutritional analysis of forage production in ranching and herbicide use.
  - Encourage better uses of herbicide by rights-of-way managers.
- Actions for addressing the conversion of native Tallgrass Prairie to non-native pasture grasses, Bermuda grass, and Fescue:
  - Create farm/ranch tax credits for maintaining or restoring native grasses.
  - Use conservation easements to maintain native landscapes.
- Actions for addressing inappropriate fire and grazing regimes that harm wildlife:
  - Modify fire laws to allow the fire management needed to protect species of greatest conservation need and restore habitat.
  - Support fire management cooperatives with education, laws, subsidies and organizational skills.
  - Encourage private for-profit fire management contractors to increase capacity and local economies.
  - Reduce liability for fire responsible contractors so that they do not have to hold all of the inherent risk.
  - Encourage or cost share the development of a demonstration site showing and describing grazing and fire regimes for counties or regions using profitability and biodiversity. (e.g., Oklahoma State University Agriculture Extension and state and federal land managers).
  - Encourage an economic study for profitability and nutrition of diverse forbs pasture.
  - Encourage and support ranch diversification for lower grazing and off set by lease hunting, fishing access, and ecotourism viewing.
  - Evaluate the policy implications of lease hunting, hunting cooperatives, diversification, ecotourism, and uniform hunting seasons to game and species of greatest conservation need and their habitat and develop a strategic direction for the state of Oklahoma and the Oklahoma Department of Wildlife Conservation.
  - If present, remove hurdles to lease hunting and hunting cooperatives.
  - Evaluate hunting seasons to provide for a more uniform distribution of seasons to enhance the profitability of lease hunting for private landowners.
  - Promote diversification, ecotourism and lease hunting.
  - Support education components for ranch diversification.
  - Facilitate the return of fire by supporting fire management burn schools for cooperatives and contractors in many locations.
  - Develop incentives for fire-grazing management that promotes landscape heterogeneity (i.e., habitat diversity), such as patch-burning.
  - Develop rancher-conservationist partnerships like in Osage/Kay and Nowata/Craig Counties to restore viable populations of the Greater Prairie Chicken.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

8. Invasive and exotic plants and animals change community structure in a way that is harmful to native wildlife.
9. Invasive native woody species displace natural habitat for wildlife.

Conservation Actions:

- Develop grant program that cost shares for education about invasive species problems and control measures that are preventative, not reactionary (e.g., low density as well as high density invasive species infestations would qualify for grant assistance).
- Conduct management pilot studies to determine successful management strategies and develop alternatives to aerial spraying.

- Create incentives to avoid riparian zones with spraying.
- Remove federal subsidies for programs that genetically design new invasive species of Bermuda grass and turf from other countries and promote invasive species.
- Promote certified hay programs exotic free and special use for people in sensitive areas.
- Change the way hay is graded to discourage the distribution of exotic grasses and pests.
- Require roadside re-vegetation with native species following construction.
- Develop programs to assist start-up of spot-spray businesses.
- Support Congressional action and lobbying of U.S. Department of Agriculture to reclassify *Sericia lespedeza* as a noxious species in the Southern Tallgrass Prairie Region of the United States (e.g., Oklahoma, Kansas, Nebraska, Missouri, and Arkansas) where it is the greatest invasive and/exotic threat to native rangelands.
- Support additional Congressional funding for control research, including biocontrols which Animal and Plant Health Inspection Service will not currently sanction due to Sericia's status as a U.S. Department of Agriculture crop species.
- Encourage rights-of-way managers to manage invasive species.
- Use patch burning and cattle rotation around large pastures rather than additional fencing to create smaller pastures, as additional fences fragment prairie habitats and encourage the growth of trees across the prairie.
- Increase cost share for tree clipping and change ranking factors.
- Use tax incentives and tax relief for maintaining good quality prairie.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Aerial spray acreage.
- Animal populations and vegetation response to management; focusing on species declining outside Oklahoma but still common here.
- Changes in acreage/coverage of exotic vegetation.
- Acres of native plant communities (species composition) restored.
- Number and acres protected, purchased, or easements secured.

Conservation Landscape: Small River

Relative condition of Small River habitat is currently good, but with a declining trend. Three small rivers occur within the Tallgrass Prairie Region - the Caney, Verdigris and Neosho rivers. Each of thee rivers originate within the Tallgrass Prairie Region in Kansas and flow into Oklahoma. The Caney River flows through the Flint Hills section and a small portion of the Crosstimbers Region before its confluence with the Verdigris River. The Verdigris and Neosho rivers originate in the Flint Hills of Kanasas and flows through the Osage Plains Region of Oklahoma before joining the Arkansas River. Tthe Caney, Verdigris and Neosho rivers are low-gradient, meandering rivers whose floodplains were largely forested historically. The flood regimes and flow patterns of all rivers have been modified by the construction of a reservoir on each main stem as well as reservoirs on one or more major tributaries. The lower portion of the Verdigris River has been further modified by the construction of a navigation channel that involved the construction of a series of locks and dams and the dredging/deepening of the channel.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Snowy Plover	X							X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Fish	Alligator Gar	X				X			
Fish	Blue Sucker	X							X
Fish	Bluntface Shiner	X							X
Fish	Kiamichi Shiner	X				X			
Fish	Neosho Madtom	X				X			
Fish	Paddlefish		X				X		

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Fish	Shorthead Redhorse	X							X
Fish	Shovelnose Sturgeon	X							X
Fish	Plains Minnow			X		X			
Inve	Bleufer			X			X		
Inve	Butterfly Mussel		X			X			
Inve	Elktoe	X				X			
Inve	Monkeyface Mussel			X			X		
Inve	Neosho Mucket	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Plain Pocketbook		X			X			
Inve	Rabbitsfoot	X				X			
Inve	Threeridge Mussel			X			X		
Inve	Wartyback Mussel		X				X		
Inve	Washboard			X			X		
Inve	Western Fanshell	X				X			
Inve	Ohio River Pigtoe	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	River Otter		X					X	
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete resource monitoring.
3. Incomplete data on a small river/watershed basis to determine the fish, mussel and crayfish community composition of specific watersheds.
4. Incomplete relational species and habitat database design and implementation.
5. Incomplete ecological data for many fish and mussel species of greatest conservation need, therefore it is not possible to accurately assess their habitat needs or determine the best practices to maintain or enhance populations and habitats.

Conservation Actions:

- Conduct research should determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing species and habitat data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

6. Water diversions and withdraws – especially water regime changes (e.g., patterns of flow, lack of channel maintenance flow, sedimentation and erosion) often have detrimental effects on species of greatest conservation need.
7. Reservoir construction and management has detrimental effects of species of greatest conservation need.
8. Addition of nutrients from fertilizers and livestock waste in storm water runoff degrades water quality.
9. Lack of headwaters protection of critical surface water sources harms species of greatest conservation need.
10. Removal of riparian vegetation is detrimental the species of greatest conservation need.
11. Geomorphic instability, disconnection of riparian vegetation with the water table, and erosion of banks are detrimental to species of greatest conservation need.
12. Invasive-exotic aquatic plants and animals make communities unstable.
13. Loss of shading affects water temperatures with negative effects on species of greatest conservation need.
14. In-stream sand or gravel mining changes the hydraulic of the in-stream flow.
15. There is a loss of temporary wetlands in floodplains which serve as breeding areas for amphibians and foraging areas for shorebirds, waterfowl and herons.
16. Livestock in channels and floodplains are detrimental to small river water quality and species of greatest conservation need.
17. Endocrine disruptors related to agricultural runoff/discharge (e.g., poultry, cattle, and use on plants) pose threats to species of greatest conservation need and humans.
18. Recreational use of rivers such as the overuse of floating and all terrain vehicles may affect species of greatest conservation need.
19. Commercial mussel harvest may harm species of greatest conservation need.
20. There is heavy metal contamination in the Neosho River from abandoned lead and zinc mining.

Conservation Actions:

- Acquire land and use conservation easements, leases, etc. to protect headwaters and banks, and provide recreational opportunities.
- Modify pond/reservoir management to ensure minimum in-stream flow, hydro periods, and more natural water regimes.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.
- Provide results of ecological studies to of water use planners and encourage their incorporation into water management plans and permits.
- Conduct management pilot studies to determine successful management strategies and use a demonstration sites.
- Develop local watershed councils, citizen's groups or river teams to address local concerns and to monitor wildlife populations.

- Provide alternative water sources for livestock to get them out of small rivers and remove ponds constructed on small rivers that restrict movement of species of greatest conservation need.
- Work collaboratively with landowners to protect riparian areas from grazing.
- Restore riparian zone, channels and plant buffer strips.
- Develop exotic and invasive species management plans and implement them.
- Provide for better cost sharing, and more acceptable landowner incentives to reduce nutrient inputs, and other Best Management Practices in the watershed to reduce nutrient inputs (i.e., point and non-point sources).
- Manage phosphorous on the watershed and support state land application limits.
- Encourage no-till/low-till farming to keep water on the lands.
- Support the Conservation Reserve Program, Conservation Reserve Enhancement Program and Grassland Reserve Program in the Farm Bill.
- Promote erosion control incentives, like the stream buffer program in Natural Resources Conservation Service.
- Educate landowners about watershed concepts, riparian habitat, Best Management Practices, existing Farm Bill type programs and Best Management Practices for grazing.
- Work collaboratively with public and private landowners to remove structures that block the passage of aquatic species of greatest conservation need.
- Educate landowners, the general public and students about ecology, water quality and quantity.
- Improve landowner knowledge of and access to Farm Bill incentive and cost-share programs to protect water quality and riparian habitat.
- Ensure long-term funding for relational database design, implementation and maintenance.
- Develop an accurate assessment/description of what small river habitat used to look like – to define the conservation target condition.
- Educate fishermen and bait producers about exotic bait, and the ecological and recreational ramifications.
- Work collaboratively with public managers to strengthen the confined cattle operations regulations for limits of waste on the land.
- Work collaboratively with public managers to enforce water quality standards.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Number of new local conservation groups and their effectiveness.
- Degraded and restored river miles of habitat.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of landowners participating in conservation practices.
- Population trends of fish and wildlife species, with emphasis on species of greatest conservation need.
- Pubic opinion toward conservation actions.
- River flow and habitat quality - measure return of river flow with range of natural variation.
- U.S. Geological Survey monitoring stations.
- Water quality parameters

Conservation Landscape: Large River

The relative condition of Large River habitat (e.g. Arkansas River) is currently good but with a declining trend. The Arkansas River flows through the southern portion of the Tallgrass Prairie Region. This large river has a seasonal period of high flow during the late spring and early summer followed by a period of much lower flow during the late summer and early fall. This seasonal fluctuation in water volume maintains a dynamic mosaic of ephemeral habitats such as sandbars, mudflats, sandbar willow thickets and marshy sloughs along and within the river channel that depend upon periodic scouring flows. For purposes of this Strategy, we consider the Large River habitat to be comprised of the river channel and these smaller ephemeral habitats that are tied to flooding and scouring flows. This mosaic of smaller habitats within the system supports a diversity of species of conservation need including the Least Tern (*Sterna antillarum*) on sandbars, shorebirds and wading birds on mudflats, and Alligator Gar and Paddlefish in deep channels and pools.

The Arkansas River has been modified by the construction of reservoirs and a navigation system on its lower reach. The river is impounded at two locations upstream from Muskogee (Kaw and Keystone reservoirs) and by a series of locks and dams below Muskogee. These modifications have resulted in an increase in deep, slowly-flowing water habitat. This has altered the historic fluctuation in flow rates and the magnitude of flood events that has diminished the abundance and condition of ephemeral habitats such as sandbars.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Interior Least Tern	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Mountain Plover	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Sandhill Crane		X				X		
Bird	Snowy Egret								
Bird	Snowy Plover	X							X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Western Sandpiper	X							X
Bird	Wilson's Phalarope				X				X
Fish	Alligator Gar	X				X			
Fish	Arkansas River Shiner (historically in Arkansas River)	X				X			
Fish	Blue Sucker	X							X
Fish	Paddlefish		X				X		
Fish	Plains Minnow			X		X			
Fish	Shorthead Redhorse	X							X
Fish	Shovelnose Sturgeon	X							X
Inve	Black Sandshell	X				X			
Inve	Bleufer			X			X		
Inve	Butterfly Mussel		X			X			
Inve	Monkeyface Mussel			X			X		
Inve	Neosho Mucket	X				X			
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Ozark Pigtoe	X							X
Inve	Plain Pocketbook		X			X			
Inve	Rabbitsfoot	X				X			
Inve	Threeridge Mussel			X			X		
Inve	Washboard			X			X		
Inve	Western Fanshell	X				X			
Mamm	River Otter		X					X	
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are

declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.

Conservation Actions:

- Establish adequate allocation of Oklahoma Department of Wildlife Conservation resources to acquire needed information to become more effective and efficient in providing protection and restoration of species of greatest conservation need.
- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify that existing data are still applicable.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct management pilot studies to determine successful management strategies.
- Monitor response of wildlife populations to various land management practices.
- Research the presettlement river status of Oklahoma rivers.
- Communicate about the species of greatest conservation need needs and knowledge with the U.S. Army Corps of Engineers and biologists about their priorities and the effects of their operations.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

2. Clearing of riparian zone negatively affects species of greatest conservation need and their habitat.
3. Use impact fees and tax disincentives for harmful practices that cause negative impacts on habitat and species.
4. Dredging and sand mining change flow and water quality.
5. Flood control management affects species of greatest conservation need.
6. Altered in-stream flows due to reservoir impoundment, resulting in altered flood patterns and low base flows, and the need to restore sandbars eliminated due to reservoir construction and operation.
7. Inter-basin introductions of aquatic species (e.g., accidental introduction of Red River Pupfish from the Red River system to the Canadian River) that compete with native wildlife.

Conservation Actions:

- Acquire land (e.g., fee title, conservation easements, leases) to protect headwaters.
- Modify reservoir management plans to protect and manage for species of greatest conservation need.
- Remove structures that block the passage of fish and or alter the presettlement pattern of water flow and flooding.
- Work with the U.S. Army Corps of Engineers to normalize in-stream flow to more natural flow patterns; check on the applicability of an 1135 project.
- Establish minimum in-stream flows below reservoirs.
- Raise the importance of recreation and alternative flow patterns.
- Support congressional reprioritizing of the U.S. Army Corps of Engineers projects to include fish, wildlife and recreation as beneficial uses.
- Cost share with U.S. Army Corps of Engineers for important priorities.
- Promote a better working relationship with the U.S. Army Corps of Engineers in economic, social and political arenas.

- Research the applicability and use of the Ecologically Sustainable Water Management Model.
- Research the use of mitigation to fund and support fish and wildlife protection and management from hydropower projects and U.S. Army Corps of Engineers impoundment project agreements.
- Change the scope of hydropower and U.S. Army Corps of Engineers projects through legislation to recognize the beneficial uses of wildlife.
- Research ways to discourage building in the floodplain, including tax incentives.
- Work within U.S. Army Corps of Engineers authorities to change management operations to benefit species of greatest conservation need.
- Research alternative methods of flood control such as levee removal and floodplain mitigation as wetland banks.
- Identify spawning areas potentially impacted by dredging.
- Implement mitigation and reimbursement for fish losses due to entrainment and stranding.
- Use the Fish and Wildlife Coordination Act between the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers to bring more attention to requirements of threatened and endangered species and species of greatest conservation need.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

8. Water quality issues (e.g., herbicides, nitrates, metals, and oil pollution).
9. Degradation of river banks by trampling and grazing of cattle.

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) and provide cost sharing that is more acceptable to landowners in order to reduce inputs and increase implementation of Best Management Practices in watersheds.
- Implement and standardize water quality requirements and levels below dams.
- Acquire land and conservation easements, leases, etc. to protect headwaters.
- Provide alternative water sources for livestock to get them out of the water to reduce water quality issues and disruption to the streams.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

10. Invasive species create unstable ecological conditions for native species.

Conservation Actions:

- Increase public education about the potential problems with releases of bait fish into rivers.
- Develop exotic and invasive species management plans.
- Develop grant program that cost shares for the education of invasive species issues and control measures that are preventative, not reactionary (e.g., low density as well as high density invasive species infestations would qualify for grant assistance).

Conservation Issue: Commercial harvest practices that negatively affect species of greatest conservation need:

11. Commercial harvest of minnows and mussels may be detrimental to habitat and species of greatest conservation need.

Conservation Actions:

- Study the effects of commercial harvest on species of greatest conservation need and implement appropriate resource management.
- Study the effects of introduced minnows into wetlands.

Conservation Issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

12. Increased recreational use of rivers and river beds by off-road vehicles adversely impact both habitat and wildlife.

Conservation Action:

- Develop and share understanding of the effects of recreation on species of greatest conservation need life requirements, habitat, water quality, and water hydrology.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of riparian forest with diverse structure.
- Amount, periodicity, value and kinds of recreation uses of rivers.
- GIS – habitat change analysis.
- Identify and monitor indicator species.
- Number of citizen's groups formed.
- Number of enhanced or restored acres of quality habitat.
- Number of reservoir management plans that take into account hydro period of the forests.
- Number of river miles degraded or improved to measure change.
- Population trends of indicator species or species of greatest conservation need.
- Acreage of quality habitat annually available.
- Stream and spring flow relational data base.
- U.S. Army Corps of Engineers reservoirs with management plans protecting tail waters, riparian land, bottom hardwood forests, sandbars and enhancing fish populations.
- Water quality parameters.

Conservation Landscape: Herbaceous Wetland

Relative condition of Herbaceous Wetland habitat in the Region is currently poor with a declining trend. Herbaceous wetlands are uncommon and their distribution and biological characteristics are poorly known in this Region. They are often small, seasonally flooded depressions and swales between dunes and hills, or in the floodplains of rivers and large streams. While they occur sporadically within the larger Tallgrass Prairie habitat type, they are more frequent in the broad floodplains of rivers. The conditions that maintain herbaceous wetlands are poorly understood but appear to involve the complex interaction of fire and fluctuating water levels. Herbaceous wetlands are also found in association with meandering prairie streams at locations where beaver activity has impounded small reaches of stream and created permanently flooded marsh habitats.

Recognized plant associations within this habitat type include:

Ravenfoot Sedge Seasonally Flooded Marsh
Common Rush Seasonally Flooded Marsh
Softstem Bulrush - Common Spike Rush Semi-permanently Flooded Marsh
Narrowleaf Cattail – Southern Cattail Semi-permanently Flooded Marsh
Broadleaf Cattail Semi-permanently Flooded Marsh
Pennsylvania Smartweed – Curlytop Smartweed Semi-permanently Flooded Wetland
Broadleaf Arrowhead – Longbar Arrowhead Semi-permanently Flooded Wetland
Prairie Cordgrass Temporarily Flooded Marsh

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X
Bird	Black Rail	X							X
Bird	Buff-breasted Sandpiper	X				X			
Bird	Canvasback	X							X
Bird	Hudsonian Godwit				X				X
Bird	Interior Least Tern	X							X
Bird	King Rail				X				X
Bird	LeConte's Sparrow		X						X
Bird	Lesser Scaup		X			X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Little Blue Heron		X						X
Bird	Long-billed Curlew	X							X
Bird	Nelson's Sharp-tailed Sparrow	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Piping Plover	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Upland Sandpiper				X		X		
Bird	Western Sandpiper	X							X
Bird	Willow Flycatcher	X							X
Bird	Wilson's Phalarope				X				X
Bird	Yellow Rail				X				X
Inve	Dotted Skipper	X				X			
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Marsh Rice Rat				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete information regarding the distribution and locations wetland habitats.
3. Incomplete information regarding the distributions and ecological needs of wetland wildlife species (i.e., which wildlife species occupy which wetland types).
4. The small size of wetlands makes them difficult to locate within larger habitat types such as prairies and woodlands.
5. There is incomplete knowledge about wetland ecology and the needs of wetland wildlife that is necessary for determining the effects of management practices.

Conservation Actions:

- Conduct Regional survey for wetlands.
- Develop a database of wetland locations and conditions.

- Conduct biological inventories of wetlands to determine plant community composition and the distribution and abundance of wildlife species of conservation need.
- Conduct studies to determine the ecological needs of wetland wildlife species (e.g., types of plant communities and the timing and duration of flooding needed for each wildlife species).
- Produce and distribute educational information for landowners and state and federal conservation agency staff regarding the ecology of herbaceous wetlands by region and wetland type.
- Develop descriptions of quality wetland habitats to serve as the target conditions for wetland restoration and enhancement efforts.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Update of the National Wetlands Inventory data and enumerate losses and gains of wetlands.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

6. Wetlands are drained or filled to convert these lands to residential, agricultural or industrial uses.
7. Water may be pumped from wetlands for irrigation which may lower the water table in some areas and alter the time during which the soil is saturated.
8. Some wetlands are dredged or deepened to create ponds to hold irrigation water, to store water for cattle or to create ponds for fishing, resulting in a loss of shallow water habitat and may result in the introduction and establishment of predatory fish.

Conservation Actions:

- Provide cost-share funding or grants to restore farmed wetlands.
- Provide information to landowners and the public regarding the ecological values of wetlands, especially seasonal wetlands.
- Improve the technology of irrigation to conserve groundwater and reduce groundwater withdrawals.
- In locations with shallow water tables (e.g., where wetlands are connected to groundwater deposits) manage the pumping and withdrawal of groundwater around wetlands to minimize local lowering of the water table and draw down of wetlands.
- Use land acquisition and conservation easement programs to place herbaceous wetlands under conservation ownership or stewardship.
- Conduct management pilot studies to determine successful management strategies.
- Work collaboratively with Oklahoma Water Resources Board to manage surface and groundwater so that wetlands, springs and headwaters of streams are protected for species of greatest conservation need.
- Acquire former wetlands and restore them.
- Improve the economic incentives, access to, and knowledge of the Wetland Reserve Program.
- Improve landowner understanding of the value of wetlands and species of greatest conservation need to them and the community.
- Develop tax breaks for landowners that maintain wetlands.
- Connect wetland owners with entities seeking wetland mitigation credits.
- Provide funding or incentives to cover the costs of maintaining wetlands.
- Provide assistance and biological data to the Natural Resources Conservation Service for its wetland conservation planning and allocation process.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

9. Feedlots, dairies, hog farms and chicken houses are often located near wetlands, and animal wastes from these operations collects in wetlands basins and closed depressions.
10. Land application of animal wastes often occurs on fields near wetlands or that drain into wetlands where nutrients, hormones, pesticides and other waste products collect.
11. Many wetlands lack buffer vegetation around them to control the movement of sediment, pesticides and nutrients into the wetlands through storm water runoff from pastures, crop fields and residential areas.
12. Endocrine disrupters from animal hormones, pesticides and agricultural chemicals enter wetlands in storm water runoff which affect the growth, reproduction and survival of amphibians, fish and invertebrates.
13. Increased nutrient inputs due to crop/pasture fertilizers and land application of animal waste result in increased algae and bacteria in wetlands.
14. Grazing of wetlands by cattle increases nutrient inputs and alters the structure and diversity of wetland vegetation.

Conservation Actions:

- Increase the knowledge of and utilization of Farm Bill programs that improve water quality and protect wetlands (e.g., Wetland Reserve Program, planting of buffer strips, and buffer vegetation).
- Provide cost-share funding to landowners to construct fencing around wetlands to control access by cattle.
- Restore/plant native vegetation around wetlands to serve as a filter for storm water runoff to aid in the removal of sediment and nutrients in storm water runoff.
- Develop certification programs to recognize conservationists and land stewards of wetlands.
- Improve small landowner access to and use of existing cost-share programs.
- Develop new or update existing Best Management Practices for controlling nutrients and sediment around wetlands.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

15. Invasive and exotic plant species become established in wetlands and compete with native vegetation.
16. Exotic plant species can dominate wetlands and reduce overall plant diversity and structural diversity reducing the wetlands' value as wildlife habitat.

Conservation Actions:

- Develop management plans to control exotic plants and reduce their abundances and distributions.
- Remove exotic wetland plants and restore native plant communities.
- Conduct management pilot studies to determine successful management strategies.
- Monitor response of wildlife populations to new control practices.

Conservation Issue: Habitat loss and fragmentation from land management practices:

17. Woody plants such as willows and salt cedar encroach on and dominate herbaceous wetlands because of fire suppression and/or past overgrazing.
18. Heavy grazing of wetlands by cattle removes plant cover for wildlife, reduces the abundance of some wetland plants and can lower overall plant diversity.
19. Seasonal wetlands are plowed/cropped which reduces perennial vegetation and alters plant community composition and structure.

Conservation Actions:

- Use fire or mechanical cutting to remove woody vegetation that has encroached upon herbaceous wetlands.
- Provide cost-share funding or grants to construct fencing around wetlands to control the access to this habitat by cattle.
- Acquire land, perpetual easements or non-development easements to place wetlands into conservation ownership or stewardship.
- Acquire wetlands or purchase conservation easements on cropped wetlands and restore them.
- Provide funding to preserve or enhance wetlands.
- Improve the economic incentive to retain wetlands in agricultural areas.
- Improve the incentives for Wetland Reserve Program enrollments.
- Provide incentives or funding to cover the costs of maintaining wetlands.
- Conduct management pilot studies to determine successful management strategies.
- Monitor response of wildlife populations to new management practices.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres in conservation programs.
- Acres of buffer strips in place.
- Assess the number of acres and the distribution of wetlands using GIS datasets.
- Measure the value of education with landowners, farmers, ranchers and the students.
- Number of reservoir management plans.
- Population trends of wetland dependent species of greatest conservation need.
- National Wetlands Inventory

Conservation Landscape: Post Oak and Black Jack Savannah and Woodland

Relative condition of Post Oak and Black Jack Savannah and Woodland habitat is currently poor with a declining trend. Dry oak woodlands occur locally within the Osage Plains Section on sandy soils and sandstone ridges, and in the Flint Hills Section at the transition between the Tallgrass and Crosstimbers Regions. This habitat type is a diverse mosaic of oak savannahs, oak woodlands and oak/hickory forests that varies geographically depending upon soil conditions, slope aspect and fire history. The dominant tree species in this habitat are Post Oak (*Quercus stellata*) and Blackjack Oak (*Quercus marilandica*), comprising as much as 90 percent of the canopy cover (Hoagland et al. 1999). Other common trees include Black Hickory (*Carya texana*), Bitternut Hickory (*Carya cordiformis*), Black Oak (*Quercus velutina*), and Chinkapin Oak (*Quercus muehlenbergii*) on more mesic sites. Eastern Redcedar (*Juniperus virginiana*) is common throughout the Region in this habitat type and has increased in abundance during the past century as a result of the reduction in periodic fires. Prominent understory trees include Chittamwood (*Bumelia lanuginosa*), Eastern Redbud (*Cercis canadensis*), Roughleaf Dogwood (*Cornus drummondii*), Mexican Plum (*Prunus mexicana*), and Winged Sumac (*Rhus copallina*). On sites with well-drained soils and/or higher fire frequencies, this habitat type has a more woodland or savannah-like structure than occurs on the more mesic, forested sites. These woodlands typically have a grassy understory dominated by Little Bluestem (*Schizachyrium scoparium*) with lesser amounts of Indian Grass (*Sorghastrum nutans*, Big Bluestem (*Andropogon gerardii*) and Small Panicgrass (*Panicum oligosanthes*).

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Greater Prairie Chicken	X				X			
Bird	Harris's Sparrow		X						X
Bird	Kentucky Warbler		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Red-headed Woodpecker		X			X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	American Burying Beetle		X						X
Inve	Byssus Skipper	X							X
Inve	Iowa Skipper	X				X			
Inve	Prairie Mole Cricket	X				X			
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Northern Scarletsnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct annual statewide survey/monitoring program to evaluate populations of species of greatest conservation need and to establish ongoing population data/information.
- Verify that existing data are applicable.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Fund universities to acquire the necessary knowledge to allow appropriate management of species of greatest conservation need.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

2. Invasive and exotic species such as *Sericia lespedeza* adversely change community structure.
3. Lack of communication between agencies providing conflicting recommendations (e.g., Natural Resources Conservation Service and Oklahoma Department of Wildlife Conservation value *Sericia lespedeza* differently).
4. Feral animals (e.g., cats and hogs) harm species of greatest conservation need and their habitat.
5. Loss of native grasses to invasion of other plants such as *Sericia lespedeza*.
6. Invasive-exotic understory plants (mostly forbs) results in a loss of native understory vegetation.

Conservation Action:

- Develop a state plan for exotic and invasive species control, eradication, and prevention.
- Develop and share techniques to manage/eliminate the impacts of feral animals on species of greatest conservation need.

Conservation Issue: Habitat loss and fragmentation from land management practices:

7. Much of native habitat has been converted to tame grasses (e.g., Fescue and Lovegrass) which do not provide habitat for species of greatest conservation need.
8. Fragmentation of woodlands and savannah tracts by urbanization, conversion to tame pastureland, road construction, utility and pipeline right of ways.
9. Loss of temporary wetlands within this habitat due to siltation or human initiated drainage projects.
10. Large-scale use of herbicides being used to eliminate native tree cover from crosstimbers areas and maximize grass cover for grazing.
11. Lack of natural fire regime which has made some areas of woodlands denser with little understory development because of the dense canopy than they were historically, causing the trees in these unnaturally dense forests on dry soils to be more susceptible to disease and drought.
12. Constraints limiting prescribed burning such as landowner liability, air quality conflicts/concerns, fire/smoke conflict with urban development, and logistical difficulties in burning in developed areas.
13. Capacity to burn (e.g., personnel/financial constraints).
14. Lack of technical assistance to landowners for prescribed burning.
15. Eastern Redcedar spreading as a result of inappropriate grazing patterns.
16. Oil and gas industry may affect species of greatest conservation need by increased number of roads, increased erosion around well sites, soil compaction, disturbance, noise and an increased potential for oil or saltwater spills.
17. Unnatural stand ages/structure in many woodland stands due to clear cutting decades ago and the regrowth is dense, even-aged, second-growth homogeneous woodland that does not provide well for all of the life needs for species of greatest conservation need.

Conservation Actions:

- Create easements to prevent development.
- Conduct management pilot studies to determine successful management strategies.
- Identify and rank focus areas for management implementation.
- Create incentive programs to restore and protect habitat.
- Acquire fee title or interest in land to protect essential habitat areas.
- Study the response of wildlife populations to various land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Restore woodlands and savannahs on public lands.
- Support the development and dissemination of information about the advantages of prescribed fire, burn crews, and liability to landowners.
- Develop a program to assist landowners with proper fire management.
- Encourage and assist in the training of burning cooperatives.
- Assist in the development of better burn laws to reduce liability and right to burn.
- Develop professional burn crew support, make support affordable to landowners, and reduce heavy equipment costs.
- Provide farmers and ranchers with information and assistance to implement Best Management Practices for grazing their land.
- Encourage Natural Resources Conservation Service to encourage and cost share on appropriate grazing patterns.

- Enforce oil and gas production site clean up using existing trust funds.
- Increase the oil and gas production site clean up fund with additional sources of state revenue and develop Best Management Practices for oil and gas production sites.
- Restore woodlands and savannahs on public lands.
- Diversify forest stand ages with regeneration cuttings.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned.
- Acres of native plant communities restored.
- Amount of technical assistance being provided.
- Animal population trends.
- Annual statewide survey/monitoring program to evaluate populations of species of greatest conservation need.
- Changes in acreage/coverage of exotic vegetation.
- Fire crews trained and working.
- Forest stand diversity.
- Indicator species and endangered/threatened species – change in population size
- Invasive species – change in their numbers or acres that they affect
- Long-term resource surveys.
- Number of acres acquired and number of acres restored.
- Number of easements secured and acreage protected.
- Number of landowners participating in landowner incentive programs.
- Partners recruited and total cost share (including in-kind).
- Vegetation response to management, fire (e.g., grasses and woody plants).
- Wildlife population response to management.

Conservation Landscape: Bottomland Hardwood Forest

Relative condition of Bottomland Hardwood Forest habitat (e.g., Shumard Oak, Bur Oak, Pecan, and Black Walnut) is currently poor with a declining trend. Bottomland hardwood forests are found locally in the floodplains of the Caney, Verdigris, Neosho and Arkansas River and their larger tributary streams. Bottomland forests in the Tallgrass Prairie Region are seasonally flooded and dominated by Pin Oak (*Quercus palustris*), Pecan (*Carya illinoiensis*), Bur Oak (*Quercus macrocarpa*), Shumard Oak (*Q. shumardii*), Bitternut Hickory (*Carya cordiformis*) and Sugarberry (*Celtis laevigata*). Common understory shrubs include Deciduous Holly (*Ilex decidua*) and Roughleaf Dogwood (*Cornus drumondii*). The loss of bottomland forest acreage in the Region has not been assessed, but a reduction has occurred as a result of the clearing of these forests for agricultural uses (e.g., crop fields, pecan orchards, and Fescue pastureland), inundation by reservoir construction and the alteration of the natural hydrology and flooding frequencies in river and stream floodplains.

Recognized vegetation associations within this habitat type include:

Bur Oak – Shumard Oak – Bitternut Hickory Temporarily Flooded Forest
Pin Oak – Pecan/Deciduous Holly Temporarily Flooded Forest
Pecan – Sugarberry Temporarily Flooded Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Cerulean Warbler	X				X			
Bird	Harris's Sparrow		X						X
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Prairie Warbler		X						X
Bird	Prothonotary Warbler		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Red-headed Woodpecker		X			X			
Bird	Rusty Blackbird	X							X
Bird	Solitary Sandpiper	X							X
Bird	Wood Thrush	X							X
Mamm	Eastern Harvest Mouse				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Marsh Rice Rat				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Scarletsnake				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Knowledge of bottomland hardwood forest habitat and its associated wildlife species is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop a monitoring program to track habitat condition, quality and the status of the species of greatest conservation need.
- Inventory all bottomland hardwoods.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Conversion of bottomland forest to pasture or cropland.
4. Chemical herbicides are used in some areas to eradicate bottomland hardwood vegetation and convert the land to other uses (e.g., pastureland).
5. Inappropriate pesticide use.
6. Fragmentation of forest tracts caused by creation of roads, homes, utility line right of ways, natural gas wells, and pipelines.
7. Unnatural stand ages/structure caused when many bottomland hardwood forest stands were clear cut in the early 1990s. The regrowth forests that developed tend to be dense, even-aged stands with poor structural diversity, having dense mid stories and poorly developed understory vegetation.
8. Loss of temporary wetlands within this habitat that serve as breeding areas for amphibians and foraging areas for waterfowl, shorebirds and herons due to the draining of wetlands, reduction of flooding that maintains the hydrology for these wetlands, or the filling of wetland by direct human action or increased siltation of wetlands.

Conservation Actions:

- Design landowner incentives to encourage the retention of riparian hardwood trees.
- Educate landowners about watershed concepts, the importance of riparian habitat, Best Management Practices, and existing Farm Bill type programs.
- Enhance the Wildlife Habitat Improvement Program, providing an improved funding mechanism for restoration.
- Develop a Conservation Reserve type program for bottomland hardwoods.
- Work to change the Wetland Reserve Program to include the preservation of bottomland hardwoods.
- Place existing bottomland hardwood forests into conservation ownership through land acquisition or conservation easement by natural resource management agencies or private conservation organizations.
- Restore crop fields and pastures in floodplains back to bottomland hardwood forest habitat.
- Explore economic alternatives to clearing and grazing bottomland hardwoods (e.g., support the development of hunting leases as a revenue source for landowners).
- Acquire fee title ownership or conservation easements on existing bottomland hardwood forest habitat or crop fields and pastures that can be preserved or restored to bottomland hardwood forest habitat.
- Develop herbicide spraying education programs for landowners through Oklahoma State University extension.
- Reduce aerial spraying of bottomland hardwoods through regulations, conservation easements or landowner education of the ecological, habitat and species vulnerability, and water quality impacts.
- Enforce existing laws for application of pesticides in aquatic habitats.
- Encourage and support hunting cooperatives in corridors and blocks.
- Use the wide range of programs like Wetlands Reserve Program of the Natural Resources Conservation Service to create habitat corridors for wildlife.
- Use private landowner assistance programs such as U.S. Fish and Wildlife Service Partners for Wildlife and the Landowner Incentive Program to provide cost-share funding to private landowners to restore hydrology through the construction of small dams and dikes to seasonally flood bottomlands.
- Develop Best Management Practices for logging bottomland hardwoods that encourage structural diversity and retain understory vegetation.
- Promulgate legislation that requires the use of Best Management Practices for logging.
- Encourage the protection of private forest land through conservation easement programs.

- Thin and selectively remove trees to increase structural diversity within forest stands and increase understory vegetation.
- Enforce laws that prevent the filling of wetlands.
- Encourage law makers to prevent any further draining of wetlands.
- Create landowner incentives to maintain wetlands or restore the hydrology to wetlands.
- Construct vernal pools or similar small wetlands within bottomland forest sites.
- Support the development of a state water plan and state wetlands plan.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

9. The construction of reservoirs permanently inundates bottomland hardwood forests, resulting in a direct loss of acreage and alteration of the hydrology of the bottomland hardwood habitat downstream of the reservoir by reducing the amount of the natural flood frequency and pattern.
10. Altered flooding regimes occur as a result of the construction of impoundments and/ or the channelization of streams. In many watersheds there is a dramatic disconnection between the riparian forests/bottomland forests and their streams due to the channelization and incision of streams leading to a lowering of the shallow water table and a reduction in periodic flooding or soil saturation in the bottomland forest zone.

Conservation Actions:

- Modify reservoir management to allow periodic flooding of bottomland hardwood tracts below dams.
- Remove structures that block the movement of fish or prevent natural flooding regimes.
- Remove cost-share programs that encourage the construction of ponds and lakes on perennial streams.
- Develop incentives for the restoration of stream channels and bottomland forest habitat.
- Develop forestry programs to protect and restore critical bottomland hardwoods.
- Acquire land and/or conservation easements for existing habitats.
- Use mitigation funds to acquire existing bottomland hardwood forests and to protect these from future development (e.g., urban development, agricultural development, and future reservoir construction).
- Support the development of a state water plan and/or a state wetland plan.
- Inventory all bottomland hardwoods remaining and their status and trend.
- Support water conservation education to decrease the needs for reservoirs.
- Encourage and support the U.S. Army Corps of Engineers, within their authority, to restore bottom hardwood forest under their management.
- Research the value of changing laws governing the regulation of groundwater as well as surface water.
- Provide ecological studies and their implications to land and water use planners and encourage them to incorporate the information into management plans.
- Restore stream channel structure to reconnect streams with their riparian zones.
- Use private landowner assistance programs such as U.S. Fish and Wildlife Service Partners for Wildlife and Landowner Incentive Program to provide cost-share funding to private landowners to restore hydrology.
- Remove flood control structures that are no longer needed, to allow seasonal floods to again occur.
- Research alternative flood control methods used in different places in the country (e.g., flood other areas, restore or plant new bottomlands inside existing levees, and create wetland mitigation sites/ banks) for applicability to Oklahoma needs.
- Improve drainage to remove standing water in bottomland hardwoods.

- Conduct management pilot studies to determine successful management strategies.
- Monitor response of wildlife populations to new water management practices.
- Promote Wildlife Habitat Improvement Program funding mechanism for restoration.
- Plug man-made drains to restore hydrology to bottomland hardwood habitat without causing standing permanent water.
- Reconnect bottomland hardwoods with the river/stream system along which they developed to restore the natural meanders of streams and historic flooding patterns (e.g., manage for the natural hydro period - many streams have incised channels and do not overflow into bottomland hardwoods regularly).

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

11. Several species of non-native plants and animals (e.g., Japanese honeysuckle, autumn olive, Chinese privet, and feral hogs) have become established within bottomland hardwood forest habitat and now compete with native species for food, water and/or space.

Conservation Actions:

- Develop and implement control or management programs for invasive and exotic species.
- Provide cost-share programs to control exotic vegetation (e.g., privet and honeysuckle).
- Monitor invasive species in the bottomland hardwoods.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned.
- Acres of herbicide use.
- Forest stand health, composition, and structure.
- Natural stream discharge/flow regimes established.
- Number of landowners/acres involved in conservation programs.
- Number or percentage of acres acquired or placed into conservation programs (e.g., incentive programs).
- Numbers of landowners educated about watershed concepts, riparian habitat, and Best Management Practices.
- Numbers of modified reservoir management plans to allow periodic flooding and natural hydro periods.
- Percent of available habitat in conservation programs, measuring net gain or loss of habitat.
- Stream flow and habitat quality, measuring return of stream flow with range of natural variation.
- Trends of nongame wildlife populations (e.g., amphibians, songbirds, and consider use of indicator target species).
- Value of incentives to property owners.

Conservation Landscape: Springs

Little is known about the current status or trend of Springs in this Region. Springs and seeps are rare and extremely local in their occurrence within the Tallgrass Prairie Region. There are few concentrations of springs within this Region and few species that are dependent upon this habitat type.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Louisiana Waterthrush		X						X
Fish	Arkansas Darter	X							X
Fish	Cardinal Shiner			X			X		
Fish	Plains Topminnow	X				X			
Fish	Sunburst (Stippled) Darter		X				X		
Inve	Bowman's Cave Amphipod	X							X
Inve	Kansas Well Amphipod	X							X
Mamm	River Otter		X					X	

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete knowledge about location and condition of springs.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.

- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Create a springs and stream data base to track location, condition, land ownership, and biological data.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.

Conservation Issue: Changing land use, modification of vegetation, community fragmentation, exotic species and conversion of habitat:

3. Lack of spring and stream headwaters protection.
4. Springs/seeps important to amphibians, crayfish are difficult to locate and protect.
5. Pipes, concrete collars, and hogs damage may damage springs.
6. Road crossings may create barriers that affect fish and mussel populations.
7. High nutrient levels caused by some inappropriate agricultural practices may affect spring and cause detrimental algae increases, which in turn causes low oxygen in the water.
8. Springs are fragile habitat that is easily disturbed or modified.
9. Springs are mostly privately owned and protection and conservation is individually determined.
10. Exotic plants and animals invade springs.
11. Clearing of riparian and forest vegetation and the subsequent loss of stream banks and changes in width/depth ratios are detrimental to springs and headwater areas.
12. Lack of riparian vegetation and the loss of shading increases water temperatures and may affect the aquatic community.
13. Groundwater contamination.
14. Groundwater withdrawal reducing spring and stream flow.
15. Lack of knowledge by the public that these habitat types are part of a larger system.
16. Endocrine disruptors related to agricultural runoff/discharge (e.g., poultry, cattle, and use on plants).
17. Lack of biological resource monitoring.
18. Heavy metal contamination of some streams in the Miami area due to seepage from abandoned lead and zinc mining.

Conservation Actions:

- Create a springs and stream data base to track location, condition, land ownership, and biological data.
- Create stream teams and citizen groups to monitor streams (e.g., biota, habitat, and water quality).
- Demonstrate the importance of the habitat and what the landowner has – grass roots level education about the connection of springs and streams as part of larger watersheds.
- Acquire land, conservation easements, lease, etc. to protect and restore habitat, water quality, and riparian habitat.
- Develop and market landowner incentive programs to protect and restore habitat, water quality, and riparian habitat.
- Support the proper design of bridges and stream crossings.
- Delineate recharge areas of springs to protect water quality.
- Assist public and private landowners to remove problem dams that warm water and make springs unusable for species of greatest conservation need.
- Control or stop introduction or spread of exotic species.
- Support and encourage an increase in natural resources education in the public schools and in the community.

- Manage water withdrawals to have the least impact (i.e., in-stream flow of springs).
- Reduce nutrient inputs (i.e., point and non-point sources) through better cost sharing, providing more acceptable landowner incentives to reduce inputs, and encouraging Best Management Practices in the watershed.
- Provide results of ecological studies to water use planners and encourage the incorporation of the information into management plans for springs.
- Develop local watershed councils, citizen's groups, or stream teams to address local concerns and to monitor wildlife populations.
- Restore riparian zones, including restoring channels.
- Educate landowners about watershed concepts, riparian habitat, Best Management Practices, existing Farm Bill type programs.
- Provide alternative water sources for livestock to get them out of streams.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Number of acres acquired or proportion of acres protected/acquired by watershed.
- Number of acres under conservation practices.
- Number of citizen groups formed around spring source protection and their effectiveness.
- Number of landowners participating in conservation practices.
- Number of protected springs/streams.
- Number of spring easements obtained.
- Population trends of fish and wildlife species, with emphasis on species of greatest conservation need.
- Populations of spring/stream organisms.
- Pubic opinion toward conservation actions.
- Stream and spring flow GIS data base.
- Stream flow and habitat quality - measure return of stream flow with range of natural variation.
- Water quality.

Conservation Landscape: Gravel-bottom Streams and Associated Riparian Forests

Relative condition of Gravel-bottom Streams and Associated Riparian Forests habitat is currently unknown with an unknown trend. Within the Flint Hills Section of the Tallgrass Prairie Region, many streams have gravel or mixed gravel/silt substrate. Relatively little information exists regarding the historic condition of streams in the Region, but at one time many of these streams appear to have had well developed floodplains, channels that were only slightly entrenched, moderate to high degrees of channel sinuosity/curvature, and relatively high width to depth ratios. Narrow forests of fast-growing trees grow along the banks of most streams in the Tallgrass Prairie Region. These forests are comprised of diverse, temporarily-flooded forest associations including American Elm (*Ulmus americana*), Sugarberry (*Celtis laevigata*), Green Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood (*Populus deltoides*), Black Willow (*Salix nigra*), Sycamore (*Platanus occidentalis*) and Boxelder (*Acer negundo*). Understory vegetation is dominated by shrubs such as Buttonbush (*Cephalanthus occidentalis*) and Roughleaf Dogwood (*Cornus drummondii*). The present condition of many streams appears to have been altered by a combination of channelization, removal of riparian vegetation and increased sediment (e.g., silt and clay) as a result of soil erosion and deposition into streams.

Recognized riparian plant associations found within this habitat type include:

Silver Maple – Boxelder Temporarily Flooded Forest
River Birch – Sycamore Temporarily Flooded Forest
Sycamore – Boxelder Temporarily Flooded Forest
Eastern Cottonwood – American Elm – Sugarberry Temporarily Flooded Forest
American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
Buttonbush Semi-permanently Flooded Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bell's Vireo		X			X			
Bird	Canvasback	X							X
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Fish	Arkansas Darter	X							X
Fish	Bluntface Shiner	X							X
Fish	Cardinal Shiner			X			X		
Bird	Northern Bobwhite		X			X			
Fish	Kiamichi Shiner	X				X			
Fish	Neosho Madtom	X				X			
Fish	Shorthead Redhorse	X							X
Fish	Sunburst (Stippled) Darter		X				X		
Inve	Linda's Roadside Skipper	X							X
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Threeridge Mussel			X			X		
Mamm	Meadow Jumping Mouse				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There is limited historic data from which to evaluate the condition of streams and riparian forests prior to large scale human alteration of this habitat.
3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is incomplete information from which land managers can predict the affect of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

- Survey taxonomic experts to determine why species of greatest conservation need have small and/or declining populations.
- Conduct research on species of greatest conservation need to determine what factors limit their population size and distribution.
- Conduct research on species of greatest conservation need to establish baseline population size, density, and distribution and habitat relationships.
- Conduct biological inventories of amphibian, fish, crayfish and mussel populations in streams to increase the knowledge of biological communities within specific watersheds.
- Summarize and verify existing species and habitat data.
- Conduct literature reviews and focused studies to establish what stream and riparian habitats looked like historically to establish a target condition for stream and riparian restoration efforts.
- Develop relational databases to monitor wildlife populations and the conditions of their habitats.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop local watershed councils, stream teams and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

5. The presence of many confined animal feeding operations such as cattle feedlots, poultry houses, and hog farms, and waste application fields close to streams and drainages increase nutrient levels.
6. Additional nutrients enter streams as a result of cattle/livestock watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae, which can result in other water quality impacts such as increased fluctuations in dissolved oxygen.
8. Endocrine disrupters and other pollutants from pesticides enter streams in storm water runoff from agricultural fields which alter the growth, reproduction and/or survival of fish, amphibians and invertebrates in the streams.

Conservation Actions:

- Work collaboratively with landowners to reduce nutrient inputs (i.e., point and non-point sources) through Best Management Practices, Farm Bill cost-share programs, and landowner incentives programs.
- Work collaboratively with landowners to provide alternative water sources for livestock to keep them out of streams.
- Increase landowner education efforts regarding watershed concepts, importance of riparian habitat, Best Management Practices for controlling nutrients, and existing Farm Bill conservation programs to control nutrients.
- Develop conservation easements or acquire land to maintain or restore natural riparian vegetation along streams and reduce or limit agricultural development in and adjacent to riparian areas.
- Establish set back distances between streams and confined animal feeding operations, waste lagoons and land application areas.
- Work collaboratively with landowners to provide cost-share funding to construct fencing along streams and riparian areas to control/limit their access by cattle.
- Work collaboratively with landowners to provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.

- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Develop local watershed councils, stream teams and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve the funding, knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

9. Some types of dams and culverts can become barriers to the movement of fish and mussels during low-flow conditions.
10. Bridges, dams and diversion structures alter the natural flow patterns and other processes of streams, especially the frequency and magnitude of natural flooding events.
11. Sedimentation, discharge, erosion, and channel straightening affect in-stream flow, community structure and the sustainability of species of greatest conservation need.
12. Water is being pumped from streams for irrigation.
13. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes, lowering water tables and reducing the flow volume of springs and seeps that feed streams.
14. Increased pond construction may be decreasing the inflow and increasing temperatures having negative impacts on important aquatic communities and species of greatest conservation need.
15. Many streams in the Region have been channelized and straightened, resulting in their becoming incised and no longer connected with their riparian vegetation.
16. Streams with incised channels have cut banks that are prone to erosion which increases sediment loads in the streams.
17. Lack of connection between streams and riparian vegetation due to the channelization and incising of streams resulting in reduced riparian vegetation and a loss of wetlands within the stream floodplain.
18. In-stream gravel mining reduces bank stability upstream and downstream of the mining area, increasing bank erosion, and altering the width to depth ratio of the stream by making it wider and shallower.
19. In-stream gravel mining can remove or reduce riffles, gravel beds and other stream structures that are important habitat for aquatic wildlife.

Conservation Actions:

- Work collaboratively with landowners to remove ponds and impoundments which are obsolete but have been shown to block the movement of fish species of conservation need.
- Work collaboratively with landowners to remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Work collaboratively with landowners to replace ponds that have been constructed on streams with alternative water sources.
- Modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.
- Work collaboratively with public managers to establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need, or diverse aquatic communities).
- Work collaboratively with public managers to manage water withdrawals to have the least impact on aquatic biota.
- Work collaboratively with public managers to manage the proposals to sell water outside of the state, or the transfer of water between basins within Oklahoma.

- Provide results and implications of ecological studies to the water use planners and permit administrators so that they can do a better job protecting Oklahoma's natural resources.
- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals and interbasin transfers of water.
- Provide cost-share funding or grants to restore the natural meander patterns and profile to stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Work collaboratively with public managers to develop regulations to eliminate the detrimental effects of gravel mining from within streams on species of greatest conservation need.
- Conduct management pilot studies to determine successful stream protection and management strategies.
- Work with local communities and counties to reduce stream channel impacts including in-stream gravel mining, placement of rip-rap on stream banks at bridge crossings, and recreational use of streams by off-road vehicles.

Conservation Issue: Habitat loss from land management practices:

20. The abundance and diversity of understory vegetation has declined in riparian areas as a result of livestock grazing, especially during the growing season.
21. Riparian forests have been cleared and converted to crop fields, or introduced pastures of exotic grasses such as Fescue and Bermuda.
22. Fragmentation of riparian forests is caused by roads, houses, pastures and utility right-of-ways.
23. Clearing of riparian vegetation reduces stream bank stability which subsequently increases erosion and alters the width/depth ratios of streams.
24. Streams and riparian habitats are fragile and easily disturbed or modified.
25. The loss of riparian vegetation increases erosion and sedimentation.
26. Lack of headwaters protection causes more sediment, nutrients, pesticides and other pollutants to enter streams.
27. Livestock grazing along stream banks increases bank erosion and increases the sediment load in the stream.
28. Livestock grazing causes a loss of stream shading as a result of reduced riparian vegetation, increasing water temperatures and negatively affecting the aquatic community.
29. Increased sediment in the stream can fill or alter riffles and gravel beds which serve as spawning areas for fish and habitats for freshwater mussels.

Conservation Actions:

- Work collaboratively with public managers to provide cost-share funding or grants to fence riparian forests to control/limit access by cattle.
- Purchase easements to protect or enhance existing riparian vegetation, and to restore riparian forests.
- Work collaboratively with landowners to encourage the planting/construction of alternative shading for livestock to reduce their use of riparian areas.
- Provide landowner incentives or cost-share programs to protect or restore riparian forests, stream banks and in-stream habitat.
- Acquire fee title purchase of stream and riparian habitat to place this into conservation ownership to conserve or enhance existing habitat.
- Acquire fee title headwaters to steams to control and limit the introduction of sediment, nutrients and chemical pollutants.

- Develop new or promote existing Best Management Practices for the grazing of cattle in or adjacent to riparian zones.
- Increase the availability of aquatic resource educational information in the public schools.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

30. Exotic plant species such as Chinese Privet, Salt Cedar and Japanese Honeysuckle have become established and are becoming more abundant in riparian forests, competing with native plants and altering the structure of the habitat that can be used by animals.
31. Exotic predatory fish such as trout may compete with native predatory fish such as bass, and create increased predation pressure on stream fish or invertebrates.
32. Feral hogs that forage in streams and along stream banks damage riparian vegetation and reduce bank stability.
33. Some native plants and animals have become more abundant in riparian forests.
    - Eastern Redcedar has increased in abundance due to heavy grazing and reduced fire frequency in riparian areas.
    - Brown-headed Cowbirds have become more abundant in riparian areas due to cattle grazing. Brown-headed Cowbirds lay their eggs in the nests of other birds thus reducing the number of chicks from the host species.

Conservation Actions:

- Develop management plans to control the abundance and distribution of exotic species and invasive species.
- Conduct management pilot studies to determine successful management strategies.
- Conduct studies to quantify the impact of exotic species on riparian forest communities (i.e., both plants and animals), or on aquatic animal communities.
- Increase educational efforts and public awareness of the ecological and economic impacts of exotic plant and animal populations.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of land acquired.
- Acres of riparian forest with diverse structure.
- Amount of gravel mining.
- GIS – change analysis.
- Identify and monitor indicator species.
- Measure the amount of quality habitat available annually.
- National Wild Turkey Federation GIS data sets.
- Number and linear miles and acres of easements obtained.
- Number of community partners.
- Number of enhanced or restored acres of quality habitat.
- Number of local citizen groups, watershed councils, stream teams and citizen's groups organized.
- Number of partnerships or easements.
- Number of protected springs and streams.
- Number of reservoir management plans that take into account hydro period of the forest.
- Number of stream miles degraded to measure change.
- Number, periodicity, value and kinds of recreation users of streams.
- Populations of indicator species or species of greatest conservation need.
- Populations of spring/stream organisms.
- Stream and spring flow relational data base.
- Water quality.

Conservation Landscape: Sandy (soft)-bottom Streams and Associated Riparian Forests

Relative condition of Sandy (soft)-bottom Streams and Associated Riparian Forests habitat is currently unknown with an unknown trend. The majority of the streams in the Tallgrass Prairie Region have a predominantly sandy or silty substrate, especially those in the Osage Plains Section. Additional work is needed to determine the historic condition of streams in the Region, but at one time many of the streams appear to have had well developed floodplains, channels that were only slightly entrenched, moderate to high degrees of channel sinuosity (i.e., number of meanders, bends, or curves), and relatively high width to depth ratios. Narrow forests of fast-growing trees grow along the banks of most streams in the Tallgrass Prairie Region. These forests are comprised of diverse, temporarily flooded forest associations dominated by American Elm (*Ulmus americana*), Sugarberry (*Celtis laevigata*), Green Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood (*Populus deltoides*), Black Willow (*Salix nigra*), Sycamore (*Platanus occidentalis*) and Boxelder (*Acer negundo*). Understory vegetation is dominated by shrubs including Buttonbush (*Cephalanthus occidentalis*) and Roughleaf Dogwood (*Cornus drummondii*), and perennial forbs.

Currently, many streams in the Region have been altered by human activity such as the removal of riparian vegetation and the straightening of the channels to remove stream meanders. These efforts to reduce the amount of area occupied by the stream's channel and floodplain have resulted in many streams cutting incised channels. Increasing degrees of channel incision separate the stream from its riparian vegetation.

Riparian Plant Associations found within this habitat type include:

Silver Maple – Boxelder Temporarily Flooded Forest
River Birch – Sycamore Temporarily Flooded Forest
Sycamore – Boxelder Temporarily Flooded Forest
Eastern Cottonwood - Black Willow Temporarily Flooded Forest
Eastern Cottonwood – American Elm – Sugarberry Temporarily Flooded Forest
American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
Green Hawthorn – Cockspur Hawthorn – Downy Hawthorn Temporarily Flooded Shrubland
Buttonbush Semi-permanently Flooded Shrubland
Swamp Privet - Buttonbush Semi-permanently Flooded Shrubland
Giant Cane Temporarily Flooded Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bell's Vireo		X			X			
Bird	Interior Least Tern	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Bobwhite		X			X			
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Trumpeter Swan	X							X
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Inve	Linda's Roadside Skipper	X							X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Meadow Jumping Mouse				X				X
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There is limited historic data from which to evaluate the condition of streams and riparian forests prior to large scale human alteration of this habitat.
3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is incomplete of information from which land managers can predict the affect of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

- Survey taxonomic experts to determine why species of greatest conservation need have small and/or declining populations.
- Conduct research on species of greatest conservation need to establish baseline population size, density, and distribution and habitat relationships.
- Conduct research on species of greatest conservation need to determine what factors limit their population size and distribution.
- Conduct biological inventories of amphibian, fish, crayfish and mussel populations in streams to increase the knowledge of biological communities within specific watersheds.
- Summarize and verify existing species and habitat data.
- Conduct literature reviews to establish what stream and riparian habitats looked like historically to establish a target condition for stream and riparian restoration efforts.
- Develop relational databases to monitor wildlife populations and the conditions of their habitats.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop local watershed councils, stream teams and citizen's groups to monitor water quality and wildlife populations.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

5. The presence of many confined animal feeding operations such as cattle feedlots, poultry houses, and hog farms apply waste to fields that run off into streams and drainages.
6. Additional nutrients enter streams as a result of cattle watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae which can result in water quality impacts such as increased fluctuations in dissolved oxygen.
8. Endocrine disrupters and other pollutants from pesticides enter streams in storm water runoff from agricultural fields, altering the growth, reproduction and/or survival of fish, amphibians and invertebrates in the streams.

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) through Best Management Practices, Farm Bill cost-share programs, landowner incentives programs.
- Work collaboratively with landowners to provide alternative water sources for livestock to keep them out of streams.
- Increase landowner education efforts regarding watershed concepts, importance of riparian habitat, Best Management Practices for controlling nutrients, and existing Farm Bill conservation programs to control nutrients.
- Develop conservation easements or acquire land to maintain or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Work collaboratively with public managers to establish set back distances between streams and confined animal feeding operations, waste lagoons and land application areas.
- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit their access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Work collaboratively with public managers and landowners to reduce the use of herbicides and other pesticides in floodplains and riparian areas.

- Develop local watershed councils, stream teams and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve landowner knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

9. Dams, bridges, stream crossings, some types of culverts and diversion structures alter the natural flow patterns, processes of streams, the frequency and magnitude of natural flooding events, and stream channels which have negative impacts on the movement of fish during low-flow conditions, and are barriers that affect the populations of fish and freshwater mussels.
10. Water is being pumped from streams for irrigation and may harm species of greatest conservation need.
11. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes and this is lowering water tables and reducing the flow volume of springs and seeps that feed streams.
12. Increased pond construction may be lowering the inflow that sustains streams.
13. Many streams in the Region have been channelized and straightened, causing them to become incised and the streams are no longer connected with their riparian vegetation.
14. Streams with incised channels have cut banks that are prone to erosion that increases sediment loads.
15. Lack of connection between streams and riparian vegetation due to channelization and incising of streams, resulting in reduced riparian vegetation and a loss of wetlands within the stream floodplain.

Conservation Actions:

- Work collaboratively with landowners to remove ponds and impoundments which are obsolete but have been shown to block the movement of fish species of conservation need.
- Work collaboratively with public and private landowners to remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Work collaboratively with landowners to replace ponds that have been constructed on streams with alternative water sources (e.g., for livestock).
- Work collaboratively with public managers to modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.
- Establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Work collaboratively with public managers to address proposals to sell water outside of the state, or the transfer of water between basins within Oklahoma.
- Provide results of ecological studies to water use planners and permit administrators so they can help sustain natural communities and habitat for species of greatest conservation need.
- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals and interbasin transfers of water.
- Work collaboratively with public managers to provide cost-share funding or grants to restore stream channels and establish natural vegetation on stream banks for stability.
- Work collaboratively with public and private landowners to restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams.

- Work collaboratively with public managers to reconnect stream and riparian vegetation through the restoration of stream channels.
- Develop local watershed councils, stream teams and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations

Conservation Issue: Habitat loss and fragmentation from land management practices:

16. The abundance and diversity of understory vegetation has declined in riparian areas as a result of livestock grazing, especially during the growing season.
17. Riparian forests have been cleared and converted to crop fields or introduced pastures of exotic grasses such as Fescue and Bermuda.
18. Fragmentation of riparian forests by roads, houses, pastures and utility right-of-ways.
19. Clearing of riparian vegetation reduces stream bank stability which subsequently increases erosion and alters the width/depth ratios of streams.
20. Streams and riparian habitats are fragile and easily disturbed or modified.
21. The loss of riparian vegetation increases erosion and sedimentation.
22. Lack of headwaters protection allows for more sediment, nutrients, pesticides and other pollutants to enter streams.
23. Livestock grazing along stream banks increases bank erosion.
24. Loss of stream shading as a result of reduced riparian vegetation increasing water temperatures and negatively affecting the aquatic animal community.

Conservation Actions:

- Provide cost-share funding or grants to fence riparian forests to control/limit their access by cattle.
- Purchase easements to protect or enhance existing riparian vegetation, or to restore riparian forests.
- Work collaboratively with landowners to encourage the planting/construction of alternative shading for livestock to reduce their use of riparian areas.
- Provide landowner incentives or cost-share programs to protect or restore riparian forests, stream banks and in-stream habitat.
- Purchase fee title stream and riparian habitat to place this into conservation ownership to conserve or enhance existing habitat.
- Acquire fee title headwaters to steams to control and limit the introduction of sediment, nutrients and chemical pollutants.
- Develop new or promote existing Best Management Practices for the grazing of cattle in or adjacent to riparian zones.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

25. Exotic plant species such as Chinese Privet, Salt Cedar and Japanese Honeysuckle have become established and are becoming more abundant in riparian forests, competing with native plants and altering the structure of the habitat that can be used by animals.
26. Exotic predatory fish such as trout may compete with native predatory fish such as bass, and create increased predation pressure on stream fish or invertebrates.
27. Feral hogs that forage in streams and along stream banks damage riparian vegetation and reduce bank stability.
28. Some native plants and animals have become more abundant in riparian forests.
    - Eastern Redcedar has increased in abundance due to heavy grazing and reduced fire frequency in riparian areas.
    - Brown-headed Cowbirds have become more abundant in riparian areas due to cattle grazing. Brown-headed Cowbirds lay their eggs in the nests of other birds thus reducing the number of chicks from the host species.

Conservation Actions:

- Develop management plans to control the abundance and distribution of exotic species and invasive species.
- Conduct studies to quantify the impact of exotic species on riparian forest communities (i.e., both plants and animals), or on aquatic animal communities.
- Increase educational efforts and public awareness of the ecological and economic impacts of exotic plant and animal populations.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of riparian forest with diverse structure.
- Degraded and restored stream miles of habitat.
- Number of species of special conservation need provided with habitat quality monitoring.
- Miles of streams.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of enhanced or restored acres of quality habitat.
- Number of landowners participating in conservation practices.
- Number of new local conservation groups and their effectiveness.
- Number of partnerships.
- Population status of indicator species or species of greatest conservation need.
- Population trends of fish and wildlife species, with emphasis on species of greatest conservation need.
- Pubic opinion toward conservation actions.
- Quantity and quality habitat required for species of greatest conservation need.
- Stream flow and habitat quality - measure return of stream flow with range of natural variation.
- U.S. Geological Survey monitoring stations data and U.S. Geological Survey groundwater levels data.
- GIS data to monitor change and management success.
- Water quality parameters

Potential partnerships to deliver conservation within the Tallgrass Prairie Region:

State Government

- Kansas -Arkansas-Oklahoma Arkansas River Compact Commission
- Grand River Dam Authority
- Kansas State University – Monarch Monitoring Program
- Kansas Wildlife and Parks Department
- Missouri Department of Conservation
- Oklahoma Corporation Commission
- Oklahoma Department of Agriculture, Food and Forestry
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Wildlife Conservation
- Oklahoma Legislature
- Oklahoma Scenic Rivers Commission
- Oklahoma State University – Cooperative Extension Service
- Oklahoma State University – Department of Forestry
- Oklahoma Tourism and Recreation Department
- Oklahoma Water Resources Board
- Other state universities and departments
- Other state-funded museums
- University of Oklahoma – Oklahoma Biological Station
- University of Oklahoma – Oklahoma Biological Survey & Oklahoma Natural Heritage Inventory
- University of Oklahoma – Sam Noble Oklahoma Museum of Natural History

Federal Government

- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Congress
- U.S. Department of Agriculture – Animal and Plant Health Inspection Service
- U.S. Department of Agriculture – Farm Service Agency
- U.S. Department of Agriculture – Natural Resources Conservation Service
- U.S. Department of Agriculture – Resource Conservation and Development Councils
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- U.S. National Park Service

Local Government

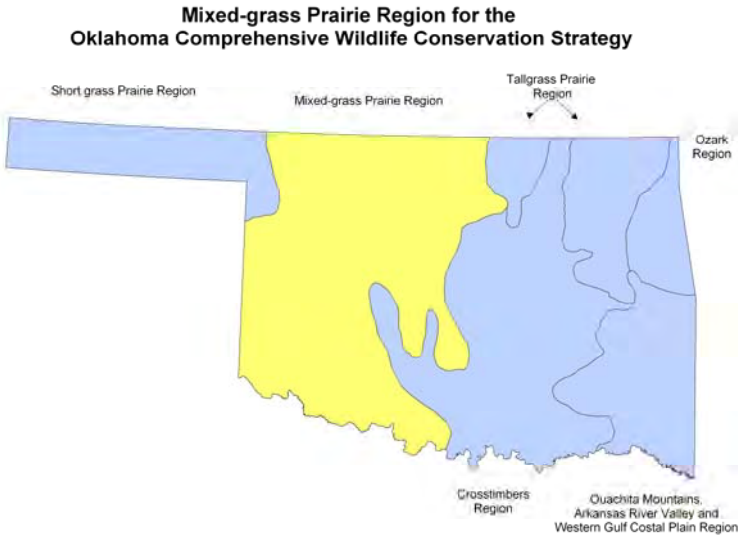
- Municipalities in Oklahoma, Arkansas, Missouri
- Municipalities wanting to buy water
- Tribal governments

Businesses, Citizens and Citizen Groups

- Chambers of Commerce
- Ducks Unlimited and local Oklahoma chapters
- Farm Bureau
- Farmers Union
- Individual farmers
- Land Legacy
- Local citizen's groups
- National Wild Turkey Federation and local Oklahoma chapters
- Oklahoma Anglers United

- Oklahoma Cattlemen's Association
- Oklahoma Forestry Association
- Oklahoma Native Plant Society
- Oklahoma Ornithological Society
- Oklahoma Section of the Society for Range Management
- Other sportsmen's groups
- Private landowners
- Producer Cooperatives
- Quail Unlimited and local Oklahoma chapters
- Small Woodland Owner's Association
- Sutton Avian Research Center
- The Izaak Walton League of America
- The National Audubon Society and local Oklahoma chapters
- The Nature Conservancy
- TNC Tallgrass Prairie Preserve
- The Wildlife Society
- Urban development groups
- Vernal Pool Society

Mixed-grass Prairie Region



This is a large and diverse ecological region that encompasses much of western Oklahoma including all or portions of Harper, Ellis, Woods, Woodward, Major, Alfalfa, Grant, Kay, Noble, Logan, Garfield, Kingfisher, Canadian, Blaine, Dewey, Custer, Washita, Roger Mills, Beckham, Harmon, Greer, Jackson, Kiowa, Tillman, Caddo, Comanche, Cotton, Stephens, and Jefferson counties. This region is equivalent to Bailey's Red Bed Plains and South-central Great Plains sections and to Omernick's Central Great Plains ecoregion and a portion of the Southwestern Tablelands ecoregion.

The best professional judgment of the advisory group and technical experts was used to identify each Conservation Landscape's status and trend. And, even though some issues and actions apply to multiple Regions, each Region chapter is designed to stand-alone.

Conservation Landscapes listed in general priority order

Very High priority Conservation Landscapes:
- Mixed-grass Prairie
- Shinnery Oak Shrubland
- Sand Sagebrush/Bluestem Shrubland
- Gypsum or Sandstone Canyonlands and Gypsum Caves

High priority Conservation Landscapes:
- Tallgrass Prairie
- Large Rivers and Sloughs/Ponds
- Herbaceous Wetland
- Small Rivers
- Post Oak/Blackjack Savannah or Shrublands and Post Oak/Blackjack Oak/Hickory Woodlands
- Sand Plum, Hawthorn, or Sumac Shrubland

Moderate priority Conservation Landscapes:
- Streams and Associated Riparian Forests
- Springs
- Mesquite Savannah or Shrublands
- Juniper Savannah or Woodlands

Conservation Landscape: Mixed-grass Prairie

The relative condition of Mixed-grass Prairie habitat in the Mixed-grass Prairie Region is currently good with an increasing trend. Historically, this is the most widespread and common habitat type found in the Mixed-grass Prairie Region. Mixed-grass Prairies have a diverse species composition, however more plant communities are dominated by Little Bluestem (*Schizachyrium scoparium*) and Sideoats Grama (*Bouteloua curtipendula*). Mixed-grass Prairie plant associations include Little Bluestem/Indiangrass (*Sorghastrum nutans*), Little Bluestem/Sideoats Grama/Blue Grama (*Bouteloua gracilis*), Little Bluestem/Big Bluestem, and Little Bluestem/Hairy Grama. Silver Bluestem (*Bothriochloa saccharoides*) and Prairie Threeawn (*Aristida oligantha*) occur in disturbed sites. Other common grasses and forbs include Sneezeweed (*Helenium anarum*), Hairy Sunflower (*Helianthus hirsutus*), Heath Aster (*Aster ericoides*), Roundleaf Bladderpod (*Lesquerella ovalifolia*), Purple Coneflower (*Echinacea angustifolia*), Leadplant (*Amorpha canescens*), Panic Grass (*Dichanthelium oligosanthes*), and Foxtail Barley (*Hordeum jubatum*). Much of the historic Mixed-grass Prairie in the Region has been converted to other land uses, especially crop land and introduced pasture. Nearly 4 million acres of Mixed-grass Prairie is thought to remain but this is less than 40 percent of the historic acreage. Mixed-grass Prairie has been altered by several factors including fire suppression, heavy year-round grazing, introduced grasses and forbs, and the expansion of Eastern Redcedar.

Recognized plant associations within this habitat type include:

Silver Bluestem Grassland
Vine Mesquite – Buffalograss Grassland
Little Bluestem – Sideoats Grama – Blue Grama Grassland
Little Bluestem – Blue Grama Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Baird's Sparrow	X							X
Bird	Bald Eagle	X						X	
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Burrowing Owl	X							X
Bird	Cassin's Sparrow		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Chestnut-collared Longspur	X							X
Bird	Ferruginous Hawk	X							X
Bird	Greater Prairie Chicken	X				X			
Bird	Harris's Sparrow		X						X
Bird	LeConte's Sparrow		X						X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			
Bird	Long-billed Curlew	X							X
Bird	McCown's Longspur				X				X
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Peregrine Falcon	X							X
Bird	Prairie Falcon	X							X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Scaled Quail		X			X			
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		
Bird	Whooping Crane	X						X	
Inve	Prairie Mole Cricket	X				X			
Inve	Rattlesnake Master Borer	X							X
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Desert Shrew				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Mountain Lion	X						X	
Mamm	Texas Kangaroo Rat	X							X
Mamm	Western Big-eared Bat	X							X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Diamond-backed Rattlesnake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are

declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:
- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:
3. Fragmentation of habitat has reduced the quality of this habitat and reduced its value to species of greatest conservation need (including that caused by inheritance laws making it difficult to pass large tracts intact to succeeding generations).
4. Conversion of large tracts of this habitat to cropland has reduced the quantity and quality of the habitat for use by species of greatest conservation need
5. Heavy grazing sometimes reduces the quality and quantity of this habitat.
6. Some birds are especially susceptible to collisions with fences.
7. Urban sprawl has reduced the quantity and quality of this habitat type in some areas.
8. Energy exploration and development can sometimes reduce the quality and quantity of this habitat type.

Conservation Actions:
- Encourage landowners to take advantage of Farm Bill provisions, including those providing economic incentives for practices favorable to species of greatest conservation need.
- Support laws to make it easier for landowners to pass large tracts to succeeding generations.
- Consider land acquisition and conservation easements to protect some of the more important tracts of this habitat.
- Promote and encourage grazing practices having the least negative impacts on habitat quantity and quality.
- Encourage and support guidelines for the Conservation Reserve Program that result in Conservation Reserve Program lands being planted to 100 percent native grasses and forbs.
- Encourage and support the replanting of existing cropland, abandoned cropland, and “improved” (Bermuda grass) pastures to Mixed-grass Prairie habitat using native grasses and forbs.
- Encourage the removal of interior fencing in pastures and the use of patch burn technology in conjunction with mineral blocks to manage cattle grazing patterns.

- Coordinate with stakeholders on energy developments (e.g., site selection and mitigation).
- Support the development of a statewide mitigation plan for wind power development.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

9. Woody vegetation encroachment reduces both the quantity and the quality of this habitat.
10. Fire suppression sometimes removes a naturally occurring control mechanism for invasive woody species.
11. Invasive plant species have moved into tracts of this habitat due to conditions becoming favorable.

Conservation Actions:

- Encourage and support changing the existing Conservation Reserve Program guidance to be more favorable to this habitat by planting Conservation Reserve Program lands to 100 percent native grasses and forbs.
- Encourage and facilitate prescribed burning and burn cooperatives.
- Encourage the use of patch burn management to manage cattle rather than extensive interior fencing.
- Encourage and support replanting existing cropland, abandoned cropland and "improved" (Bermuda grass) pastures to Mixed-grass Prairie habitat using native grasses and forbs.
- Encourage landowners to use the Farm Bill programs like the Grassland Reserve Program or the Conservation Reserve Programs to plant crop fields to native grasses and forbs instead of Old World Bluestem and Lovegrass.

Conservation issue: Black-tailed Prairie Dog habitat related issues

12. Land usage has reduced the number and sizes of Black-tailed Prairie Dog towns.

Conservation Actions:

- Provide landowner incentives for following agricultural practices that maintain Black-tailed Prairie Dogs.
- Encourage and support alternative economic use of agricultural lands, including fee hunting, fee access for fishing, and ecotourism.
- Develop and distribute informational materials for landowners and others on topics including grazing ecology, natural systems, and exotic invasive species.
- Encourage the use of programs like the Landowner Incentive Program for the conservation of Black-tailed Prairie Dogs and other species of greatest conservation need.
- Support necessary changes in the inheritance legislation to enable large ranches to remain in single family ownership.
- Encourage land acquisition and conservation easements by private entities (e.g., land trusts and organizations such as The Nature Conservancy).
- Increase funding from the subsidy side of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Encourage the development or updating of Best Management Practices for practices that protect this habitat and make it suitable for species of greatest conservation need.
- Identify and prioritize core areas of habitat and corridors to connect to get the most benefits.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres enrolled in conservation programs.
- Acres of native plant communities restored.
- Numbers, size and distribution of Black-tailed Prairie Dog colonies.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Response of species to management practices such as burning, fencing, and grazing.

Conservation Landscape: Shinnery Oak Shrubland

The relative condition of Shinnery Oak Shrubland habitat in the Mixed-grass Region is currently good with a declining trend. The Shinnery Oak Shrubland habitat is unique to this Region and occurs locally on sandy soils and stabilized dunes in portions of Harmon, Beckham, Roger Mills, Ellis, Dewey, and Woodward counties. Duck and Fletcher (1944) estimated that nearly 750,000 acres of Shinnery Oak Shrublands historically occurred in Oklahoma. Dering and Pettit (1972) estimated that more than 100,000 acres of this had been converted to other cover types; primarily crop fields and introduced pastures. Shinnery Oak Shrublands are a climax plant community in which shrubs and grasses are codominant. Harvard Oak (*Quercus harvardii*), also known as Shinnery Oak, is the dominant shrub, though Sand Sagebrush (*Artemesia filifolia*), Sand Plum (*Prunus angustifolia*), and Netleaf Hackberry (*Celtis reticularia*) are also common. Dominant grasses are Sand Dropseed (*Sporobolus cryptandrus*) and Little Bluestem (*Schizachyrium scoparium*). Sand Bluestem (*Andropogon hallii*), Switchgrass (*Panicum virgatum*), Sideoats Grama (*Bouteloua curtipendula*), and Sand Lovegrass (*Eragrostis trichodes*) are also common. Harvard (i.e., Shinnery) Oak is a low shrub usually less than two meters tall that develops a massive system of underground stems and deep root system. A single Harvard Oak may have over 100 above ground stems, each appearing to be a single small shrub and spreading 3 to 16 meters in diameter (Mueller 1951). Harvard Oak hybridizes with other oak species. Much of the Shinnery Oak Shrublands in Oklahoma contain scattered groves or mottes of oaks up to 5 meters tall that are hybrids between Harvard Oak and Post Oak (*Quercus stellata*) (Muller 1951, Correll and Johnston 1970). Like pure Harvard Oak, these hybrids develop large underground stem and root systems. Typically, a motte of hybrid oaks is comprised of a single individual with several dozen large stems.

Recognized plant associations within this habitat type include:

Shinnery Oak/Sand Dropseed – Little Bluestem Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Burrowing Owl	X							X
Bird	Cassin's Sparrow		X						X
Bird	Ferruginous Hawk	X							X
Bird	Harris's Sparrow		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	LeConte's Sparrow		X						X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Scaled Quail		X			X			
Bird	Swainson's Hawk		X						X
Inve	Outis Skipper								
Inve	Shinnery Oak Buck Moth								
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Mountain Lion	X						X	
Mamm	Ringtail				X				X
Rept	Common Lesser Earless Lizard				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.

- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition and to assess and identify the most important Shinnery Oak tracts.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. School land property administration sometimes does not consider the ecological impacts of their actions.
4. Use of herbicides can reduce the quantity and quality of this habitat.
5. Heavy grazing sometimes reduces the quantity and quality of this habitat.
6. Advisors to landowners sometimes lack proper technical information.
7. A variety of activities including oil and gas development, tree rows and hardwood invasion, windbreaks, conversion to crop fields, power lines and utilities, and wind power development have resulted in fragmentation of this habitat.
8. The Conservation Reserve Program does not currently restore this habitat type.

Conservation Actions:

- Cooperate with the school land office to develop mechanisms for maintaining and improving habitat on school land properties that will benefit Lesser Prairie Chickens and other species of greatest conservation need.
- Research the feasibility of restoring pasture and cropland to Shinnery Oak.
- Develop and distribute information to landowners and others concerning grazing management, fire management, energy development, and natural systems.
- Provide the most up-to-date information to technical assistance and extension staff.
- Encourage road right-of-way management that considers maintenance of this habitat.
- Consider conservation easements and land acquisition to conserve some of the most important tracts of Shinnery Oak habitat in the Mixed-grass Prairie Region.
- Cooperate with the state Conservation Reserve Program and Grassland Reserve Program technical committees and promote giving greater consideration to increasing shrubs.
- Encourage modifications to existing Conservation Reserve Program contracts that will be more favorable to Shinnery Oak habitat.
- Cooperate with oil and gas and wind energy developers and others to minimize surface damages to shrublands.
- Encourage the development of a statewide mitigation plan for wind power development.
- Encourage and facilitate changes in grazing management that restores native grass cover to this shrub land community.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

9. Fire suppression has altered the ability of this habitat to be self-sustaining.
10. As a result of fire suppression in this habitat, junipers have invaded many tracts.
11. Conditions in this habitat have become favorable for invasion by Brown-headed Cowbirds.

Conservation Actions:

- Encourage regular burning to maintain this habitat.
- Encourage use of prescribed fire to control invasive species.
- Encourage and facilitate burn cooperatives.
- Develop and distribute information to landowners and others concerning grazing management, fire management, energy development, natural systems, and invasive species.
- Encourage and support actions to manage Brown-headed Cowbird populations.

Potential indicators for monitoring the effectiveness of the conservation actions:

- GIS/remote sensing (e.g., numbers of acres and distributions).
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Sand Sagebrush/Bluestem Shrubland

The relative condition of Sand Sagebrush/Bluestem Shrubland habitat in the Mixed-grass Prairie Region is currently good with a stable trend. Sand Sagebrush Shrublands are found locally in the northwestern portion of the Mixed-grass Prairie Region and occur on deep sandy soils and stabilized dunes in the vicinity of the Cimarron, North Canadian, and Canadian Rivers. This Region encompasses approximately half of the Sand Sagebrush (*Artemisia filifolia*) Shrublands that occur in Oklahoma. Sand Sagebrush is typically found growing in association with Sand Dropseed (*Sporobolus cryptandrus*) and Little Bluestem (*Schizachyrium scoparium*). In these plant communities, Sand Sagebrush may comprise 5 to 50 percent of the canopy cover depending upon factors such as grazing pressure which tends to decrease grass coverage and increase sagebrush, or fire frequency which tends to decrease sagebrush and increase the coverage by grasses. Other grasses and forbs found in this community include Sand Bluestem (*Andropogon hallii*), Sideoats Grama (*Bouteloua curtipendula*), Prairie Sandreed (*Calamovilfa longifolia*), Sand Lovegrass (*Eragrostis trichodes*), Sand Paspalum (*Paspalum stramineum*), Prairie Sunflower (*Helianthus petiolaris*), Mentzelia (*Mentzelia sp.*), Hairy Goldenaster (*Chrysopsis villosa*), Halfshrub Sundrops (*Calylophus serrulatus*), Annual Buckwheat (*Eriogonum anuum*), Indian Blanket (*Gaillardia pulchellum*), Western Spiderwort (*Tradescantia occidentalis*), and Yucca (*Yucca glouca*).

Recognized plant associations within this habitat type include:
Sand Sagebrush/Sand Dropseed – Little Bluestem Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Burrowing Owl	X							X
Bird	Cassin's Sparrow		X						X
Bird	Ferruginous Hawk	X							X
Bird	Harris's Sparrow		X						X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Red-headed Woodpecker		X			X			
Bird	Scaled Quail		X			X			
Bird	Swainson's Hawk		X						X
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Western Big-eared Bat	X							X
Rept	Common Lesser Earless Lizard				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practice:

3. Fragmentation of habitats, including that caused by inheritance laws, reduces the value of these habitats to species of greatest conservation need.

4. Conversion of these habitats to cropland reduces their value to species of greatest conservation need.
5. Excessive grazing can reduce the quantity and quality of this habitat.
6. Some bird species are especially vulnerable to collisions with fences.
7. Spraying of sagebrush with herbicides to encourage grasses often results in a reduction of shrubland.
8. Conservation Reserve Program contracts do not currently include restoration of this habitat.
9. Energy exploration and development can result in reductions in quality and quantity of this habitat in the Mixed-grass Prairie Region.

Conservation Actions:

- Consider land acquisition and conservation easements to conserve the most important tracts of this habitat in the Mixed-grass Prairie Region.
- Encourage and support changes in inheritance legislation to make it easier to pass large intact tracts to succeeding generations.
- Encourage grazing practices that include conservation of this habitat.
- Encourage the use of the Conservation Reserve Program to plant program acreages to 100 percent native grasses and forbs.
- Encourage replanting cropland, abandoned cropland and improved (e.g., Bermuda grass) pastures to Sagebrush/Bluestem Prairie habitat using native grasses and forbs and shrubs.
- Encourage the use of Farm Bill offerings like the Conservation Reserve Program and Grassland Reserve Program to be used for planting Conservation Reserve Program fields to native grasses and forbs instead of Old World Bluestems and Lovegrass.
- Encourage grazing practices which result in removal of interior fencing in pastures and use patch burn technology, in conjunction with mineral blocks, to manage cattle.
- Encourage modifications to existing Conservation Reserve Program contracts that provide for conservation of this habitat.
- Cooperate with energy developers and others both in site selection and mitigation.
- Encourage the development and implementation of a statewide mitigation plan for wind power development.
- Cooperate with energy developers and others to minimize surface damages to shrubland.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

10. Fire suppression has created conditions in this habitat that encourage woody encroachment.
11. Invasive species can reduce the quality of this habitat and its suitability for species of greatest conservation need.

Conservation Actions:

- Encourage and support prescribed burning.
- Encourage and facilitate burn cooperatives.

Conservation issue: Black-tailed Prairie Dog habitat related Issue:

12. Land usage has reduced the number and sizes of Black-tailed Prairie Dog towns.

Conservation Actions:

- Provide landowner incentives for following agricultural practices that maintain Black-tailed Prairie Dogs.
- Encourage and support alternative economic use of agricultural lands, including fee hunting, fee access for fishing, and ecotourism.

- Develop and distribute informational materials for landowners and others on topics including grazing ecology, natural systems, and exotic invasive species.
- Encourage the use of programs like the Landowner Incentive Program for the conservation of Black-tailed Prairie Dogs and other species of greatest conservation need.
- Support necessary changes in the inheritance legislation to enable large ranches to remain in single family ownership.
- Encourage land acquisition and conservation easements by private entities (e.g., land trusts and organizations such as The Nature Conservancy).
- Increase funding from the subsidy side of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Encourage the development or updating of Best Management Practices for practices that protect this habitat and make it suitable for species of greatest conservation need.
- Identify and prioritize core areas of habitat and corridors to connect to get the most benefits.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres enrolled in conservation programs.
- Acres of native plant communities restored.
- GIS data layers / remote sensing to measure numbers of acres and their distribution.
- Numbers, size and distribution of Black-tailed Prairie Dog colonies.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Response of species to management practices such as burning, fencing, and grazing.

Conservation Landscape: Gypsum or Sandstone Canyonlands and Gypsum Caves

The relative condition of Gypsum or Sandstone Canyonlands and Gypsum Caves habitat in the Mixed-grass Prairie Region is currently good with a stable trend. This habitat occurs in three discreet portions of the Mixed -grass Prairie Region. The largest expanse of this habitat occurs over the Blaine Gypsum formation in the north central portion of the Region extending through portions of Blaine, Major, Woods, and Woodward counties. Other gypsum pockets occur in Harmon, Greer, Beckham, and Washita County. This habitat type occurs on hilly, dissected uplands where layers of brick-red shales, sandstones, and interbedded grayish gypsum are exposed at or near the earth's surface. The thin, dry, calcareous soils overlying these rock layers support a unique community of low stature, drought-tolerant prairie grasses and forbs including Little Bluestem (*Schizachyrium scoparium*) and Hairy Grama (*Bouteloua hirsuta*). Years of erosion have carved out canyons, buttes, and mesas while groundwater movement has dissolved gypsum to create numerous caves. These caves harbor the northern most colonies of the Brazilian Free-tailed Bat (*Tadarida brasiliensis*).

Recognized plant associations within this habitat type include:

Little Bluestem
Yellow Indian Paintbrush
Gordan's Bladderpod Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Black-capped Vireo	X				X			
Bird	Cassin's Sparrow		X						X
Bird	Ferruginous Hawk	X							X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Swainson's Hawk		X						X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Desert Shrew				X				X
Mamm	Mountain Lion	X						X	
Mamm	Ringtail				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mamm	Western Big-eared Bat	X							X
Rept	Common Lesser Earless Lizard				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Diamond-backed Rattlesnake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.
Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Fire suppression and other ideal conditions have resulted in a virtual explosion by all species of junipers encroaching into this habitat.
4. Heavy grazing can lead to soil erosion in this habitat.
5. Wind power development may reduce the quantity and quality of this habitat.

Conservation Actions:

- Develop and implement alternative methods of cedar control and removal.

- Develop and distribute informational materials to landowners and others dealing with fire and fire management.
- Encourage and facilitate prescribed burning.
- Encourage and facilitate formation of burn cooperatives, including law or regulation changes if necessary.
- Develop and distribute information to landowners and others on grazing management.
- Encourage use of Farm Bill provisions by landowners that include consideration of conserving species of greatest conservation need.
- Consider the use of land acquisition and conservation easements to conserve the most important tracts of this habitat in the Mixed-grass Prairie Region.
- Encourage and support legislation that provides opportunities for landowners to transfer large intact tracts to future generations.
- Encourage grazing practices that provide the least damaging impacts to this habitat.
- Encourage landowners using the Conservation Reserve to plant program acres to 100 percent native grasses and forbs.
- Conduct field studies to clarify the potential impacts of wind power development on species of greatest conservation need in this habitat.
- Participate in the development of a statewide mitigation plan for wind power development.
- Coordinate with other stakeholders on energy development and mitigation.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Monitor and assess changes in the number of acres and distribution of habitat using GIS data sets.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Tallgrass Prairie

The relative condition of Tallgrass Prairie habitat in the Mixed-grass Prairie Region is currently poor with a declining trend. The Tallgrass Prairie community is widespread along the eastern edge of the Mixed-grass Prairie Region in its transition zones with the Crosstimbers and Tallgrass Prairie Regions. Tallgrass Prairie communities also occur locally in the central and western portions of the Region on relatively mesic slopes, on stabilized dunes, and in floodplains. Within this Region, Tallgrass Prairies are dominated by Big Bluestem (*Andropogon gerardi*), Switchgrass (*Panicum virgatum*), and Little Bluestem (*Schizachyrium scoparium*). The structure of this herbaceous community is maintained by the occurrence of periodic fires that suppress the growth of woody plant species and favor grasses and some forbs. Other common grasses and forbs include Prairie Dropseed (*Sporobolus hetrolepis*), Sideoats Grama (*Bouteloua curttipendula*), Compass Plant (*Silphium laciniatum*), Lead Plant (*Amorpha canescens*), Wild Alfalfa/Scurf Pea (*Psoralea tenuifolia*), Illinois Bundleflower (*Desmanthus illinoensis*), Blazing Star (*Liatris sp.*), Goldenrod (*Solidago sp.*), Indian Paintbrush (*Castillega coccinea*), and Maximillian Sunflower (*Helianthus maximilliani*).

Historically, Tallgrass Prairies were more abundant, especially in the eastern portion of the Region, than they are currently. Tallgrass Prairie habitat remains primarily on sites that are too steeply sloped, sandy, or rocky to be suitable for crop production or conversion to Bermuda grass pasture. The extent and distribution of Tallgrass Prairies is poorly known, but the existing tracts appear to be scattered and small relative to their presettlement condition. Where Tallgrass Prairie habitat remains, continuous grazing, fire suppression, and the encroachment of non-native plants have changed this plant community's composition and structure by increasing Juniper cover, increasing the abundance of exotic plants, and decreasing the abundance of native perennial forbs.

Recognized vegetation associations (Hoagland 2000) include:

Big Bluestem – Switchgrass Herbaceous Community
Big Bluestem – Little Bluestem - Indian Grass Herbaceous Community
Sand Bluestem – Giant Sandreed Herbaceous Community
Little Bluestem – Big Bluestem Herbaceous Community

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Burrowing Owl	X							X
Bird	Greater Prairie Chicken	X				X			
Bird	Harris's Sparrow		X						X
Bird	LeConte's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Peregrine Falcon	X							X
Bird	Prairie Falcon	X							X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		
Inve	Prairie Mole Cricket	X				X			
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.

- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Conversion of this habitat for crop production or Bermuda grass pasture has reduced the quantity and quality of the habitat to support species of greatest conservation.
4. Introduced grasses have less value for species of greatest conservation need than those native grasses that are part of this habitat in its most natural condition.
5. Heavy grazing can in some cases reduce the quantity and quality of this habitat.
6. Herbicide treatments can alter the quality of this habitat for supporting species of greatest conservation need.
7. Fragmentation, including that caused by inheritance laws, reduces the ability of this habitat to support species of greatest conservation need.
8. Some birds are especially susceptible to collisions with fences.
9. Urban sprawl around metropolitan areas reduces the quality and quantity of this habitat in the Mixed-grass Prairie Region.
10. Energy exploration and development sometimes reduces the quantity and quality of this habitat.

Conservation Actions:

- Develop and distribute information to landowners and others concerning grazing management, fire usage, energy development, natural systems, and invasive species.
- Encourage the conversion of pastures containing introduced species to tall grasses.
- Consider land acquisition and conservation easements for protecting the most important tracts of this habitat.
- Encourage an economic study for profitability and nutrition of diverse forbs pasture.
- Encourage and support ranch diversification for lower grazing and off set by lease hunting, fishing access, and ecotourism viewing.
- Support efforts and cooperate to remove hurdles to lease hunting and hunting cooperatives.
- Support education components for ranch diversification.
- Encourage restoration of Bermuda grass pastures and crop fields to native Tallgrass Prairie grasses and forbs.
- Encourage and support restoration of Conservation Reserve Program fields to native Tallgrass Prairie plants.
- Encourage and facilitate development of a statewide mitigation plan for wind power development.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

11. Woody encroachment reduces the quantity and quality of this habitat in many areas.
12. Improper burning frequencies may not result in achievement of the desired objective, and may actually worsen habitat conditions.
13. Fire suppression has resulted in making conditions more or less ideal for encroachment by undesirable plants in this habitat.
14. Exotic plant invasive species have thrived in portions of this habitat.

Conservation Actions:

- Develop and distribute information to landowners and others concerning grazing management, fire usage, energy development, natural systems, and invasive species.
- Encourage development of business and a market for the cutting of Eastern Redcedar.
- Encourage and support conversion of pastures containing introduced species to tall grasses.
- Support and encourage changes in laws regulating fire to make it easier and safer to implement burning as a treatment for maintaining and improving this habitat.
- Encourage and support fire management cooperatives.
- Encourage and facilitate fire management contractors.
- Support laws and regulations reducing liability for fire contractors.
- Encourage restoration of Bermuda grass pastures and crop fields to native Tallgrass Prairie grasses and forbs.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Periodically assess changes in the distribution and acreage of habitat.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Large Rivers and Sloughs/Ponds

The relative condition of Large Rivers and Sloughs/Ponds habitat in the Mixed-grass Prairie Region is currently poor with a declining trend. Portions of five large rivers pass through the Mixed-grass Prairie Region: the Arkansas, Cimarron, North Canadian, Canadian and Red. Each of these rivers has a sandy substrate and a broad floodplain. There is a seasonal period of high flow during the spring months followed by a period of much lower flow during the summer that creates and maintains a dynamic mosaic of ephemeral habitats such as sandbars, mudflats, Sandbar Willow thickets, and marshy sloughs along and within the river channel that depend upon periodic scouring flows. For purposes of this Strategy, we consider the Large River habitat to be comprised of the river channel and these smaller ephemeral habitats that are tied to flooding and scouring flows. This mosaic of smaller habitats supports a diversity of species of conservation need including the least tern on sandbars, shorebirds and wading birds on mudflats, Arkansas River and Red River Shiners in shallow braided channels, and Bell's Vireo in willow thickets.

The Arkansas, Cimarron, North Canadian and Canadian rivers are all connected as part of the Arkansas River watershed. The Red River, which forms the southern boundary of the Region, is a separate watershed and supports a distinctly different community of fish and mussels including the Red River Shiner, Red River Pupfish and Chub Shiner. Each of the Regions large rivers has been modified to some extent by the construction of reservoirs on their main stems, flood control impoundments on their tributaries, and water withdrawals. These modifications have altered the historic fluctuation in flow rates and the magnitude of flood events and have thus affected the abundance and condition of ephemeral habitats such as sandbars, mud flats, and willow thickets associated with the rivers, and the movement of fish populations within the rivers. As a general pattern, flooding magnitude, water volume, and the quality of ephemeral habitats has declined over the past century.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Interior Least Tern	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Mountain Plover	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Snowy Plover	X							X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Western Sandpiper	X							X
Bird	Whooping Crane	X						X	
Bird	Wilson's Phalarope				X				X
Fish	Alligator Gar	X				X			
Fish	Arkansas River Shiner	X				X			
Fish	Arkansas River Speckled Chub	X				X			
Fish	Black Buffalo	X							X
Fish	Chub Shiner				X				X
Fish	Paddlefish		X				X		
Fish	Plains Minnow			X		X			
Fish	Prairie Speckled Chub		X						X
Fish	Red River Pupfish			X			X		
Fish	Red River Shiner			X			X		
Fish	Shovelnose Sturgeon	X							X
Inve	Bleufer			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Plain Pocketbook		X			X			
Inve	Threeridge Mussel			X			X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	River Otter		X					X	
Mamm	Western Big-eared Bat	X							X
Rept	Midland Smooth Softshell				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about river flow control and non-point and point-source pollution in this habitat is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct research to analyze dam breaching for at risk species (e.g., Paddlefish and terns).
- Determine the most effective ways to discourage building/developing in river floodplains.
- When studying impacts of development and runoff, consider the cumulative effects.
- Conduct investigations to determine alternative methods of flood control such as levee removal and floodplain mitigation as wetland banks.
- Identify spawning areas of important species of greatest conservation need potentially impacted by dredging.

Conservation issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

3. Water quality can be altered by such things as herbicides, nitrates, metals, oil field discharges, and other forms of pollution.

Conservation Actions:

- Encourage opposition to the Red River chloride project.
- Develop and distribute information to landowners and others concerning grazing management, energy development, and natural systems.
- Conduct research to analyze dam breaching for providing benefits to at risk species (e.g., Paddlefish and terns).
- Support and encourage pollution abatement efforts.
- Encourage practices that will improve water quality below dams.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

4. Water impoundments alter the natural hydrology of this habitat and thereby its suitability for species of greatest conservation need.
5. Sedimentation occurring as a result of altered flow regimes can reduce the quantity and quality of this habitat.
6. Maintaining minimum in-stream flows to provide habitat for species of greatest conservation need can be a controversial topic in some areas.
7. Such things as channelization, sand mining, water diversions for municipal and agricultural uses, and dredging can alter river morphology and hydrology.
8. Lack of sandbars can hinder the suitability of this habitat for some species of greatest conservation need.

9. Frequencies and magnitudes of flooding impacts the suitability of this habitat for some species of greatest conservation need.
10. The proposed desalinization of the Red River system would likely reduce the quantity and quality of this habitat.

Conservation Actions:

- Develop and distribute information to landowners and others concerning grazing management, energy development, and natural systems.
- Conduct research to analyze dam breaching for providing benefits to at risk species (e.g., Paddlefish and terns).
- Encourage and support legislation needed to achieve in-stream flows.
- Encourage research concerning the use of mitigation to fund and support fish and wildlife protection and management from hydropower projects and U.S. Army Corps of Engineers impoundment project agreements.
- Coordinate with U.S. Army Corps of Engineers and others to modify the scope of projects to provide greater benefits to species of greatest conservation need in this habitat.
- Encourage practices that will improve water quantity below dams.

Conservation Issue: Habitat loss and fragmentation from land management practices:

11. Clearing of the riparian zone reduces the quantity and quality of this habitat.
12. Heavy grazing in the riparian zone can reduce the quantity and quality of this habitat.

Conservation Actions:

- Encourage and support the creation and maintenance of riparian buffer zones.
- Encourage prescribed burning and thinning of cottonwood.
- Develop and distribute information to landowners and others concerning grazing management, fire management, energy development, natural systems, and invasive species.

Conservation issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

13. Off-road vehicle usage can reduce the quality and quantity of river channels and floodplains.

Conservation Action:

- Evaluate the potential impact of off-road vehicles on species of greatest conservation need in this habitat and develop mitigation plans to reduce the impacts.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

14. Salt Cedar expansion has reduced the quantity and quality of this habitat in the Mixed-grass Prairie Region.
15. People have facilitated the movement of various fish species between river basins, such as the introduction of the Red River Shiner to the Cimarron River.

Conservation Action:

- Develop and distribute information to landowners and others concerning grazing management, energy development, natural systems, invasive species, and the ecological issues associated with bait bucket introductions and transfers of fish between watersheds.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Invasive fish species surveys.
- Monitor compliance with Oklahoma water quality standards.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- U.S. Army Corps of Engineers stream flow monitoring in South Canadian River below Lake Meredith.
- U.S. Geological Survey gauging stations for flows.

Conservation Landscape: Herbaceous Wetland

The relative condition of Herbaceous Wetland habitat in the Mixed-grass Prairie Region is currently poor with a declining trend. Herbaceous Wetlands in the Mixed-grass Prairie Region are most often small (i.e., less than 10 acres in size). They may occur as sloughs and cutoff channels from streams and rivers, as seasonally flooded depressions within floodplains, or isolated from streams and rivers as swales and depressions in prairies and between stabilized sand dunes. Periodic fires during dry periods prevent woody plant species from dominating Herbaceous Wetlands. The plant community composition of Herbaceous Wetlands is variable depending upon soils and frequency of soil moisture saturation. Common Herbaceous Wetland plant communities include Pink Smartweed (*Polygonum pensylvanicum*), Barnyard Grass (*Echinochloa crusgalli*), Three-square Bulrush (*Scirpus americanus*), Softstem Bulrush (*Csirpus tabernaemontani*), and Common Spike Rush (*Eleocharis tenuis*).

Recognized plant associations in this habitat type include:

Common Reed Semi-permanently Flooded Marsh
Three-square Bulrush Semi-permanently Flooded Marsh
Softstem Bulrush - Common Spike Rush Semi-permanently Flooded Marsh
Broadleaf Cattail Semi-permanently Flooded Marsh
Pennsylvania Smartweed – Curlytop Smartweed Semi-permanently Flooded Wetland
Broadleaf Arrowhead – Longbar Arrowhead Semi-permanently Flooded Wetland
Inland Saltgrass – Alkali Sacaton Temporarily Flooded Grassland
Inland Saltgrass – Three-square Bulrush Temporarily Flooded Grassland
Common Spikerush – Hairy Waterclover Temporarily Flooded Marsh
Prairie Cordgrass Temporarily Flooded Marsh

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Black Rail	X							X
Bird	Buff-breasted Sandpiper	X				X			
Bird	Canvasback	X							X
Bird	Hudsonian Godwit				X				X
Bird	Interior Least Tern	X							X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	King Rail				X				X
Bird	LeConte's Sparrow		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Long-billed Curlew	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Piping Plover	X							X
Bird	Prairie Falcon	X							X
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Solitary Sandpiper	X							X
Bird	Swainson's Hawk		X						X
Bird	Trumpeter Swan	X							X
Bird	Upland Sandpiper				X				X
Bird	Western Sandpiper	X							X
Bird	Whooping Crane	X						X	
Bird	Wilson's Phalarope				X				X
Inve	Dotted Skipper	X				X			
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Western Big-eared Bat	X							X
Rept	Midland Smooth Softshell				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Texas Gartersnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Information regarding the distribution and locations wetland habitats is incomplete.
3. Information regarding the distributions and ecological needs of wetland wildlife species (e.g., which wildlife species occupy which wetland types) is incomplete.
4. The small size of wetlands makes them difficult to locate within larger habitat types such as prairies and woodlands.
5. Land landowners and conservation agency personnel are often unaware of the effects of management practices on wetlands animals and plant communities.

Conservation Actions:

- Encourage and facilitate a survey of wetlands in the Mixed-grass Prairie Region.

- Develop a database of wetland locations and conditions.
- Encourage and support biological inventories of wetlands to determine plant community composition and the distribution and abundances of wildlife species of conservation need.
- Encourage and support field studies to determine the ecological needs of wetland wildlife species (e.g., types of plant communities and the timing and duration of flooding needed for species of greatest conservation need).
- Develop and distribute information for landowners and others regarding the ecology of Herbaceous Wetlands within the Mixed-grass Prairie Region.
- Support studies to develop descriptions of quality Herbaceous Wetland habitats in this Region to serve as the target condition for wetland restoration and enhancement efforts.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

6. Wetlands have been and continue to be drained or filled to provide land for residential or agricultural development.
7. Irrigation practices can result in lowering water tables.
8. Agricultural developments, including large confined animal feeding operations (e.g., hog farms) can reduce the quantity and quality of this habitat.
9. Current land practices sometimes make conditions in this habitat ideal for invading species or introduced species, especially woody encroachment.
10. Some farming practices can lead to siltation of herbaceous wetlands.
11. Invasion by cattails sometimes results in herbaceous wetlands being reduced in quantity and quality.
12. Increased nutrients, pesticides, sediment, and endocrine disruptors in storm water runoff from urban and agricultural areas can alter the quality and quantity of this habitat.
13. Removal of buffer vegetation around wetlands to protect them from pollutants in storm water runoff results in a decline in habitat quality.
14. Pumping groundwater for wetlands management is not defined as a beneficial use.
15. Existing habitat conditions in many areas encourage Salt Cedar encroachment.
16. Many people do not understand the swampbusting provisions of Farm Bill.
17. Wetland Reserve Program enrollments lack adequate incentives.

Conservation Actions:

- Encourage improvements in the technology of irrigation that contribute to the health of this habitat.
- Encourage the selection of crops requiring less irrigation.
- Provide technical assistance and financial incentives for landowners to manage wetlands.
- Consider use of land acquisition and conservation easements to conserve some of the most valuable tracts of Herbaceous Wetlands in the Mixed-grass Prairie Region.
- Encourage and support legislation and regulations that provide tax breaks for wetlands conservation.
- Encourage fencing of wetlands to control grazing and allow the development of vegetative buffers.
- Encourage and support full use of the Farm Bill at national, state, and local levels.
- Develop and distribute information to landowners and others concerning seasonal wetlands, the value of water, swampbusting laws and practices, grazing management, crop selection, fire management, energy development, natural systems, and invasive species.
- Encourage legislation to designate groundwater pumping for wetlands as a beneficial use of groundwater.

- Encourage activities that will increase Conservation Reserve Enhancement Program enrollments.
- Encourage and support improving small landowner access to cost-share programs, especially those in the Farm Bill that improve water quality.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Develop GIS datasets to monitor changes in the number of acres and distribution of wetlands.
- National Wetland Inventory.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Wetlands in conservation programs; numbers of acres and distribution.

Conservation Landscape: Small Rivers

The relative condition of Small Rivers habitat in the Mixed-grass Prairie Region is currently poor with a declining trend. Primary small rivers in this habitat are South Fork of the Arkansas, Chickashia, Washita, South Fork of the Red, and North Fork of the Red.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Interior Least Tern	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Mountain Plover	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Snowy Plover	X							X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Whooping Crane	X						X	
Fish	Alligator Gar	X				X			
Fish	Arkansas Darter	X							X
Fish	Arkansas River Shiner	X				X			
Fish	Arkansas River Speckled Chub	X				X			
Fish	Paddlefish		X				X		
Fish	Plains Minnow			X		X			
Fish	Prairie Speckled Chub		X						X
Fish	Red River Pupfish			X			X		
Fish	Red River Shiner			X			X		
Inve	Bleufer			X			X		

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	Ohio River Pigtoe	X				X			
Inve	Plain Pocketbook		X			X			
Inve	Threeridge Mussel			X			X		
Inve	Wartyback Mussel		X				X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	River Otter		X					X	
Mamm	Western Big-eared Bat	X							X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Information regarding species of greatest conservation need and their habitat needs (e.g., distribution and ecological needs) in incomplete.
3. Resource monitoring is incomplete.

Conservation Actions:

- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.
- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.

- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

4. Some irrigation practices degrade the quantity and quality of small rivers habitat in the Mixed-grass Prairie Region.
5. Heavy grazing has detrimental impacts on small rivers habitat.
6. Dams and water diversions cause reductions in flows and a lack of scouring in small rivers.
7. Excessive runoff of nutrients from confined animal farming operations (e.g., hog farms) can cause reductions of water quality in small rivers.
8. Channelization and reservoir construction alter channel morphology and hydrology.
9. Clearing of riparian vegetation along small rivers results in reduced habitat quality.
10. Water withdrawals for irrigation or municipal use reduce the quality and quantity of small rivers habitat.
11. Excessive grazing in the riparian zone reduces the quantity and quality of small rivers, as well as degradation of river banks.
12. The potential diversion of water to reduce naturally occurring salinity in the Red River system would reduce the quantity and quality of small rivers habitat.
13. Water quality in small rivers is sometimes reduced by discharges of herbicides, nitrates, endocrine disruptors, and oil field pollution chemicals.

Conservation Actions:

- Encourage programs and activities which restore river channel morphology.
- Encourage and support programs to improve water quality and flows below reservoirs.
- Encourage and support congressional reprioritizing of the U.S. Army Corps of Engineers projects to include fish, wildlife, and recreation as beneficial uses.
- Cooperate with the U.S. Army Corps of Engineers to establish more natural alternative flow patterns.
- Encourage and support legislation to establish minimum in-stream flow provisions.
- Encourage and support pollution abatement efforts.
- Encourage and support landowners and others efforts to create and maintain riparian buffer zones.
- Oppose the Red River chloride project (i.e., water diversions).
- Develop and distribute information to landowners and others concerning the value of water, grazing management, crop selection, fire management, energy development, and natural systems.
- Encourage replacement of stock ponds with alternative water sources.
- Encourage and support programs that protect riparian areas from grazing.
- Encourage and support increased use of Farm Bill incentives.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

14. Conditions in this habitat have become suitable for woody vegetation encroachment.
15. Invasive species encroachment, especially by the exotic Salt Cedar, has reduced the quantity and quality of this habitat.
16. Exclusion of fire has made this habitat vulnerable to invasion and encroachment.
17. Introduction of fish from other river systems through bait releases and accidental introductions (e.g., introduction of Red River Pupfish from the Red River to the Canadian River) threatens native fish populations.

Conservation Actions:

- Develop and distribute information to landowners and others concerning the value of water, grazing management, crop selection, fire management, energy development, natural systems, and invasive species (e.g., bait bucket releases and other fish translocations between river species).
- Encourage and support programs that help control invasive species.
- Encourage and facilitate the creation of burn cooperatives.
- Encourage an evaluation of burn laws in Oklahoma in an effort to make them more compatible with habitat conservation of small rivers in the Mixed-grass Prairie Region.

Conservation issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

18. Unregulated use of off-road vehicles can reduce habitat quantity and quality.

Conservation Actions:

- Conduct studies to determine the impacts of off-road vehicles on species of greatest conservation need and their habitats.
- Encourage efforts to locate and provide off-road vehicle areas/parks.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of riparian habitat restored.
- Miles of river channel restored.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- U.S. Geological Survey groundwater levels check.
- U.S. Geological Survey monitoring stations.
- Water flow (e.g., U.S. Geological Survey monitoring stations).
- Water quality monitoring.

Conservation Landscape: Post Oak/Blackjack Savannah or Shrublands and Post Oak/Blackjack Oak/Hickory Woodlands

The relative condition of Post Oak/Blackjack Savannah or Shrublands and Post Oak/Blackjack Oak/Hickory Woodlands habitat in the Mixed-grass Prairie Region is currently poor with a declining trend. Post Oak/Blackjack Oak Shrublands and Woodlands occur locally in the Wichita Mountains and bands of sandy soils and stabilized dunes north of the Canadian, North Canadian, and Cimarron rivers in the eastern part of the Region. This community is a mosaic with patches of Tallgrass Prairie interspersed with patches of oak scrub or oak thickets and open oak woodlands and its structure is maintained by periodic fires and dry soil conditions. The dominant grasses and trees in this community include Little Bluestem *(Schizachyrium scoparium*), Indian Grass (*Sorghastrum nutans*), Big Bluestem (*Andropogon gerardii*), Post Oak (*Quercus stellata*), Blackjack Oak (*Quercus marilandica*) and Eastern Redcedar (*Juniperus virginiana*). Other common woody plants include Chittamwood (*Bumelia lanuginosa*), Eastern Redbud (*Cercis canadensis*), Roughleaf Dogwood (*Cornus drummondii*), Mexican Plum (*Prunus mexicana*), and Winged Sumac (*Rhus copallina*). In a few sheltered sites within the Wichita Mountains, small numbers of Sugar Maple (*Acer sacchrum*), Shumard Oak (*Quercus shumardii*), and Little Walnut (*Juglans microcarpa*) can be found growing in association with Post and Blackjack Oaks. This community supports the last remaining nesting populations of the endangered Black-capped Vireo. Decades of fire suppression have altered the structure of this community throughout the Region by allowing for greater densities of oak trees and an increased abundance and dominance of Eastern Redcedar (*Juniper virginiana*).

Recognized vegetation associations within this habitat type include:

Post Oak – Eastern Redcedar Woodland
Blackjack Oak/Little Bluestem Woodland
Post Oak – Blackjack Oak/Little Bluestem Woodland
Texas Live Oak – Post Oak/Little Bluestem Woodland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Black-capped Vireo	X				X			
Bird	Harris's Sparrow		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Red-headed Woodpecker		X			X			
Inve	Iowa Skipper	X				X			
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Maintain databases (e.g., Natural Heritage Inventory) and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Knowledge about the impacts of many land management practices on populations of many of the species of greatest conservation need in this habitat is incomplete.
4. Natural fire regimes in this habitat have been disrupted or eliminated.

5. Forests in this habitat are becoming unnaturally dense with little understory development.
6. Current laws and regulations make prescribed burning difficult through things such as landowner liability.
7. Burning in this habitat causes air quality conflicts and concerns.
8. People in urban areas are frequently unwilling to deal with the fire and smoke associated with prescribed burning.
9. There can be extreme logistical difficulties with burning in developed areas.
10. Technical assistance to landowners for prescribed burning is often limited.
11. Much of the native vegetation in this habitat has been converted to tame grasses such as Bermuda grass and Lovegrass.
12. There has been widespread invasion of other plants (e.g., *Sericea lespedeza*, and other exotic understory plants) throughout this habitat in the Mixed-grass Prairie Region.
13. Timber harvest has increased throughout this habitat.
14. Urbanization has fragmented many of the woodlands and savannah tracts within this habitat.
15. Construction of roads and corridors for utilities or pipelines reduces the quantity and quality of this habitat.
16. Heavy grazing can encourage the spread of Eastern Redcedar.
17. Herbicide treatment of oak savannahs can reduce the quality of this habitat for species of greatest conservation need.
18. Oil and gas exploration and development results in increased numbers of roads, increased erosion around well sites, increased potential for oil or saltwater spills, and causes other reductions in quantity and quality of this habitat.

Conservation Actions:

- Conduct studies of the responses wildlife populations to various land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Develop and distribute information on burning strategies and management to landowners.
- Encourage creation of burn cooperatives.
- Encourage and support burn laws that reduce landowner liability and include the right to burn.
- Encourage and facilitate professional burn crew support, making it accessible and affordable to landowners, and reducing liability and heavy equipment costs.
- Cooperate in the development of a program to assist landowners with proper fire management.
- Encourage and facilitate programs that provide financial incentives for landowners to restore habitat.
- Cooperate with other stakeholders to produce demonstration areas of restored woodlands and savannahs on public lands.
- Consider land acquisition and conservation easements to prevent development and conserve some of the more important tracts of this habitat.
- Cooperate with other stakeholders to identify and rank focus areas for implementation of actions.
- Cooperate with oil and gas industry representatives and others to create incentive programs to restore habitat

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired (e.g., easements secured and acreage protected).
- Acres burned/treated.
- Acres of native plant communities restored.
- Amount of technical assistance being provided.
- Animal populations and vegetation response to management.

- Changes in acreage/coverage of exotic vegetation.
- Number of landowners participating in landowner incentive programs.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Vegetation response to fire (e.g., grasses and woody plants).

Conservation Landscape: Sand Plum, Hawthorn, or Sumac Shrublands

The relative condition of Sand Plum, Hawthorn, or Sumac Shrubland habitat in the Mixed-grass Prairie Region is currently poor with a declining trend. This uncommon shrub-dominated habitat occurs locally on sandy soils and stabilized dunes in the northern portion of the Region or can occur as relatively small tracts within Mixed-grass Prairies and old fields that are subject to infrequent burning. This habitat type is typically dominated by Sand Plum (*Prunus angustifolia*) and/or Skunkbrush (*Rhus aromatica*). Other woody plants that may occur in lesser numbers include Sand Sagebrush (*Artemesia filifolia*), Oklahoma Plum (*Prunus gracilis*), and Netleaf Hackberry (*Celtis reticulata*). These shrubs typically grow in a mosaic of small thickets interspersed with Tall or Mixed-grass Prairie grasses including Little Bluestem (*Schizachyrium scoparium*), Sideoats Grama (*Bouteloua curtipendula*), and Switchgrass (*Panicum virgatum*). This habitat may occur as a climax plant association on stabilized dunes or as a transitional community in infrequently burned prairies.

Recognized plant associations within this habitat type include:

Sand Plum/Little Bluestem Shrubland
Smooth Sumac Shrubland
Skunkbrush (Aromatic Sumac) Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Black-capped Vireo	X				X			
Bird	Cassin's Sparrow		X						X
Bird	Harris's Sparrow		X						X
Bird	Lesser Prairie Chicken	X				X			
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Scaled Quail		X			X			
Bird	Short-eared Owl				X				X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mamm	Eastern Spotted Skunk				X				X
Mamm	Mountain Lion	X						X	
Mamm	Western Big-eared Bat	X							X
Rept	Common Lesser Earless Lizard				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Maintain databases (e.g., Natural Heritage Inventory) and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres enrolled in conservation programs.
- Acres of native plant communities restored.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

- Response of populations of species of greatest conservation need to management practices such as burning, fencing, and grazing.

Conservation Landscape: Streams and Associated Riparian Forests

The relative condition of Streams and Associated Riparian Forests habitat is currently poor with a declining trend. Streams in the Mixed-grass Prairie Region are variable but most have sandy or silty substrates. Though in heavily dissected landscapes, streams often flow over areas of hard clay. Very little information exists regarding the historic conditions of these prairie streams but prior to settlement, many streams appear to have been slightly entrenched with well developed floodplains, moderate degrees of channel sinuosity (i.e., meanders), and moderate width to depth ratios. Narrow riparian woodlands and shrublands historically grew along the banks of most streams. These communities were comprised of a diversity of tree species including American Elm (*Ulmus americana*), Sugarberry (*Celtis laevigata*), Western Soapberry (*Sapindus drummondii*), Eastern Cottonwood (*Populus deltoides*), Black Willow (*Salix nigra*), Roughleaf Dogwood (*Cornus drummondii*), and Buttonbush (*Cephalanthus occidentalis*). Over the past century, many streams in the Region have been altered by human activity such as the removal of riparian vegetation and the straightening of the stream channels to remove meanders. These efforts to reduce the amount of acreage occupied by streams and their floodplains have resulted in many streams cutting deep incised channels that separate them from their former riparian zone.

Recognized plant associations within this habitat type include:

Eastern cottonwood – American elm – sugarberry temporarily flooded forest
American/red elm – sugarberry/hackberry – green ash temporarily flooded forest
American/red elm – chinquapin oak temporarily flooded forest
Eastern cottonwood – sandbar willow temporarily flooded woodland
Eastern cottonwood – black willow temporarily flooded woodland
Black willow temporarily flooded woodland
Sandbar willow/Switchgrass temporarily flooded shrubland
Buttonbush semi-permanently flooded shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Bell's Vireo		X			X			
Bird	Bullock's Oriole		X						X
Bird	Golden-fronted Woodpecker	X							X
Bird	Little Blue Heron		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Loggerhead Shrike		X			X			
Bird	Louisiana Waterthrush		X						X
Bird	Northern Bobwhite		X			X			
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Snowy Egret								
Fish	Plains Minnow			X		X			
Fish	Red River Pupfish			X			X		
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Mountain Lion	X						X	
Mamm	River Otter		X					X	
Mamm	Western Big-eared Bat	X							X
Rept	Midland Smooth Softshell				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and provide long-term funding to maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible

for population declines, and develop recommendations to enhance populations through improving habitat conditions.

- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct field studies to develop accurate descriptions of what a quality habitat looks like to serve as the management goal.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

3. Conditions in this habitat have made it vulnerable to invasive species such as Redcedar, Salt Cedar, and Brown-headed Cowbirds.
4. Fire exclusion encourages the increase of cedars.

Conservation Actions:

- Encourage actions that reduce cedar encroachment.
- Develop and distribute information to landowners and others concerning grazing management, fire management, energy development, natural systems, and invasive species.
- Support the development and implementation of exotic and invasive species management plans.

Conservation Issue: Habitat loss and fragmentation from land management practices:

5. Heavy grazing can result in a reduction of the understory in this habitat.
6. Conversion of riparian habitat to other land use types, especially Bermuda grass pasture and crop fields, reduce its value to species of greatest conservation need.

Conservation Actions:

- Encourage fencing of riparian corridors to control cattle grazing.
- Encourage use of alternative shading for livestock to reduce impacts to habitat.
- Develop and distribute information to landowners and others concerning grazing management, fire management, energy development, natural systems, invasive species, and the availability of Farm Bill programs such as Wildlife Habitat Incentives Program and Environmental Quality Incentives Program.
- Consider land acquisition, conservation easements, and leasing to conserve the most important tracts of this habitat.
- Encourage and facilitate restoration of habitat and stream/river channels.
- Encourage management of livestock use of in bottomland forests.

Conservation issue: Altered patterns of water flow that negatively affect both habitat and species:

7. Channelization of streams has reduced the quantity and quality of this habitat in the Mixed-grass Prairie Region.

Conservation Actions:

- Encourage and facilitate the reconnection of forests with their rivers/streams by restoring channels and managing for the natural hydro period.
- Encourage and facilitate restoration of habitat and stream/river channels.

Potential indicators for monitoring the effectiveness of the conservation actions:

- GIS – change analysis.
- National Wild Turkey Federation GIS data sets.
- Partnerships with local governments.
- Population response of species of greatest conservation need to management actions such as riparian fencing, prescribed burning.

- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Springs

The relative condition of Springs habitat in the Mixed-grass Prairie Region is currently poor with a declining trend.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Fish	Arkansas Darter	X					X		
Mamm	Western Big-eared Bat	X				X			

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Maintain databases (e.g., Natural Heritage Inventory) and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible

for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

3. Heavy grazing can reduce the quantity and quality of this habitat.
4. Landowners and livestock operators sometimes modify springs by adding concrete structures to facilitate cattle watering.
5. Watering cattle by ponds can reduce the quality and quantity of this habitat.
6. Heavy cattle grazing and use of agricultural chemicals can produce drainage into springs which elevate nutrient levels and increase algae.

Conservation Actions:

- Consider land acquisition, conservation easements, and leasing to conserve the most important tracts of spring habitat in the Mixed-grass Prairie Region.
- Encourage the use of landowner incentive programs having provisions for protecting and restoring habitat, water quality, and riparian vegetation.
- Encourage and facilitate programs that restore vegetation around springs and remove modifications such as small impoundments.
- Encourage fencing springs to control access by livestock.
- Conduct field studies to delineate recharge areas of springs necessary to protect water quality and flows.

Conservation issue: Altered patterns of water flow that negatively affect both habitat and species:

7. Groundwater withdrawals reduce spring and stream flow.

Conservation Action:

- Encourage management of water withdrawals to lessen impact on spring flows.

Conservation issue: Habitat loss and fragmentation from land management practices:

8. Riparian zones are a limited, fragile habitat segment that are easily disturbed or modified and are subject to exotic plant invasion.

Conservation Actions:

- Consider land acquisition, conservation easements, and leasing to conserve the most important tracts of spring habitat in the Mixed-grass Prairie Region.
- Encourage and facilitate programs that restore vegetation around springs and remove modifications such as small impoundments, especially those at the spring source.
- Encourage fencing springs to control access by livestock.
- Cooperate with other stakeholders to implement programs that control or stop introduction of exotic species such as Salt Cedar.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Easements obtained.
- Populations of spring/stream organisms.
- Protected springs/streams.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stream and spring flow.
- Water quality

Conservation Landscape: Mesquite Savannah or Shrublands

The relative condition of Mesquite Savannah or Shrublands habitat in the Mixed-grass Prairie Region is currently good with a stable trend. This community is sometimes treated as a variation of the Mixed-grass Prairie community with the addition of a Honey Mesquite (*Prosopsis glandulosa*) overstory. The Mesquite Savannah and Shrubland community occurs widely in roughly the southern third of the Mixed-grass Prairie Region, particularly on sites with clay soils. The historic abundance of Mesquite within this community is poorly unknown and heavily debated. Despite the range of opinions regarding the historic abundance of Mesquite, most biologists agree that Mesquite is more prevalent today than it was prior to European settlement. Additionally, Mesquite is typically viewed as a native species with invasive tendencies whose abundance was historically controlled by periodic prairie fires. The combined effects of widespread fire suppression and heavy grazing over the past century have contributed to recent increases in the amount of Mesquite cover.

Common grasses and forbs within this community include Blue Grama (*Bouteloua gracilis*), Buffalo Grass (*Buchloe dactyloides*), Sideoats Grama (*Bouteloua curtipendula*), Little Bluestem (*Schizachyrium scoparium*), Vine Mesquite (*Panicum obtusum*), and Pricklypear Cactus (*Opuntia sp.*), Soapweed Yucca (*Yucca glauca*), and Sneezeweed (*Helenium anarum*).

Recognized vegetation associations include:

Honey Mesquite – Blue Grama – Buffalo Grass Shrubland
Honey Mesquite – Lotebush Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Harris's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Mountain Lion	X							X
Mamm	Ringtail				X				X
Rept	Common Lesser Earless Lizard				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Diamond-backed Rattlesnake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Maintain databases (e.g., Natural Heritage Inventory) and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Fragmentation, including that caused by inheritance laws, reduces the quantity and quality of this habitat to support species of greatest conservation need.
4. Conversion of this habitat to cropland has the potential for detrimental impacts to species of greatest conservation need.
5. Heavy grazing can reduce the quantity and quality of this habitat.

Conservation Actions:

- Encourage and facilitate prescribed burning and controlled herbicide application.
- Consider conservation easements and land acquisition to conserve some of the most important tracts of this habitat in the Mixed-grass Prairie Region.

- Encourage and support inheritance legislation making it easier for landowners to pass large tracts to succeeding generations.
- Encourage and promote grazing practices which conserve this habitat.
- Encourage use of the Conservation Reserve Program by planting program acres to 100 percent native grasses and forbs.
- Encourage replanting of cropland, abandoned cropland and "improved" (e.g., Bermuda grass) pastures to Mixed-grass Prairie habitat using native grasses and forbs.
- Encourage grazing management by removal of interior fencing in pastures and use of patch burn technology, in conjunction with mineral blocks.

Conservation issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

6. Fire suppression and other conditions have made this habitat vulnerable to woody encroachment and invasive species.

Conservation Actions:

- Encourage and facilitate prescribed burning.
- Encourage and support formation of burn cooperatives, including legislative changes if necessary.

Conservation issue: Black-tailed Prairie Dog habitat related Issue:

7. There has been a reduction in the number and sizes of Black-tailed Prairie Dog towns.

Conservation Actions:

- Encourage programs that provide financial incentives for landowners who conserve Black-tailed Prairie Dogs.
- Develop and distribute information to landowners and others on several topics including grazing ecology, natural systems, and exotic invasive species.
- Encourage and support programs like the Landowner Incentive Program for the conservation of Black-tailed Prairie Dogs and other species of greatest conservation need.
- Encourage and support inheritance legislation to enable large ranches to remain in single family ownership.
- Encourage private land acquisition and conservation easements by land trusts and organizations such as The Nature Conservancy to protect and maintain this habitat type.
- Encourage and support increasing funding from the subsidy side of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Encourage and support ranch diversification for lower grazing and off set by lease hunting, fishing access, and ecotourism viewing.
- Encourage and participate in development and updating Best Management Practices for a variety of land management practices.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres enrolled in conservation programs.
- Acres of native plant communities restored.
- Numbers, size and distribution of Black-tailed Prairie Dog colonies.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Response of species to management practices such as burning, fencing, and grazing.

Conservation Landscape: Juniper Savannah or Woodlands

The relative condition of Juniper Savannah or Woodlands habitat in the Mixed-grass Prairie Region is currently good with an increasing trend. Two types of juniper woodlands occur in the Mixed-grassed Prairie Region of Oklahoma. Woodlands of Eastern Redcedar (*Juniperus virginiana*) are now common and distributed throughout the Region. Eastern Redcedar is a native juniper that has shown a dramatic increase in abundance across this Region over the past half century, most likely as a result of fire suppression or a combination of year-round grazing pressure coupled with fire suppression. As a result of its increasing abundance, many acres of Mixed-grass Prairie and Tallgrass Prairie have developed into juniper savannahs or woodlands. The increase in juniper abundance also has affected the structure of other habitat types including Sand Sagebrush Shrublands and Post Oak/Blackjack Oak Shrublands.

Much less common and more restricted-range juniper woodland occurs in the southwestern part of the Region. Here, woodlands dominated by Redberry or Pinchot Juniper (*Juniperus pinchotii*) are found on rugged, dissected hills in portions of Beckham, Greer, Harmon, and Jackson counties. It is likely that Redberry Juniper also has increased in abundance as a result of fire suppression but Redberry Juniper woodlands do not appear to have spread beyond their historic range and remain uncommon and local.

Recognized plant associations within this habitat type include:

Pinchot Juniper/Grama (Sideoats, Hairy) Woodland
Eastern Redcedar/Little Bluestem Woodland
Little Bluestem/Eastern Redcedar Prairie

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Barn Owl	X							X
Bird	Burrowing Owl		X						X
Bird	Cassin's Sparrow		X						X
Bird	Ferruginous Hawk	X							X
Bird	Golden-fronted Woodpecker	X							X
Bird	Harris's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Scaled Quail		X			X			
Inve	Outis Skipper	X							X
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Desert Shrew				X				X
Mamm	Ringtail				X				X
Mamm	Texas Kangaroo Rat	X							X
Mamm	Western Big-eared Bat	X							X
Rept	Common Lesser Earless Lizard				X				X
Rept	Texas Horned Lizard				X				X
Rept	Texas Long-nosed Snake				X				X
Rept	Western Diamond-backed Rattlesnake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field studies to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Maintain databases (e.g., Natural Heritage Inventory) and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to identify factors that limit population sizes, evaluate factors that may be responsible for population declines, and develop recommendations to enhance populations through improving habitat conditions.
- Develop methods to accurately identify and map the distribution and condition of this habitat to establish a baseline condition.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. School land property administration often overlooks opportunities for habitat conservation.
4. Herbicide applications sometimes reduce the quantity and quality of this habitat in the Mixed-grass Prairie Region.
5. Heavy grazing pressure can reduce the quantity and quality of this habitat.
6. Local sources of technical advice on agricultural matters sometimes lack current information.
7. Habitat fragmentation resulting from oil and gas development, tree rows/hardwood invasion, windbreaks, crop fields, power lines/utilities, and wind power development can reduce the suitability of this habitat for species of greatest conservation need.
8. Conversion of natural habitat to introduced pasture or cropland reduces its suitability for species of greatest conservation need.

Conservation Actions:

- Develop and distribute information to landowners and school land administrators on items such as grazing, fire, energy, and natural systems.
- Cooperate with the school land office to develop incentives and requirements for habitat maintenance on school lands.
- Encourage and promote programs that restore pasture and cropland to natural habitat.
- Distribute the most up to date information to technical assistance/extension staff.
- Encourage management of this habitat on road rights-of-ways.
- Cooperate with state Conservation Reserve Program technical committee to develop recommendations for increasing shrubs.
- Encourage modifying existing Conservation Reserve Program contracts to conserve this habitat and species of greatest conservation need.
- Cooperate with energy companies to minimize surface damages from oil, gas, and wind energy developments.
- Participate in the creation of a statewide mitigation plan for wind power development.
- Encourage and support programs that result in grazing management restoring native grass cover to this habitat.

Conservation issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

9. Fire suppression and other activities have resulted in an unnaturally high density of juniper and invasion of this habitat by Brown-headed Cowbirds.

Conservation Actions:

- Develop and distribute information to landowners and others on grazing, fire management, natural systems, and invasive species management.
- Encourage appropriate uses of prescribed fire in this habitat.
- Encourage and support formation of burn cooperatives.
- Encourage and facilitate the development of Brown-headed Cowbird management plans.

Potential indicators for monitoring the effectiveness of the conservation actions:

- GIS/remote sensing (e.g., numbers of acres and distributions).
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Potential partnerships to deliver conservation for Mixed-grass Prairie Region:

State Government

- Conservation Districts
- Oklahoma Biological Survey
- Oklahoma Commissioner of the Land Office
- Oklahoma Corporation Commission
- Oklahoma Department of Agriculture and Forestry Service
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Wildlife Conservation
- Oklahoma Energy Resources Board
- Oklahoma Legislature
- Oklahoma Renewable Energy Council
- Oklahoma State University, Cooperative Extension Service
- Oklahoma State University, Department of Forestry
- Oklahoma Water Resources Board
- Other state universities and departments
- Texas Parks and Wildlife

Federal Government

- Federal Energy Regulatory Commission
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Department of Agriculture, Farm Service Agency
- U.S. Department of Agriculture, Forest Service
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Agriculture, Resource Conservation and Development Councils
- U.S. Department of Defense
- U.S. Department of the Interior, Bureau of Land Management
- U.S. Department of Agriculture, Forest Service, Black Kettle National Grasslands
- U.S. Fish and Wildlife Service – refuges division
- U.S. Fish and Wildlife Service - High Plains Initiative
- U.S. Geological Survey

Local Government

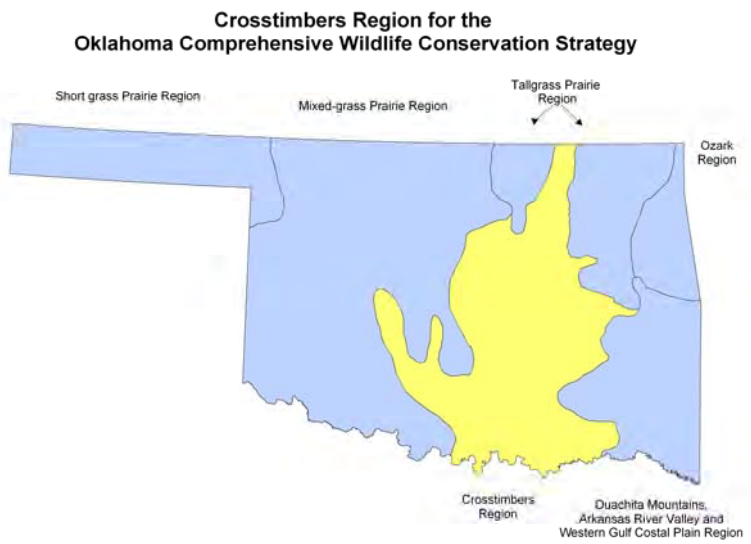
- Municipalities
- Tribal governments

Businesses, Citizens and Citizen Groups

- Locak Audubon Chapters and Birding Clubs
- Chambers of Commerce
- Ducks Unlimited and local Oklahoma chapters
- Electric Utilities
- Farm Bureau
- Farm organizations
- Farmers Union
- Individual farmers and ranchers
- National and Oklahoma Wind Power Initiative
- National Rivers Society
- National Wild Turkey Federation and local Oklahoma chapters
- North American Grouse Partnership
- Northwest Range Fire Management Association
- Off-road vehicle clubs/associations/dealers

- Oklahoma Anglers United
- Oklahoma Cattlemen's Association
- Oklahoma Native Plant Society
- Oklahoma Section of the Society for Range Management
- Oklahoma Western Prairie Heritage Alliance
- Playa Lakes Joint Venture
- Private landowners
- Producer Cooperatives
- Quail Unlimited and local Oklahoma chapters
- Small Woodland Owner's Association
- Tallgrass Prairie Alliance
- Texas Prairie Rivers, Inc.
- The Nature Conservancy
- The Wildlife Society
- Urban development groups
- Western Governor's Association
- Wind energy groups

Crosstimbers Region



This region encompasses a mosaic of oak woodlands and tallgrass prairies in roughly the central one-third of Oklahoma. All or portions of the following counties are part of Cross Timbers Region: Kay, Noble, Pawnee, Payne, Logan, Lincoln, Oklahoma, Cleveland, McClain, Grady, Caddo, Stephens, Jefferson, Garvin, Murray, Carter, Love, Marshall, Johnston, Pontotoc, Coal, Atoka, Bryan, Choctaw, Pittsburg, McIntosh, Hughes, Seminole, Pottawatomie, Okfuskee, Creek, Okmulgee, Tulsa, and Osage. In Bailey's ecological classification system, the Crosstimbers Region is equivalent to the combination of the Crosstimbers and Prairies Section and the Blackland Prairies Seciton. In Omernick's classifcation system, it is equivalent to the Oklahoma/Texas Plains Ecoregion.

The Crosstimbers Region is a complex mosaic of upland deciduous forest, savanna, and prairie communities that highlight the broad ecotone between the eastern forests and the grasslands of the Great Plains (Hoagland et.al. 1999). The Crosstimbers are dominated by Post Oak and Blackjack Oak. It extends from central Texas, across eastern Oklahoma, and into southeastern Kansas. The presettlement Crosstimbers may have covered nearly 20 million acres and consisted largely of low-stature oaks that were not suited for lumber production. The Crosstimbers may be the least disturbed forest ecosystem that survives in the eastern United States.

According to Duck and Fletcher (1945)[1], the Crosstimbers represent the largest single ecosystem type in the state of Oklahoma. Eastern Oklahoma, north central Texas, and southeastern Kansas contain some of the most extensive tracts of ancient woodland in the eastern United States. Most of these remnant woodlands are found in fragmented tracts from 40 to 1,000 acres in size along cliffs and rocky uplands. But, several areas are identified where ancient Crosstimbers are still present over thousands of contiguous acres and literally dominate the landscape. These ancient oak-dominated woodlands provide vital natural habitat in an increasingly human-dominated landscape and are becoming increasingly fragmented, but the remnants provide vital habitat for Neotropical migrant birds and other native flora and fauna.

Ecologically distinct lines do not exist between the Crosstimbers Region and the adjacent Mixed-grass Prairie and Tallgrass Prairie regions. Therefore, areas of overlap occur where patches of mixed-grass prairie habitat are embedded within oak woodlands and patches of oak woodland or

[1] Duck, L. G. and J. B. Fletcher. 1945. A survey of the game and furbearing animals of Oklahoma. Div. Wildl. Restor. and Res., Oklahoma Game and Fish Comm., Pitman-Robertson Ser. No. 2, State Bull. No. 3. Oklahoma City.

shrubland are embedded within mixed-grass and tallgrass prairie habitats. Tallgrass prairies occur throughout the region and comprise most of the region's historic grassland acres. Mixed-grass prairie habitat is more limited and occurs along the western edge of the region and the Arbuckle Uplift.

The best professional judgment of the advisory group and technical experts was used to identify each Conservation Landscape's status and trend. And, even though some issues and actions apply to multiple Regions, each Region chapter is designed to stand-alone.

Conservation Landscapes listed in general priority order:

- Very High priority Conservation Landscapes:
  - Small River
  - Large River
- High priority Conservation Landscapes:
  - Oak and Hickory Bottomland Hardwood Forest
  - Post Oak/Blackjack Oak/Hickory Woodland and Forest
  - Tallgrass Prairie
  - Small Gravel (hard)-bottom Streams and Associated Riparian Forest
  - Herbaceous Wetlands
  - Sandstone Canyonlands and Post Oak and Blackjack Oak Shrubland
- Moderate priority Conservation Landscapes:
  - Small Sandy (soft)-bottom Streams and Associated Riparian Forest
  - Mixed-grass Prairie
  - Limestone Cave
  - Springs

Conservation Landscape: Small River

Relative condition of Small River habitat is currently poor with a declining trend. Small Rivers within the Crosstimbers Region include all or a portion of four tributaries to the Red River (the Washita, Blue, Clear Boggy, and Muddy Boggy Rivers) and two tributaries within the Arkansas River system (the Little and Deep Fork Rivers). The water conditions and aquatic species compositions of these small rivers are variable but each river differs from the Large River habitats in having more moderate seasonal flow fluctuations and lacking the dynamic mosaic of ephemeral disturbance-maintained habitats such as sandbars, mudflats, scoured bends, and sandbar willow thickets. Each of these is a low-gradient river that meanders through a broad predominately forested floodplain.

The Blue and Clear Boggy Rivers originate within the rocky Arbuckle Uplift. The upper portions of these rivers are clear and swiftly flowing over gravel or cobble substrate. The lower portions of these rivers are more similar to the Washita, Muddy Boggy, Little and Deep Fork Rivers which are turbid slow-moving rivers with silty to sandy substrates that meander across relatively broad floodplains. Flow rates are generally greater during the winter and spring months and lower during the summer and fall, however the seasonal variation is less than that which is seen on the five large rivers.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Whooping Crane	X						X	
Fish	Alligator Gar	X				X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Fish	Blue River pop. of Least Darter	X				X			
Fish	Blue Sucker	X							X
Fish	Bluntface Shiner	X							X
Fish	Crystal Darter	X							X
Fish	Kiamichi Shiner	X				X			
Fish	Paddlefish		X				X		
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Fish	Red River Shiner			X			X		
Fish	Redspot Chub		X				X		
Fish	Rocky Shiner		X						X
Fish	Taillight Shiner	X							X
Fish	Western Sand Darter	X							X
Inve	Bleufer			X			X		
Inve	Butterfly Mussel		X			X			
Inve	Faxonella blairi				X				X
Inve	Little Dubiraphian Riffle Beetle				X				X
Inve	Little Spectaclecase			X			X		
Inve	Monkeyface Mussel			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Creekshell	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Plain Pocketbook		X			X			
Inve	Texas Lilliput	X							X
Inve	Threeridge Mussel			X			X		
Inve	Wartyback Mussel		X				X		
Inve	Washboard			X			X		
Inve	Winged Mapleleaf	X				X			
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.
3. Incomplete resource and management monitoring.
4. Commercial mussel harvest and management data are incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify the validity of existing data and assumptions.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct inventories and habitat surveys on all streams.
- Conduct genetic studies to assess gene flow among populations of aquatic animals.
- Conduct studies of spawning habitat.
- Conduct studies of invertebrates in all streams.
- Increase knowledge, capacity, and capability about stream restoration and stream management actions.
- Develop an accurate assessment and description of what small river habitat used to look like so that this can be used as a conservation target condition.
- Monitor response of wildlife populations to land management practices.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

5. Aquifer pumping and water withdrawals have altered natural flow regimes.
6. Impoundments have altered natural flow regimes (e.g., channelization changes the ecology of river systems).

Conservation Actions:

- Study in-stream flow requirement for ecology, fish, wildlife, and recreation.
- Support the designation of the Blue River as Wild and Scenic.
- Encourage water conservation.
- Encourage and support the development of a state water plan and municipal water plans.
- Research and get involved with existing recharge rate studies to determine sustainability of aquifers and springs affecting wildlife and fish.
- Support the management oversight of potential problem aquifers.
- Support studies of recycling gray water for irrigation.
- Research and make a policy decision about lake water being pumped into aquifers.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

7. Pollution of the water.
8. Degradation of riparian areas.
9. Sedimentation changes stream flow regimes.
10. Addition of nutrients via fertilizers and livestock waste in storm water runoff.
11. Endocrine disruptors related to agricultural runoff/discharge (e.g., poultry, cattle, and use on plants).

Conservation Actions:

- Develop better understanding of effects water quality, riparian degradation, in-stream flow, and endocrine disruptors.
- Enforce water quality standards.
- Use regional workshops to educate landowners with stream problems (e.g., spraying and stream management).
- Encourage riparian buffers in Conservation Reserve Program.
- Increase water quality monitoring.
- Study the response of wildlife populations to various land management practices and use this information to recommend improved management practices.

Conservation Issue: Habitat loss and fragmentation from geomorphic alteration and instability of river channels:

12. Geomorphic instability including degradation of riparian areas, inappropriate management of watersheds, sedimentation, alternate flow regimes, and decreasing spawning habitat management.

Conservation Actions:

- Mitigate unnatural flows regimes on streams.
- Encourage private landowners to protect uplands and reduce runoff.
- Explore the U.S. Environmental Protection Agency's Watershed Restoration Programs and encourage a pilot project.
- Assist landowners to get grants to reduce runoff.
- Restore stream channels and riparian areas.
- Oklahoma Department of Wildlife Conservation should extend the stream program statewide.
- Small road crossings and un-engineered stream crossings should be reconstructed.

Conservation Issue: Habitat loss and fragmentation from land management practices:

13. Erosion and runoff from cities and agricultural fields increase sediment transport and create problems for certain fish and invertebrates.
14. Grazing and vegetation degradation increase erosion and sedimentation.
15. Gravel mining alters the ecology of river systems.

Conservation Actions:

- Encourage programs and activities which restore river channel morphology.
- Encourage and support programs to improve water quality and flows below reservoirs.
- Encourage and support congressional reprioritizing of the U.S. Army Corps of Engineers projects to include fish, wildlife, and recreation as beneficial uses.
- Cooperate with the U.S. Army Corps of Engineers to establish more natural alternative flow patterns.
- Encourage and support legislation to establish minimum in-stream flow provisions.
- Encourage and support pollution abatement efforts.
- Encourage and support landowners and others efforts to create and maintain riparian buffer zones.

- Develop and distribute information to landowners and others concerning the value of water, grazing management, crop selection, fire management, energy development, natural systems, and invasive species.
- Encourage replacement of stock ponds with alternative water sources.
- Encourage and support programs that protect riparian areas from grazing.
- Encourage and support increased use of Farm Bill incentives.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Degraded and restored river miles of habitat.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of landowners participating in conservation practices.
- Number of new local conservation groups or watershed groups.
- Populations and trends of species of greatest conservation need.
- Pubic opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).

Conservation Landscape: Large River

Relative condition of Large River habitat in the Crosstimbers Region is currently poor with a declining trend. Portions of five large rivers pass through the Crosstimbers Region (the Arkansas, Cimarron, North Canadian, Canadian and Red Rivers). Each of these rivers has a seasonal period of high flow during the spring months followed by a period of much lower flow during the summer months. This seasonal fluctuation in water volume maintains a dynamic mosaic of ephemeral habitats such as sandbars, mudflats, sandbar willow thickets, and marshy sloughs along and within river channels that depend upon periodic scouring flows. For purposes of this Strategy, we consider the Large River habitat to be comprised of the river channel and these smaller ephemeral habitats that are tied to flooding and scouring flows. This mosaic of smaller habitats within the system supports a diversity of species of conservation need including the Least Tern (*Sterna antillarum*) on sandbars, shorebirds and wading birds on mudflats, Arkansas River and Red River Shiners in shallow braided channels, Bell's Vireos in willow thickets, and Alligator Gar in deep channels and pools.

The Arkansas, Cimarron, North Canadian, and Canadian Rivers are all connected as part of the Arkansas River watershed. The Red River, which forms the southern boundary of the Region, is a separate watershed and supports a distinctly different community of fish and mussels including the Red River Shiner (*Notropis bairdi*) and Chub Shiner (*Notropis potteri*). Each of the Regions large rivers has been modified to some extent by the construction of reservoirs on their main stems, flood control impoundments on their tributaries, and water withdrawals. These modifications have altered the historic fluctuation in flow rates and the magnitude of flood events and have thus affected the abundance and condition of ephemeral habitats such as sandbars, mud flats, and willow thickets associated with the rivers, and the movement of fish populations within the rivers.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Bald Eagle	X						X	
Bird	Bell's Vireo		X			X			
Bird	Canvasback	X							X
Bird	Hudsonian Godwit				X				X
Bird	Interior Least Tern	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Piping Plover	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Snowy Egret								
Bird	Snowy Plover	X							X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Western Sandpiper	X							X
Bird	Whooping Crane	X						X	
Bird	Wilson's Phalarope				X				X
Fish	Alligator Gar	X				X			
Fish	Arkansas River Shiner	X				X			
Fish	Blue Sucker	X							X
Fish	Chub Shiner				X				X
Fish	Paddlefish		X				X		
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Fish	Red River Pupfish			X			X		
Fish	Red River Shiner			X			X		
Fish	Shovelnose Sturgeon	X							X
Fish	Western Sand Darter	X							X
Inve	Bleufer			X			X		
Inve	Monkeyface Mussel			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Plain Pocketbook		X			X			
Inve	Threeridge Mussel			X			X		
Inve	Washboard			X			X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	River Otter		X					X	
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.
3. Incomplete biological resource monitoring.
4. Incomplete knowledge regarding the habitat needs and management responses of species of greatest conservation need.
5. Incomplete of knowledge about the response of species of greatest conservation need to management.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Research the presettlement river status of Oklahoma rivers.
- Support the sharing of information about the habitat needs of species of greatest conservation need between researchers and water management agencies such as the U.S. Army Corps of Engineers.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

6. Clearing of riparian zone negatively affects the habitat for species of greatest conservation need.
7. Dredging and sand mining alter water quality, quantity, and channel maintenance.
8. Flood control management alters water quality, quantity, and channel maintenance.
9. Reservoir management plans do not adequately protect species of greatest conservation need in the reservoirs and downstream.
10. There are no established minimum in-stream flows below reservoirs.
11. Sandbars, which are important to some species of greatest conservation need, have diminished due to reduction in flooding/scouring flows due to reservoir construction and operation.

Conservation Actions:

- Land acquisition (e.g., conservation easements and leases) to protect headwaters.
- Modify management of reservoirs to protect species of greatest conservation need.
- Alter or remove structures that block the passage of fish and or alter the presettlement pattern of water flow and flooding.
- Encourage the public to work with the U.S. Army Corps of Engineers authority to establish more natural flow patterns.
- Raise the importance of recreation and alternative flow patterns.

- Support Congressional reprioritizing of the projects to include fish, wildlife, and recreation as beneficial uses.
- Cost share with U.S. Army Corps of Engineers for priority actions.
- Promote a better working relationship with the U.S. Army Corps of Engineers in economic, social, and political arenas.
- Research the applicability and use of e-SWIM model (Ecologically Sustainable Water Impoundment Management).
- Research the use of mitigation to fund and support fish and wildlife protection and management from hydropower projects and U.S. Army Corps of Engineers impoundment project agreements.
- Change the scope of hydropower and similar projects through legislation.
- Research ways to discourage building in the floodplain (e.g., look for tax incentives).
- Encourage the U.S. Army Corps of Engineers to reevaluate the flood risks for Oklahoma rivers and streams.
- Research alternative methods of flood control such as levee removal and floodplain mitigation as wetland banks.
- Identify spawning areas potentially impacted by dredging.
- Implement mitigation and reimbursement for fish losses to dam entrainment and stranding due to quickly dropping water.
- Standardize the water requirements below dams.
- Improve water quality requirements around dams.

Conservation Issue: Water quality changes that negatively affect both habitat and species of greatest conservation need:

12. Water quality issues (e.g., herbicides, nitrates, metals, oil, and pollution).
13. Grazing (i.e., degradation of river banks by trampling and grazing of cattle).

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) by providing better cost-sharing, more acceptable landowner incentives to reduce inputs, and other Best Management Practices in the watershed.
- Study the cumulative effects of development and runoff to develop recommendations for management options.
- Land acquisition (e.g., conservation easements and leases) to protect headwaters.
- Provide alternative water sources for livestock to get them out of the river.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

14. Invasive species such as Salt Cedar and non-native fishes negatively impact species of greatest conservation need.
15. Inter-basin introductions of aquatic species (e.g., accidental introduction of Red River Pupfish from the Red River system to the Canadian River) have negative effects on species of greatest conservation need.

Conservation Actions:

- Increase public education about the potential problems with accidental releases of bait fish into rivers.
- Develop exotic and invasive species management plans.

Conservation Issue: Commercial harvest practices that negatively affect species of greatest conservation need:

16. Commercial harvest of minnows and mussels may affect the sustainability of species of greatest conservation need.

Conservation Actions:

- Study the effects of commercial harvest on species of greatest conservation need.
- Conduct management pilot studies to determine successful management strategies.

Conservation Issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

17. Increased recreational use of rivers and river beds by off-road and all terrain vehicles.

Conservation Actions:

- Understand the effects of recreation on species of greatest conservation need life requirements, habitat, and water quality and water hydrology.
- Conduct management pilot studies to determine successful management strategies.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Degraded and restored stream miles of habitat.
- Populations and trends of indicator species and endangered or threatened species.
- Numbers of new local conservation groups.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of landowners participating in conservation practices.
- Populations and trends of fish and wildlife species (i.e., species of greatest conservation need).
- Pubic opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- U.S. Geological Survey gauging station for natural flow regimes.
- Water quality parameters.

Conservation Landscape: Oak and Hickory Bottomland Hardwood Forest

Relative condition of Oak and Hickory Bottomland Hardwood Forest habitat is currently poor with a declining trend. Bottomland Hardwood forests are found in the floodplains of the larger streams and small rivers throughout the Crosstimbers Region. Between 80,000 and 100,000 acres of bottomland hardwood forest are thought to remain in the Region and the largest tracts occur along the Deep Fork, Little, Clear Boggy and Muddy Boggy Rivers (Brabander et al. 1985)[2]. Over the past century, much of the former bottomland hardwood forests in the Region has been converted to agricultural land uses (e.g., crop fields or pasture) or permanently inundated by the construction of reservoirs. Bottomland hardwood forests are diverse plant communities and the composition of individual stands varies with soil conditions and the frequency and duration of seasonal flooding. Bottomland hardwood forests in this Region are dominated by oaks and hickories including Bur Oak (*Quercus macrocarpa*), Shumard Oak (*Quercus shumardii*), Chinkapin Oak (*Quercus muehlenbergii*), Pecan (*Carya illinoiensis*), and Black Walnut (*Juglans nigra*). In the Red River watershed in the southern portion of the Region, Water Oak (*Quercus nigra*) and Bitternut Hickory (*Carya cordiformis*) are common bottomland forest trees. The canopy trees include Red Elm (*Ulmus rubra*), White Ash (*Fraxinus americana*), Green Ash (*Fraxinus pennsylvanica*), and Sugarberry (*Celtis laevigata*). Common understory vegetation includes Green Hawthorn (*Crataegus viridis*), Deciduous Holly (*Ilex decidua*), and Red Mulberry (*Morus rubra*). An unusual and unique bottomland association occurs in some of the deep canyons in Caddo County where an isolated population of Sugar Maples (*Acer saccharum*) is found growing with Shumard and Chinkapin Oaks.

Recognized plant associations within this habitat type include:

Bur Oak – Shumard Oak – Bitternut Hickory Temporarily Flooded Forest
Pecan – Sugarberry Temporarily Flooded Forest
Water Oak – Red Elm – Shumard Oak Temporarily Flooded Forest
Sugar Maple – Red Elm – Black Walnut Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X

[2] Brabander, J.J., R.E. Masters, and R.M. Short. 1985. Bottomland Hardwoods of Eastern Oklahoma: A Special Study of Their Status, Trends and Values. Joint Report of the U.S. Fish and Wildlife Service and the Oklahoma Department of Wildlife Conservation. 167 pages.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bell's Vireo		X			X			
Bird	Harris's Sparrow		X						X
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Rusty Blackbird	X							X
Bird	Solitary Sandpiper	X							X
Bird	Wood Thrush	X							X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Eastern Harvest Mouse				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Marsh Rice Rat				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Scarletsnake				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

3. Knowledge of bottomland hardwood forest habitat is incomplete.

Conservation Actions:

- Conduct research, using best professional judgment need to determine why species of greatest conservation need are low and/or declining and determine management strategies.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Inventory all bottomland hardwoods remaining and their status and trend.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop a monitoring program to track habitat condition.
- Collect information regarding wildlife abundance and density in order to translate acres of habitat changed into wildlife population changed.

Conservation Issue: Habitat loss and fragmentation from land management practices:

4. Conversion of bottomland forest to pasture or crop may be detrimental to species of greatest conservation need.
5. Inappropriate herbicide use may cause damage to species of greatest conservation need.
6. Fragmentation of forest tracts can be due to creation of pastures, croplands, roads, homes, utility line right of ways, natural gas wells, and pipelines. Species that rely on unbroken tracts are susceptible to this trend.
7. Loss of temporary wetlands due to the draining of wetlands, reduction of flooding that maintains the hydrology for these wetlands or the filling of wetland by direct human action or increased siltation of wetlands within this habitat that serve as breeding areas for amphibians and foraging areas for waterfowl, shorebirds, herons, and species of greatest conservation need.
8. Many bottomland hardwood forest stands were clear-cut in the early 1990s for wood, creating unnatural stand ages/structures. The regrowth forests that developed after logging and widespread clear cutting tend to be dense even-aged stands with poor structural diversity, often having dense midstories and poorly developed understory vegetation.

Conservation Actions:

- Design landowner incentives to encourage the retention of riparian hardwood trees.
- Educate landowners about watershed concept, importance of riparian habitat, Best Management Practices, and existing Farm Bill type programs.
- Add Wildlife Habitat Improvement Program funding mechanism for restoration to Natural Resources Conservation Service conservation programs.
- Develop a Conservation Reserve type program for bottomland hardwoods.
- Place existing bottomland hardwood forests into conservation ownership through land acquisition or conservation easement by natural resource management agencies or private conservation organizations.
- Restore crop fields and pastures in floodplains back to bottomland hardwood forest habitat through cost sharing, easements, and acquisition.
- Explore economic alternatives to clearing and grazing bottomland hardwoods (e.g., support the development of hunting leases as a revenue source for landowners).
- Acquire fee title ownership or conservation easements on existing bottomland hardwood forest habitat that can be preserved or crop fields and pastures that can be restored to bottomland hardwood forest. Conservation of existing mature forest

habitat should be a higher priority than restoration because of the long time frame and uncertainty associated with restoring this habitat type.

- Reduce inappropriate aerial spraying of bottomland hardwoods through regulations, conservation easements, or landowner education of the water quality impacts.
- Enforce existing laws for application in aquatic habitats.
- Encourage and support hunting cooperatives in corridors and blocks.
- Use the wide range of programs (e.g., Wetlands Reserve Program and Natural Resources Conservation Service) to connect habitats for wildlife.
- Use private landowner assistance programs such as U.S. Fish and Wildlife Service Partners for Wildlife and Landowner Incentive Program to provide cost-share funding to private landowners to restore hydrology through the construction of small dams and dikes to seasonally flood bottomlands.
- Study the "corridor concept" to see if this strategy addresses fragmentation issues.
- Craft laws that complete the protection of remaining wetlands.
- Construct vernal pools or similar small wetlands within bottomland forest sites.
- Encourage and support the development of a state water plan and a state wetlands plan.
- Eliminate federal funding assistance for clearing forests and establishing introduced grasses.
- Develop Best Management Practices for logging bottomland hardwoods that encourage structural diversity and retain understory vegetation.
- Promulgate legislation that requires the use of Best Management Practices for logging.
- Encourage the protection of private forest land through conservation easement programs and information/education programs.
- Use thinning or selective tree removal to increase structural diversity within forest stands and increase understory vegetation.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

9. The construction of reservoirs permanently inundates bottomland hardwood forests resulting in a direct loss of acreage, and altering the hydrology of the bottomland hardwood habitat downstream of the reservoir by reducing of the natural flooding frequency and pattern.
10. Altered flooding regimes occur as a result of the construction of impoundments and/or the channelization of streams, causing dramatic disconnection between the riparian forests, bottomland forests, and their streams due to the channelization and incision of streams which leads to a lowering of the shallow water table and a reduction in periodic flooding or soil saturation in the bottomland forest zone.

Conservation Actions:

- Modify reservoir management to allow periodic flooding of bottomland hardwood tracts below dams.
- Remove structures that block the movement of fish or prevent natural flooding regimes.
- Remove cost-share programs that encourage the construction of ponds and lakes on perennial streams.
- Develop incentives for the restoration of stream channels and bottomland forest habitat.
- Seek acquisition and easements of existing habitats to protect bottom hardwood forest.
- Use mitigation funds to acquire existing bottomland hardwood forests and to protect them from future development (e.g., urban development, agricultural development, and future reservoir construction).
- Support the development of a state water plan or state wetland plan.

- Support water conservation education to decrease the needs for reservoirs.
- Work with the U.S. Army Corps of Engineers within their authority to restore bottom hardwood forest under their management.
- Provide the results of ecological studies to land and water use planners and encourage the incorporation of them into state and local management plans.
- Restore stream channel structure to reconnect streams with their riparian zones.
- Use private landowner assistance programs such as U.S. Fish and Wildlife Service Partners for Wildlife and Landowner Incentive Program to provide cost-share funding to private landowners to restore hydrology through the construction of small dams and dikes to seasonally flood bottomlands.
- Remove flood control structures that are no longer needed.
- Research alternative flood control methods used in different places in the country (e.g., flood other areas, restore or plant new bottomlands inside existing levees, or create wetland mitigation sites/ banks).
- Use the Wildlife Habitat Improvement Program as a funding mechanism for restoration.
- Restore hydrology and natural standing water to bottomland hardwood habitat.
- Reconnect bottomland hardwoods with the river/stream system along which they developed.
- Manage for the natural hydro period through restoration of the natural meanders of streams and historic flooding patterns.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

11. Several species of non-native plants and animals (e.g., Japanese Honeysuckle, Autumn Olive, Chinese Privet, feral hogs) have become established within bottomland hardwood forest habitat and now compete with native species for food, water, and space.

Conservation Actions:

- Develop control or management programs for invasive and exotic species.
- Provide cost-share programs to control exotic vegetation (e.g., privet, honeysuckle).
- Monitor populations of invasive species in the bottomland hardwoods.
- Develop and implement exotic and invasive species management plans.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Forest stand health and composition structure.
- Forests converted to pasture or cropland (e.g., Natural Resources Conservation Service records).
- Number or percentage of acres acquired or placed into conservation programs (e.g., incentive programs).
- Percent of available habitat in conservation programs (e.g., measure net gain or loss of habitat).
- Relative condition (populations/trends) and distribution changes of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Post Oak/Blackjack Oak/Hickory Woodland and Forest

Relative condition of Post Oak/Blackjack Oak/Hickory Woodland and Forest habitat is currently good with a stable trend. Dry woodlands, known locally as Crosstimbers, historically covered over 2 million acres of the Crosstimbers Region. The Crosstimbers were a diverse mosaic of oak savannahs, oak/hickory woodlands and oak/hickory forests that varied geographically depending upon soil, rainfall, and fire history. The dominant tree species in this habitat are the Post Oak (*Quercus stellata*) and Blackjack Oak (*Quercus marilandica*) and these two oaks may comprise as much as 90 percent of the canopy cover. Other common trees include Black Hickory (*Carya texana*), Black Oak (*Quercus velutina*) and Eastern Redcedar (*Juniperus virginiana*). Black Hickory and Black Oak are more common in the more mesic sites in the eastern part of the Region. Eastern Redcedar is common throughout the Region and has increased in abundance during the past century as a result of the reduction of periodic fires. Prominent understory plants include Chinkapin Oak (*Quercus muehlenbergii*), Chittamwood (*Bumelia lanuginosa*), Eastern Redbud (*Cercis canadensis*), Roughleaf Dogwood (*Cornus drummondii*), Mexican Plum (*Prunus mexicana*), and Winged Sumac (*Rhus copallina*). In the eastern portion of the Region, Winged Elm (*Ulmus alata*) is a common understory tree. In sites that are drier and/or have a higher frequency of fire, the Crosstimbers has a more woodland or savannah-like structure. These areas typically have a grassy understory dominated by Little Bluestem (*Schizachyrium scoparium*) but also with Indian Grass (*Sorghastrum nutans*), Big Bluestem (*Andropogon gerardii*), and Small Panicgrass (*Panicum oligosanthes*). On rocky limestone soils in the Arbuckle Mountains, Texas Oak (*Quercus shumardii texana*), Chinkapin Oak (*Quercus muehlenbergii*), Ashe Juniper (*Juniperus ashei*), and Texas Ash (*Fraxinus texensis*) are common associates with Post Oak and Blackjack Oak.

The Crosstimbers Woodland is one of the most widespread and abundant native habitat types in the Crosstimbers Region, however many acres have been converted to pasture. Much of the remaining Crosstimbers habitat has a more forest-like structure than it did historically as a result of fire suppression that has allowed for increased survival and density of young oaks as well as the dramatic increase in abundance of Eastern Redcedar

Recognized vegetation associations in this habitat type include:

- Chinquapin Oak – Shumard Oak Forest
- Texas Oak – Texas Ash – Chinquapin Oak Forest
- Post Oak – Blackjack Oak – Black Hickory Forest
- Post Oak – Shumard Oak – Bitternut Hickory Forest
- Post Oak – Winged Elm Forest
- Post Oak – Eastern Redcedar Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Bell's Vireo		X			X			
Bird	Black-capped Vireo	X				X			
Bird	Harris's Sparrow		X						X
Bird	Kentucky Warbler		X						X
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Inve	American Burying Beetle		X						X
Inve	Byssus Skipper	X							X
Inve	Prairie Mole Cricket	X				X			
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Ringtail				X				X
Rept	Northern Scarletsnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Diamond-backed Rattlesnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Support economic studies and models about the costs of fragmentation.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Fragmentation of woodland tracts by urbanization, conversion to tame pastureland, road construction, and utility/pipeline right of ways.
4. Loss of the natural fire regime that has increased the density of some woodland stands relative to their historic condition.
5. Loss of native understory vegetation, due in part to a combination of dense canopies, grazing by cattle, and introduced forbs.
6. Herbicide treatment of oak woodlands to convert this habitat type to pasture.
7. Oil and gas exploration and development results in increased numbers of roads, increased erosion around well sites, increased potential for oil or saltwater spills, and causes other reductions in quantity and quality of this habitat.

Conservation Actions:

- Establish demonstration areas where landowners can see the results of management practices.
- Identify focus areas to get the most value for the dollar.
- Restore woodlands community structure on public lands.
- Acquire easements to prevent development of important habitat.
- Conduct ecological and economic studies to quantify the costs of fragmentation.
- Reinvigorate fire management as a management technique.
- Help non-profit organizations disseminate information to landowners.
- Encourage the development of burning cooperatives or contractors (e.g., Native American tribes).
- Help write prescribed burn laws to reduce liability and provide a right to burn.
- Support burn crews by making it affordable to landowners, reducing liability, and reducing heavy equipment costs.
- Prepare for and address the air quality issues associated with fires.
- Help encourage overgrazing education about Best Management Practices for landowners.
- Study how to overcome overgrazing that facilitates the spread of Eastern Redcedar.
- Monitor response of wildlife populations to various land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Support more outreach to industry and landowners.
- Help encourage herbicide use education and Best Management Practices.
- Provide incentives to use Best Management Practices.
- Create an incentive program to restore habitat.
- Eliminate federal funding assistance for clearing forests and establishing introduced grasses.
- Acquire land fee title where appropriate and with willing sellers.
- Assist the industry to minimize the impacts of roads.
- Help find funds to clean up abandoned sites.
- Support research of new and less expensive cleanup methods.
- Encourage more remediation of abandon sites.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

8. Invasive species create problems for agriculture and species of greatest conservation need.

Conservation Actions:

- Monitor response of wildlife populations to various land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Increase cost share on invasive species control for private landowners.

- Encourage the invasive species task force's research for controls.
- Conduct management pilot studies to determine successful strategies.
- Support tax credits for invasive species control.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres protected, acquired, and restored.
- Amount of technical assistance being provided.
- Landowners participating in landowner incentive programs.
- Population response of species of greatest conservation need and the vegetation (e.g., grasses and woody plants) response to fire.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Use of fire on the landscape (e.g., number of acres burned).
- Wildlife population response to management.

Conservation Landscape: Tallgrass Prairie

Relative condition of Tallgrass Prairie habitat is currently poor with a declining trend. Tallgrass Prairies are herbaceous plant communities dominated by four common, Tall Grass species: Big Bluestem (*Andropogon gerardi*), Indian Grass (*Sorghastrum nutans*), Switchgrass (*Panicum virgatum*), and Little Bluestem (*Schizachyrium scoparium*). This is a widespread habitat in the Crosstimbers Region and is found on a variety of deep, fine textured silt, and clay soil types. The structure of this habitat type is maintained by frequent, naturally occurring fires that limit the growth of woody plant species and favor grasses and some forbs. All four of the dominant grass species are present in most Tallgrass Prairie sites, however Big Bluestem and Indian Grass tend to be most prevalent in mesic sites, while Big Bluestem and Little Bluestem are most common on drier sites. In mesic loamy soils such as those found in floodplains and bottomlands, Switchgrass and Big Bluestem are often the dominant grasses. Other widespread or common grasses include Prairie Dropseed (*Sporobolus hetrolepis*), Sideoats Grama (*Bouteloua curttipendula*), and Eastern Gamagrass (*Tripsacum dactyloides*). Common forbs include Western Ragweed (*Ambrosia psilostachya*), Rosinweed (*Silphium integrifolium*), Compass Plant (*Silphium laciniatum*), Lead Plant (*Amorpha canescens*), Wild Alfalfa/Scurf Pea (*Psoralea tenuifolia*), Illinois Bundleflower (*Desmanthus illinoensis*), Blazing Star (*Liatris sp.*), Goldenrod (*Solidago sp.*), Roundhead Lespedeza (*Lespedeza capitata*), Indian Paintbrush (*Castillega coccinea*), and Maximillian Sunflower (*Helianthus maximilliani*).

In the Red River valley, pockets of dark alkaline soils over limestone parent material support a rare and locally occurring variation of Tallgrass Prairie known as Blackland Prairies. This southern Tallgrass Prairie community is comprised of Indian Grass, Eastern Gamagrass, Big Bluestem, Tall Dropseed, Longspike Tridens (*Tridens scrictus*), Maximillian Sunflower (*Helianthus maximilliani*), Ashy Sunflower (*Helianthus mollis*), and Rattlesnake Master (*Eryngium yuccifolium*). The distribution of Blackland Prairies in Oklahoma is poorly known.

Though Tallgrass Prairie remains a fairly common and widespread habitat type in the Region, much of the habitat has been tilled and converted to introduced pastures planted to Bermuda grass and other non-native grasses. Further habitat has been converted to cropland for the production of wheat, alfalfa, cotton, or peanuts. The extent of the remaining prairies is unknown but most tracts of native prairie appear to be scattered and relatively small. Where prairie habitat remains, decades of continuous grazing, fire suppression, and encroachment of non-native plants has resulted in changes in to the plant community composition and structure. These changes include a greater abundance of Eastern Redcedar and other woody plants, increased abundance of exotic grasses, and decreased abundance of native forbs.

Recognized plant associations within this habitat include:

Big Bluestem – Switchgrass Grassland
Big Bluestem – Little Bluestem – Indian Grass Grassland
Switchgrass – Eastern Gamagrass – Indian Grass – Maximillian Sunflower Grassland
Little Bluestem – Indian Grass Grassland
Little Bluestem – Big Bluestem Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Burrowing Owl	X							X
Bird	Greater Prairie Chicken	X				X			
Bird	Harris's Sparrow		X						X
Bird	Henslow's Sparrow	X							X
Bird	LeConte's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Falcon	X							X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		
Inve	American Burying Beetle		X						X
Inve	Byssus Skipper	X							X
Inve	Dotted Skipper	X				X			
Inve	Iowa Skipper	X				X			
Inve	Prairie Mole Cricket	X				X			
Inve	Regal Fritillary				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Texas Horned Lizard				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are

declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:
- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct management pilot studies to determine successful strategies.

Conservation Issue: Habitat loss and fragmentation from land management practices:
3. Knowledge about the impacts of many land management practices on populations of many of the species of greatest conservation need in this habitat is incomplete.
4. Conversion of prairie to other land uses (e.g., oil, highways, wind farms, agriculture conversion, utilities, private land ownership, and hay biomass production).
5. Urban communities are sprawling into open spaces and agricultural fields and adversely affecting species of greatest conservation need.
6. Inappropriate use of herbicides.
7. Inappropriate fire and grazing regimes and suppression, including too much fire; management agencies need to better understand and manage fire use.

Conservation Actions:
- Collaborate with the Natural Resources Conservation Service to find ways to alleviate habitat loss and fragmentation.
- Support tax reform to keep people on the land and be able to pass land between generations.
- Support tax shelters for ranch businesses to reduce fragmentation.
- Acquire perpetual easements.
- Support private acquisition by land trusts and organizations such as The Nature Conservancy.
- Increase funding from the subsidy side of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Restore native Tallgrass Prairie by converting Bermuda grass pastures back to native warm season grasses and forbs.
- Remove federal and state involvement or cost sharing or funding in projects that cause fragmentation.
- Reduce oil production impacts using incentives.
- Use impact fees and tax disincentives for practices that cause habitat community fragmentation.
- Eliminate Farm Bill programs that promote the destruction or conversion of native prairie.
- Develop programs that preserve prairies and community structure so that species of greatest conservation need are protected and restored.
- Encourage accountability for Farm Bill conservation practices.
- Subsidize burn schools for cooperatives and contractors.
- Increase diversification of farming and open new markets.

- Create and fund Regional Planning Organizations to address agricultural land, fragmentation, urban sprawl, open space, and watershed protection.
- Assist and work with the Council of Governments and use regional plans to assist their private and public clients.
- Use conservation easements and non-development easements on both public and private land.
- Use new suburban development (i.e., sustainable development) techniques that minimize impacts such as cluster development and integrated and protected open space.
- Develop disincentives and safe guards against inappropriate suburban and urban development.
- Support the study of economic analysis and nutritional analysis of forage production on ranching and herbicide use.
- Encourage better uses of herbicide by rights-of-way managers.
- Encourage or cost share the development of a demonstration model showing and describing grazing and fire regimes (e.g., with OSU Agriculture Extension).
- Encourage an economic study for profitability and nutrition of diverse forbs pastures.
- Support education components for ranch diversification.
- Improve fire laws and agency management of fire on the landscape.
- Support fire management cooperatives so that effective and efficient fire management by knowledgeable and trained workers can be accomplished.
- Promote regional fire management contractors.
- Help with legislation to reduce liability for fire contractors, yet protect the private parties.
- Update Best Management Practices for farming and resource manage practices.
- Encourage the marketing of land for other purposes and revenue sources.
    - Encourage and support ranch diversification for lower grazing to be off set by lease hunting, fishing access, and ecotourism viewing.
    - Support pilot studies to determine the economic factors, net profits for alternative markets and the resulting protection or restoration of species of greatest conservation need.
    - Remove hurdles to lease hunting and hunting cooperatives.
    - Remove restrictive hunting seasons and provide for more uniform seasons and timing so an industry can be built up.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

8. Invasive species and control methods may have detrimental impacts to species of greatest conservation need.
9. Invasive native woody species management is required because land management practices are not producing stable community structure for species of greatest conservation need.

Conservation Actions:

- Develop management plans to control the abundance and distribution of exotic species and invasive species.
- Develop alternatives to aerial spraying.
- Remove federal subsidies for programs promoting invasive species (e.g., new invasive species of Bermuda grass and turf from other countries).
- Promote certified hay programs that are exotic free.
- Help change the way hay is graded.
- Improve the screening process for genetically modified plants and imported plants.
- Use weed laws to help private property owners manage exotics.

- Require roadside re-vegetation following construction to native species and improve management of roadsides.
- Help support burning cooperatives and independent contractors.
- Encourage rights-of-way managers to manage invasive and exotics species.
- Use patch burning as a tool and rotate cattle around larger pastures rather than additional fencing to create smaller pastures as additional fences fragment prairie habitat and encourage the growth of tree lines across prairies.
- Work through Natural Resources Conservation Service to increase cost share for tree clipping and change Farm Bill ranking factors so that important techniques are encouraged.
- Use tax incentives and tax relief for maintaining good quality prairie.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned or treated.
- Changes in acreage/coverage of exotic vegetation.
- Changes in virgin prairie.
- Diversity of agriculture production and agriculture economy.
- Acres of native plant communities (species composition) restored.
- Number of easements secured and acreage protected.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Status of species declining elsewhere but still common in Oklahoma.
- Use of fire (acres burned).
- Vegetation response to management.

Conservation Landscape: Small Gravel (hard)-bottom Streams and Associated Riparian Forests

Relative condition of Small Gravel (hard)-bottom Streams and Associated Riparian Forests habitat is currently unknown with an unknown trend. Gravel or rock-bottom streams are uncommon in the Crosstimbers Region and occur locally in and to the east of the Arbuckle Mountains. The soils in this area are shallow and rocky and the streams originating here have a gravel, cobble, or boulder substrate. Many of these streams have well defined riffle and pool sections, well-developed floodplains, high width to depth ratios, and only slightly entrenched channels. Gravel-bottom streams often support diverse riparian forest communities. One unique riparian plant found in several streams originating in the Arbuckle Mountains is the Seaside Alder (*Alnus maritima*) that is found in only three other states along the Atlantic coast.

Recognized riparian plant associations within this habitat type include:

Sycamore – Boxelder Temporarily Flooded Forest
American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
Seaside Alder – False Indigo Temporarily Flooded Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Bell's Vireo		X			X			
Bird	Canvasback	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Trumpeter Swan	X							X
Fish	Blue River pop of Least Darter	X				X			
Fish	Bluntface Shiner	X							X
Fish	Plains Minnow			X		X			
Fish	Redspot Chub		X				X		
Fish	Rocky Shiner		X						X
Fish	Shorthead Redhorse	X							X
Inve	Byssus Skipper	X							X
Inve	Little Dubiraphian Riffle Beetle				X				X
Inve	Little Spectaclecase			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Creekshell	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Threeridge Mussel			X			X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Meadow Jumping Mouse				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Scarletsnake				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There is limited historic data from which to evaluate the condition of streams and riparian forests prior to large-scale human alteration of this habitat.

3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is incomplete information from which land managers can predict the effects of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

- Survey taxonomic experts to determine why species of greatest conservation need have small and/or declining populations.
- Conduct research on species of greatest conservation need to determine what factors limit their population size and distribution.
- Conduct research on species of greatest conservation need to establish baseline population size, density, and distribution and habitat relationships.
- Conduct biological inventories of amphibian, fish, crayfish, and mussel populations in streams to increase the knowledge of biological communities within specific watersheds.
- Summarize and verify existing data.
- Conduct literature reviews and focused studies to establish what stream and riparian habitats looked like historically to establish a target condition for stream and riparian restoration efforts.
- Develop/support relational databases (e.g., Natural Heritage Inventory) to examine wildlife populations and the conditions of their habitats.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

5. The presence of confined animal feeding operations such as cattle feedlots, poultry houses, hog farms, and waste application fields close to streams and drainages may affect water quality and the habitat of some species of greatest conservation need.
6. Additional nutrients enter streams as a result of cattle/livestock watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae that can result in other water quality impacts such as increased fluctuations in dissolved oxygen.
8. Pollutants from pesticides, including endocrine disrupters, enter streams in storm water runoff from agricultural fields, altering the growth, reproduction and/or survival of fish, amphibians, and invertebrates in the streams.

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) through Best Management Practices, Farm Bill cost-share programs, and landowner incentive programs.
- Provide alternative water sources for livestock to keep them out of streams.
- Increase landowner education efforts regarding the watershed concept, importance of riparian habitat, Best Management Practices for controlling nutrients, and existing Farm Bill conservation programs to control nutrients.
- Develop conservation easements or acquire land to maintain or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Establish setback distances and Best Management Practices between streams and confined animal feeding operations, and their waste lagoons, and land application areas.

- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit their access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve the knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.
- Conduct management pilot studies to determine successful new management strategies.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

9. Many streams in the Region have been channelized or straightened, causing them to become incised and no longer connected with their riparian vegetation.
10. Streams with incised channels have cut banks that are prone to erosion which increases sediment loads in the streams.
11. Lack of connection between streams and riparian vegetation due to the channelization and incising of streams resulting in reduced riparian vegetation and a loss of wetlands within the stream floodplain.
12. In-stream gravel mining reduces bank stability upstream and downstream of the mining area and increases bank erosion and alters the width to depth ratio of the stream by making it wider and shallower.
13. In-stream gravel mining can remove or reduce riffles, gravel beds, and other stream structures that are important habitat for aquatic wildlife.
14. Water is being pumped from streams for irrigation.
15. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes and this is lowering water tables and reducing the flow volume of springs and seeps that feed streams.
16. Increased pond construction may be lowering the inflow that sustains streams.
17. Bridges can impact streams by altering stream channels and flows.
18. Some types of culverts can become barriers to the movement of fish during low-flow conditions.
19. Dams and bridges across streams can create fish barriers that affect the populations of fish and freshwater mussels.
20. Dams and diversion structures alter the natural flow patterns and other processes of streams, especially the frequency and magnitude of natural flooding events.

Conservation Actions:

- Provide cost-share funding or grants to restore stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Work collaboratively with public managers and Legislature to develop regulations to reduce gravel mining from within streams.
- Work with local communities and counties to reduce stream channel impacts including in-stream gravel mining, placement of rip-rap on stream banks at bridge crossings, and recreational use of streams by off-road vehicles.

- Establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Stop the proposals to sell water outside of the state or the transfer of water between basins within Oklahoma.
- Brief water use planners and permit writers on ecology and the importance of their work in protecting species of greatest conservation need.
- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals, and interbasin transfers of water.
- Work collaboratively with landowners to remove ponds and impoundments that are obsolete but have been shown to block the movement of fish species of conservation need.
- Work collaboratively with landowners to remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Work collaboratively with landowners to replace ponds that have been constructed on streams with alternative water sources (e.g., for livestock).
- Work collaboratively with public land managers to modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.

Conservation Issue: Habitat loss and fragmentation from land management practices:

21. The abundance and diversity of understory vegetation has declined in riparian areas as a result of livestock grazing, especially during the growing season.
22. Riparian forests have been cleared and converted to crop fields or introduced pastures of exotic grasses such as Fescue and Bermuda.
23. Fragmentation of riparian forests by roads, houses, pastures, and utility right-of-ways.
24. Clearing of riparian vegetation reduces stream bank stability that subsequently increases erosion and alters the width/depth ratios of streams.
25. Streams and riparian habitats are fragile and easily disturbed or modified.
26. The loss of riparian vegetation increases erosion and sedimentation.
27. Lack of headwaters protection allows for more sediment, nutrients, pesticides, and other pollutants to enter streams.
28. Loss of stream shading as a result of reduced riparian vegetation, increasing water temperatures and affecting the aquatic animal community.
29. Increased sediment in the stream can fill or alter riffles, gravel beds that serve as spawning areas for fish and habitats for freshwater mussels.

Conservation Actions:

- Provide cost-share funding or grants to fence riparian forests to control/limit their access by cattle.
- Purchase easements to protect or enhance existing riparian vegetation or to restore riparian forests.
- Encourage the planting/construction of alternative shading for livestock to reduce their use of riparian areas.
- Provide landowner incentives or cost-share programs to protect or restore riparian forests, stream banks, and in-stream habitat.
- Use fee title purchase of stream and riparian habitat to place this into conservation ownership to conserve or enhance existing habitat.
- Fee title acquisition of headwaters to steams to control/limit the introduction of sediment, nutrients, and chemical pollutants.
- Develop new or promote existing Best Management Practices for the grazing of cattle in or adjacent to riparian zones.

- Increase the availability of aquatic resource educational information in the public schools.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

30. Exotic plant species such as Chinese Privet, Salt Cedar and Japanese Honeysuckle have become established and are becoming more abundant in riparian forests, and are competing with native plants and altering the structure of the habitat that can be used by animals.
31. Exotic predatory fish such as trout may compete with native predatory fish such as bass and create increased predation pressure on stream fish or invertebrates.
32. Feral hogs that forage in streams and along stream banks damage riparian vegetation and reduce bank stability.
33. Some native plants and animals have become more abundant in riparian forests.
    - Eastern Redcedar has increased in abundance due to heavy grazing and reduced fire frequency in riparian areas.
    - Brown-headed Cowbirds have become more abundant in riparian areas due to cattle grazing. Brown-headed Cowbirds lay their eggs in the nests of other birds thus reducing the number of chicks from the host species.

Conservation Actions:

- Develop management plans to control the abundance and distribution of exotic species and invasive species.
- Conduct studies to quantify the impact of exotic species on riparian forest communities (i.e., plants and animals) or on aquatic animal communities.
- Increase educational efforts and public awareness of the ecological and economic impacts of exotic plant and animal populations.
- Conduct management pilot studies to determine successful management strategies.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of riparian forest with diverse structure.
- Creation of new local conservation and watershed groups.
- Degraded and restored stream miles of habitat.
- National Wild Turkey Federation GIS data sets.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of enhanced or restored acres of quality habitat.
- Number of landowners participating in conservation practices.
- Number of partnerships.
- Populations of indicator species.
- Populations and trends of fish and wildlife species with emphasis on species of greatest conservation need.
- Pubic opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- Create relational databases and use GIS to monitor habitat change.
- Water quality parameters (e.g., sediment).

Conservation Landscape: Herbaceous Wetlands

Relative condition of Herbaceous Wetlands habitat is currently poor with a declining trend. Herbaceous wetlands are rare and their distribution and biological characteristics are poorly known in the Crosstimbers Region. Herbaceous wetlands are often small seasonally flooded, depressions between dunes and hills or in relatively level prairies and river floodplains. The conditions that maintain herbaceous wetlands are poorly understood but probably involve the interaction of fire and fluctuating water levels. Other herbaceous wetlands are found in association with streams where beaver activity impounds small reaches and creates permanently flooded marshes and other emergent wetlands.

Recognized herbaceous wetland plant associations within this habitat include:

Ravenfoot Sedge Seasonally Flooded Marsh
Common Rush Seasonally Flooded Marsh
Common Reed Semi-permanently Flooded Marsh
Softstem Bulrush – Common Spike Rush Semi-permanently Flooded Marsh
Narrowleaf Cattail – Southern Cattail Semi-permanently Flooded Marsh
Broadleaf Cattail Semi-permanently Flooded Marsh
Broadleaf Cattail – Powdery Thalia Semi-permanently Flooded Marsh
Broadleaf Arrowhead – Longbar Arrowhead Semi-permanently Flooded Marsh
Prairie Cordgrass Temporarily Flooded Marsh

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Black Rail	X							X
Bird	Buff-breasted Sandpiper	X				X			
Bird	Canvasback	X							X
Bird	Hudsonian Godwit				X				X
Bird	Interior Least Tern	X							X
Bird	King Rail				X				X
Bird	LeConte's Sparrow		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Long-billed Curlew	X							X
Bird	Nelson's Sharp-tailed Sparrow	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Piping Plover	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Upland Sandpiper				X		X		
Bird	Western Sandpiper	X							X
Bird	Whooping Crane	X						X	
Bird	Wilson's Phalarope				X				X
Bird	Yellow Rail				X				X
Inve	Dotted Skipper	X				X			
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Marsh Rice Rat				X				X
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Texas Gartersnake				X				X
Rept	Western Chicken Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete information regarding wetland locations and wildlife:
    - distribution and locations wetland habitats (e.g., small size of wetlands is very important but the small size makes them difficult to locate and protect within larger habitat types such as prairies and woodlands),
    - distributions and ecological needs of wetland species (i.e., which species occupy which wetland types), and
    - the effects of management practices on wetlands animal and plant communities.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct regional survey for wetlands.
- Develop a database of wetland locations and conditions.
- Conduct biological inventories of wetlands to determine plant community composition and the distribution and abundances of wildlife species of conservation need.
- Conduct studies to determine the ecological needs of wetland wildlife species (e.g., types of plant communities and the timing and duration of flooding needed for each wildlife species).
- Produce educational information for landowners and conservation agency staff regarding the ecology of herbaceous wetlands by region and wetland type.
- Develop descriptions of what quality wetland habitats look like. These can serve as the target condition for wetland restoration and enhancement efforts.
- Conduct management pilot studies to determine successful management strategies incorporating Department of Agriculture and Natural Resources Conservation Service wetland information/data for Oklahoma.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

3. Feedlots, dairies, hog farms, and chicken houses are often located near wetlands; animal waste from these operations collects in wetlands basins and closed depressions.
4. Land application of animal wastes often occurs on fields near wetlands or that drain into wetlands where nutrients, hormones, pesticides, and other waste products collect.
5. Many wetlands lack buffer vegetation around them to control the movement of sediment, pesticides, and nutrients into the wetlands through storm water runoff from pastures, crop fields, and residential areas.
6. Endocrine disrupters from animal hormones, pesticides, and agricultural chemicals enter wetlands in storm water runoff, negatively affecting the growth, reproduction, and survival of amphibians, fish, and invertebrates.
7. Increased nutrient inputs due to crop/pasture fertilizers and land application of animal waste result in increased algae and bacteria in wetlands.
8. Grazing of wetlands by cattle increases nutrient inputs and alters the structure and diversity of wetland vegetation.

Conservation Actions:

- Increase the knowledge of and utilization of Farm Bill programs that improve water quality and protect wetlands (e.g., Wetland Reserve Program and planting of buffer strips).
- Provide cost-share funding to landowners to construct fencing around wetlands to control access by cattle.
- Restore/plant native vegetation around wetlands to serve as a filter for storm water runoff to aid in the removal of sediment and nutrients in storm water runoff.
- Develop certification programs to recognize conservationists and land stewards of wetlands.

- Improve small landowner access to and use of existing cost-share programs.
- Develop new or update existing Best Management Practices for controlling nutrients and sediment around wetlands.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

9. Invasive and exotic plant species become established in wetlands and compete with native vegetation.
10. Exotic plant species can dominate wetlands and reduce overall plant diversity and structural diversity, reducing the wetlands' value as wildlife habitat.

Conservation Actions:

- Develop management plans to control exotic plants and reduce their abundances and distributions.
- Remove exotic wetland plants and restore native plant communities.
- Monitor response of wildlife populations and habitat to various management practices.

Conservation Issue: Habitat loss and fragmentation from land management practices:

11. Woody plants such as willows and Salt Cedar encroach on and dominate herbaceous wetlands because of fire suppression and/or overgrazing.
12. Heavy grazing of wetlands by cattle removes plant cover for wildlife, reduces the abundance of some wetland plants, and can lower overall plant diversity.
13. Seasonal wetlands are plowed and cropped, reducing perennial vegetation and altering plant community composition and structure.

Conservation Actions:

- Use fire or mechanical cutting to remove woody vegetation that has encroached upon herbaceous wetlands.
- Provide cost-share funding or grants to construct fencing around wetlands to control access to this habitat by cattle.
- Use land acquisition, perpetual easement programs, or non-development easement programs to place wetlands into conservation ownership or stewardship.
- Acquire wetlands or purchase conservation easements on cropped wetlands.
- Provide funding to preserve or enhance wetlands.
- Improve the economic incentive to retain wetlands in agricultural areas.
- Improve the incentives for Wetland Reserve Program enrollments.
- Provide incentives or funding to cover the costs of maintaining wetlands.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

14. Wetlands are drained or filled to convert these lands to residential, agricultural, or industrial uses.
15. Water may be pumped from wetlands for irrigation.
16. Irrigation around wetlands may lower the water table in some areas and alter the time during which the soil is saturated.
17. Some wetlands are dredged or deepened to create ponds to hold irrigation water (e.g., to store water for cattle or to create ponds for fishing) resulting in a loss of shallow water habitat and may result in the introduction and establishment of predatory fish.

Conservation Actions:

- Provide cost-share funding or grants to restore farmed wetlands.
- Provide information to landowners and the public regarding the ecological values of wetlands, especially seasonal wetlands.

- Improve the technology of irrigation to conserve groundwater and reduce groundwater withdrawals.
- Produce education and outreach materials about swampbuster laws and practices.
- Increase the knowledge of and utilization of Farm Bill programs to conserve wetlands (e.g., Wetland Reserve Program).
- Use land acquisition and conservation easement programs to place herbaceous wetlands under conservation ownership or stewardship.
- Acquire former wetlands and restore them through a combination of dredging, diking, and re-vegetation.
- Facilitate crop selection and diversification to move agriculture away from crops with high water needs.
- Improve landowner access to cost-share programs (e.g., improve cost-share ratios, economic incentives, and increase the total amount available).
- Develop tax breaks for landowners that maintain wetlands.
- Connect wetland owners with entities seeking wetland mitigation credits.
- Improve the economic incentive to retain wetlands in agricultural areas.
- Improve the incentives for Wetland Reserve Program enrollments.
- Provide funding or incentives to cover the costs of maintaining wetlands.
- Increase Conservation Reserve Enhancement Program enrollments.
- Help the Natural Resources Conservation Service do wetland conservation planning.
- Conduct management pilot studies to determine successful management strategies.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acreage and distribution of wetlands.
- Acres of farmer conversion to alternative crops and diversifying.
- Acres of Wetlands Reserve Program, Conservation Reserve Program, Grassland Reserve Program and other important Natural Resources Conservation Service programs.
- Appropriate permitting and regulations for cattle confinement operations.
- GIS monitoring loss of wetlands using the National Wetland Inventory data base.
- Incentives to landowners from Legislature and Congress.
- Population status of wetland dependent species of greatest conservation need.
- Stream buffer use.
- U.S. Geological Survey groundwater levels/checks.

Conservation Landscape: Sandstone Canyonlands and Post Oak and Blackjack Oak Shrubland

Relative condition of Sandstone Canyonlands and Post Oak and Blackjack Oak Shrubland habitat is currently poor with a declining trend. Post Oak and Blackjack Oak Shrublands occur locally throughout the Crosstimbers Region in areas where the soil is thin and rocky and underlain by sandstone in most of the Region or limestone in the Arbuckle Mountains. Oak shrubland communities are a mosaic of oak thickets and Tallgrass or Mixed-grass Prairie dominated by Little Bluestem (*Schizachyrium scoparium*), Indian Grass (*Sorghastrum nutans*), and Big Bluestem (*Andropogon gerardii*), and their structure is maintained by periodic fires and dry soil conditions. Post Oak (*Quercus stellata*) is the dominant woody species, but Blackjack Oak (*Quercus marilandica*), Chittamwood (*Bumelia lanuginosa*), Eastern Redbud (*Cercis canadensis*), Roughleaf Dogwood (*Cornus drummondii*), Mexican Plum (*Prunus mexicana*), and Winged Sumac (*Rhus copallina*) are also common. Historically, these shrublands supported nesting populations of the endangered Black-capped Vireo but fire suppression has altered the structure of many patches of oak shrubland habitat and allowed for an increase in the abundance and dominance of junipers such as Eastern Redcedar (*Juniper virginiana*) and Ash Juniper (*Juniper ashei*).

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Black-capped Vireo	X				X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Swainson's Hawk		X						X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Desert Shrew				X				X
Mamm	Ringtail				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Diamond-backed Rattlesnake				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge of the plant and animal community and presettlement fire patterns is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Evaluate the current and historic distributions and conditions of this habitat and determine the factors that maintain this vegetation community.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Eastern Redcedar encroachment due to a combination of fire suppression and historic overgrazing.
4. Inappropriately heavy grazing may facilitates the spread of Eastern Redcedar.
5. Fire suppression which has allowed for a dramatic increase in Redcedar and some increase in oak numbers and height; this unnaturally high amount of woody vegetation growing on thin dry soils makes the trees (e.g., oaks) more susceptible to disease and drought stress.

Conservation Actions:

- Facilitate fire management by supporting burning cooperatives.
- Establish demonstration pilot studies to determine successful management strategies so that private and public landowners can see the results of management practices.
- Identify focus areas to get the most return on the dollar.
- Create an incentive program to restore habitat.
- Acquire public land and perpetual easements.
- Implement land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Restore oak shrubland on public lands.
- Seek alternative methods of cedar removal.
- Develop descriptions of quality habitat.
- Increase education about grazing, fire, natural systems, invasive species, and Best Management Practices.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Use of fire on the landscape (e.g., number of acres burned).
- Develop GIS datasets to monitor change in habitat acreage.
- Populations and trends of indicator species.
- Number of acres acquired and number of acres restored.
- Number of landowners participating in landowner incentive programs.

- Species of greatest conservation need distribution.
- Species of greatest conservation need populations' response to management.

Conservation Landscape: Small Sandy (soft)-bottom Streams and Associated Riparian Forest

Relative condition of Small Sandy (soft)-bottom Streams and Associated Riparian Forest habitat is currently unknown with an unknown trend. The majority of streams in the Crosstimbers Region have predominantly sandy or silty substrates, though these same streams may have sections of gravel or rock substrates in riffles. Narrow forests of often fast-growing trees grow along the banks of most streams. These forests were comprised of a diversity of tree species including American Elm (*Ulmus americana*), Sugarberry (*Celtis laevigata*), Green Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood (*Populus deltoides*), Black Willow (*Salix nigra*), Sycamore (*Platanus occidentalis*), and Boxelder (*Acer negundo*). Historically, larger streams in the eastern part of the Region often supported extensive shrublands of Giant Cane (*Arundinaria gigantean*).

More work is needed to examine the historic condition of streams in the Region but at one time many streams appear to have had well developed floodplains, been only slightly entrenched, had moderate to high degrees of sinuosity and relatively low width to depth ratios. Currently, many streams in the Region have been altered by human activity such as the removal of riparian vegetation and the straightening of the channels to remove stream meanders. These efforts to reduce the amount of acreage occupied by streams and their floodplains have resulted in many streams cutting deep incised channels that separate the stream from its former riparian zone.

Recognized plant associations within this habitat include:

Silver Maple – Boxelder Temporarily Flooded Forest
River Birch – Sycamore Temporarily Flooded Forest
Sycamore – Boxelder Temporarily Flooded Forest
Eastern Cottonwood – Black Willow Temporarily Flooded Forest
Eastern Cottonwood – American Elm – Sugarberry Temporarily Flooded Forest
American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
Green Ash – American Elm Temporarily Flooded Forest
Green Ash – Cedar Elm – Sugarberry Temporarily Flooded Forest
Eastern Cottonwood – Black Willow Temporarily Flooded Forest
Green Hawthorn – Cockspur Hawthorn – Downy Hawthorn Temporarily Flooded Shrubland
Sandbar Willow/Switchgrass Temporarily Flooded Shrubland
Buttonbush Semi-permanently Flooded Shrubland
Giant Cane Temporarily Flooded Shrubland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bell's Vireo		X			X			
Bird	Canvasback	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Fish	Western Sand Darter	X							X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Meadow Jumping Mouse				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X
Rept	Western Massasauga				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There is limited historic data from which to evaluate the condition of streams and riparian forests prior to large scale human alteration of this habitat.

3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is incomplete information from which land managers can predict the affect of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

- Survey taxonomic experts to determine why species of greatest conservation need have small and/or declining populations.
- Conduct research on species of greatest conservation need to determine what factors limit their population size and distribution.
- Conduct research on species of greatest conservation need to establish baseline population size, density, distribution, and habitat relationships.
- Conduct biological inventories of amphibian, fish, crayfish, and mussel populations in streams to increase the knowledge of biological communities within specific watersheds.
- Summarize and verify existing data.
- Conduct literature reviews and focused studies to establish what stream and riparian habitats looked like historically to establish a target condition for stream and riparian restoration efforts.
- Develop relational databases (e.g., Natural Heritage Inventory) to monitor wildlife populations and the conditions of their habitats.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Conduct management pilot studies to determine successful management strategies.

Conservation Issue: Water quality changes that negatively affect both habitat and species of greatest conservation need:

5. The presence of large confined animal feeding operations (e.g., cattle feedlots, poultry houses, hog farms, and their waste application fields) may contribute nutrients to the water through storm water runoff into streams and drainages.
6. Additional nutrients enter streams as a result of cattle and livestock watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae, resulting in other water quality impacts such as increased fluctuations in dissolved oxygen.
8. Pollutants, including endocrine disrupters, enter streams in storm water runoff from agricultural fields altering the growth, reproduction and/or survival of fish, amphibians, and invertebrates in the streams.

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) through Best Management Practices, Farm Bill cost-share programs, and landowner incentives programs.
- Provide alternative water sources for livestock to keep them out of streams.
- Increase landowner education efforts regarding watershed concepts, importance of riparian habitat, Best Management Practices for controlling nutrients, and existing Farm Bill conservation programs to control nutrients.
- Develop conservation easements or acquire land to maintain or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Establish setback distances between streams and confined animal feeding operations, waste lagoons, and land application areas.

- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Conduct management pilot studies to determine successful strategies.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve landowner knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.

Conservation Issue: Altered patterns of stream structure and flow that negatively affect both habitat and species:

9. Many streams in the Region have been channelized and straightened, becoming deeply incised and no longer connected with their riparian vegetation.
10. Streams with incised channels have cut banks that are prone to erosion that increases sediment loads in the streams.
11. Lack of connection between streams and riparian vegetation due to the channelization and incising of streams results in reduced riparian vegetation and a loss of wetlands within the stream floodplain.
12. Water is being pumped from streams for irrigation.
13. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes, lowering water tables and reducing the flow volume of springs and seeps that feed streams.
14. Increased pond construction may be lowering the inflow that sustains streams.
15. Bridges can impact streams by altering stream channels, erosion, and flow.
16. Some types of culverts can become barriers to the movement of fish during low-flow conditions.
17. Dams and bridges across streams can create fish barriers that affect the populations of fish and freshwater mussels.
18. Dams and diversion structures alter the natural flow patterns and other processes of streams, especially the frequency and magnitude of natural flooding events that are required to maintain downstream channels and banks.

Conservation Actions:

- Provide cost-share funding or grants to restore stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams to enhance flood storage and create shallow water habitat for shorebirds, waterfowl, and amphibians.
- Conduct management pilot studies to determine successful management strategies.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Anticipate and articulate to the Legislature and the Congressional delegation the potential effects of proposals to sell water outside of the state or the transfer of water between basins within Oklahoma.
- Provide the results of ecological studies to water use planners and those who issue permits.

- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals, and interbasin transfers of water.
- Work collaboratively with landowners to remove ponds and impoundments that are obsolete and have been shown to block the movement of fish species of conservation need.
- Work collaboratively with landowners to remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Work collaboratively with landowners to replace ponds that have been constructed on streams with alternative water sources (e.g., for livestock).
- Work collaboratively with public managers to modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.

Conservation Issue: Habitat loss and fragmentation from land management practices:

19. Reduction of riparian vegetation.
20. The abundance and diversity of understory vegetation has declined in riparian areas as a result of livestock grazing, especially during the growing season.
21. Riparian Forests have been cleared and converted to crop fields or introduced pastures of exotic grasses such as Fescue and Bermuda.
22. Fragmentation of riparian forests by roads, houses, pastures, and utility right-of-ways.
23. Clearing of riparian vegetation reduces stream bank stability which subsequently increases erosion and alters the width/depth ratios of streams.
24. Streams and riparian habitats are fragile and easily disturbed or modified.
25. The loss of riparian vegetation increases erosion and sedimentation.
26. Lack of headwaters protection allows for more sediment, nutrients, pesticides, and other pollutants to enter streams.
27. Livestock grazing along stream banks increases bank erosion.
28. Loss of stream shading as a result of reduced riparian vegetation, increasing water temperatures and affecting the aquatic animal community.

Conservation Actions:

- Provide cost-share funding or grants to fence riparian forests to control/limit their access by cattle.
- Purchase easements to protect or enhance existing riparian vegetation or to restore riparian forests.
- Encourage the planting/construction of alternative shading for livestock to reduce their use of riparian areas.
- Provide landowner incentives or cost-share programs to protect or restore riparian forests, stream banks, and in-stream habitat.
- Use fee-title purchase of stream and riparian habitat to place this into conservation ownership to conserve or enhance existing habitat.
- Fee-title acquisition of headwaters to steams to control/limit the introduction of sediment, nutrients, and chemical pollutants.
- Develop new and promote existing Best Management Practices for the grazing of cattle in or adjacent to riparian zones.
- Conduct management pilot studies to determine successful new management strategies.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

29. Exotic plant species such as Chinese Privet, Salt Cedar and Japanese Honeysuckle have become established and are becoming more abundant in riparian forests,

competing with native plants and altering the structure of the habitat that can be used by animals.

30. Feral hogs that forage in streams and along stream banks damage riparian vegetation and reduce bank stability.
31. Some native plants and animals have become more abundant in riparian forests.
    - Eastern Redcedar has increased in abundance due to heavy grazing and reduced fire frequency in riparian areas.
    - Brown-headed Cowbirds have become more abundant in riparian areas due to cattle grazing. Brown-headed Cowbirds lay their eggs in the nests of other birds thus reducing the number of chicks from the host species.

Conservation Actions:

- Develop management plans to control the abundance and distribution of exotic species and invasive species.
- Conduct studies to quantify the impact of exotic species on riparian forest communities (e.g., plants and animals) or on aquatic animal communities.
- Conduct management pilot studies to determine successful new management strategies.
- Increase educational efforts and public awareness of the ecological and economic impacts of exotic plant and animal populations.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of riparian forest with diverse structure.
- Creation of new local conservation groups.
- Degraded and restored stream miles for habitat.
- GIS to monitor change and computerize data into relation data.
- Number of acres acquired.
- Number of acres under easements or conservation practices.
- Number of enhanced or restored acres of quality habitat.
- Number of landowners participating in conservation practices.
- Number of partnerships or easements.
- Population of indicator species
- Populations and trends of fish and wildlife species (species of greatest conservation need)
- Proportion of acres protected/acquired within a given watershed.
- Pubic opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- U.S. Geological Survey monitoring stations data and U.S. Geological Survey groundwater levels check.
- Water quality parameters.

Conservation Landscape: Mixed-grass Prairie

Relative condition of Mixed-grass Prairie habitat is currently poor with a declining trend. Mixed-grass Prairies occur locally on relatively dry and well-drained upland sites along the western edge of the Crosstimbers Region and in areas of relatively coarse and/or thin soils in the southern part of the Region south and east of the Arbuckle Mountains. This habitat type is maintained by a combination of soil conditions and frequent fire. Mixed-grass prairies are dominated by Little Bluestem (*Schizachyrium scoparium*) and Sideoats Grama (*Bouteloua curtipendula*). Other grasses that may be common include Big Bluestem (*Andropogon gerardi*) and Blue Grama (*Bouteloua gracilis*). Forbs are often abundant and include Poppy Mallow (C*allirhoe involucrata*), Heath Aster (*Symphyotrichum ericoides*), and Dotted Blazing Star (*Liatris punctata*).

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Burrowing Owl	X							X
Bird	Chestnut-collared Longspur	X							X
Bird	Ferruginous Hawk	X							X
Bird	Harris's Sparrow		X						X
Bird	LeConte's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Prairie Falcon	X							X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	Prairie Mole Cricket	X				X			
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Diamond-backed Rattlesnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.
3. Understanding of microhabitat/climate from working landscapes that affect species of greatest conservation need is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Conduct microclimate studies to understand effects and management alternatives for working landscapes.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

4. Loss of historic fire regimes and the subsequent increase of woody plants such as Juniper.
5. Introduced exotic species such as Old World Bluestem and Bermuda grass harm species of greatest conservation need.
6. Some grazing practices (e.g., overgrazing) harm species of greatest conservation need.
7. Conversion to cropland or introduced pasture may harm species of greatest conservation need.

Conservation Actions:

- Change the Conservation Reserve and Grassland Reserve Programs to be more effective at protecting species of greatest conservation need.
- Implement appropriate patch burning and prescribed fire on the landscape.
- Encourage rangeland management and proper use (i.e., Best Management Practices).

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired or in permanent easement.
- Acres burned and patch size.
- Acres of converted of cropland planted to native grasses.
- Conversion acres of Mixed-grass Prairie.
- Create an index of fragmentation.
- Population trends or distribution changes of the species of greatest conservation need.

Conservation Landscape: Limestone Cave

Relative condition of Limestone Cave habitat is currently good with a stable trend. The presence of caves in the Crosstimbers Region is limited to the Arbuckle Mountains in portions of Murray, Pontotoc, and Carter counties. The Arbuckle Mountains are a limestone karst formation with numerous underground aquifers and a few surface caves. Cave locations are poorly known and poorly studied but they have the potential to harbor breeding or hibernating colonies of several bat species. There are no known vertebrate species found only in the Arbuckle Mountains but at least one cave/groundwater dwelling amphipod is restricted to this area.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	Caecidotea acuticarpa	X							X
Inve	Caecidotea antricola	X							X
Inve	Oklahoma Cave Amphipod	X				X			

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. In general, cave entrances are unknown.
3. Incomplete resource monitoring.
4. Unknown species that use cave habitat forage outside of caves (e.g., bats) or live in the aquifer (e.g., invertebrates).

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.

- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Study populations of cave species (e.g., Oklahoma Cave Amphipod).
- Delineate/map recharge areas around caves. Conduct surveys to identify caves (e.g., map certain caves).
- Surveys for populations of cave species.
- Study and research the ecological, life history, and management of cave species.

Conservation Issue: Water quality changes which negatively affect both habitat and species of greatest conservation need:

5. Pollution in the recharge zone around/above caves, groundwater quality degradation, and addition of nutrients could harm the species of greatest conservation need.
6. Water diversions and withdrawals (e.g., water regime changes such as patterns of flow).
7. Potential for water sale decreasing the amount available to these little know species and habitat.
8. Endocrine disruptors related to agricultural runoff/discharge (e.g., poultry, cattle, and use on plants).

Conservation Actions:

- Monitor cave parameters and establish management priorities.
- Conduct management pilot studies to determine successful management strategies.

Conservation Issue: Habitat loss from land management practices:

9. Heavy recreational use.
10. Land use around cave affects foraging habitat for bats.
11. Limestone quarrying may affect cave habitats.

Conservation Actions:

- Acquire interest in land through fee title or conservation easements and leases.
- Develop landowner incentives program for cave management (e.g., cave gating and maintenance).
- Development of education programs (e.g., cave resources and landowner opportunities).
- Maintain security of cave locations to protect cave organisms as well as landowners.
- Construct appropriately designed gates.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Air quality, temperature, and humidity in caves.
- Bat gates (e.g., effectiveness against vandalism).
- Groundwater quantity and quality.
- Population trends of cave species (e.g., bats and invertebrates).

Conservation Landscape: Springs

Relative condition of Springs habitat is currently good with a stable trend. Springs are rare in the Crosstimbers Region. The majority of biologically significant springs occur in the Arbuckle Mountains area where the limestone karst geology supports a large complex groundwater aquifer and several surface springs. This aquifer is the only habitat for the regionally endemic Oklahoma Cave Amphipod (*Allocragonyx pellucidus*).

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
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Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Louisiana Waterthrush		X						X
Fish	Blue River pop of Least Darter	X				X			
Fish	Orangebelly Darter			X			X		
Fish	Redspot Chub		X				X		
Inve	Caecidotea acuticarpa	X							X
Inve	Caecidotea macropoda	X							X
Inve	Caecidotea simulator	X							X
Inve	Oklahoma Cave Amphipod	X				X			
Inve	Rattlesnake Master Borer	X							X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Marsh Rice Rat				X				X
Mamm	Seminole Bat				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete data regarding spring locations.
3. Population data for spring and stream species is incomplete.

4. Springs are difficult to monitor because of small size and because habitat is mostly privately owned.
5. Small springs and seeps that are important to amphibians and crayfish are difficult to locate.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Create a springs/stream data base to track location, land ownership, and biological data.
- Create spring teams and citizen teams to monitor springs (e.g., biota, habitat, flow, and water quality).

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

6. Habitat degradation and modification of springs by small dams, pipes, and recreational use.
7. Lack of adequate riparian zones and vegetation protection.
8. Some road crossings may create fish barriers that affect fish populations.
9. Groundwater withdrawal reducing spring and stream flow.

Conservation Actions:

- Educate landowners about the existence, importance, and significance of this habitat.
- Acquire land or conservation easements and leases.
- Assist landowners to modify their dams that keep fish from swimming upstream or that warm the water.
- Encourage the formation of groundwater districts to manage withdrawals.
- Manage water withdrawals to have the least impact (e.g., in-stream flow protection).
- Use landscape planning and water planning principles to demonstrate and establish the value and importance of this habitat for species of greatest conservation need.

Conservation Issue: Water quality changes that negatively affect both habitat and species of greatest conservation need:

10. High nutrient levels increase algae and affect oxygen levels and the sustainability of species of greatest conservation need.
11. Livestock in springs is detrimental to the sustainability and protection of species of greatest conservation need.
12. Groundwater contamination and withdrawal that reduces spring flows quantity and quality.
13. Fragile habitat is easily disturbed or modified, especially by exotic plant invasion.

Conservation Actions:

- Educate landowners about the existence, importance, and significance of this habitat.
- Acquire land or conservation easements and leases.
- Encourage the use of landowner incentive programs to protect and restore habitat, water quality, and riparian habitat.
- Delineate recharge areas of springs to protect water quality.
- Control or stop introduction of exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Number of easements obtained to protect or restore springs.
- Number of protected springs/streams.
- Populations of spring/stream organisms.
- Stabilized stream and spring flow and quality.
- Water quality improvements.

Potential partnerships to deliver conservation for Crosstimbers Region:

State Government

- Oklahoma Biological Survey
- Oklahoma Corporation Commission
- Oklahoma Department of Agriculture and Forestry Service
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Transportation
- Oklahoma Department of Wildlife Conservation
- Oklahoma Energy Resources Board
- Oklahoma Legislature
- Oklahoma Natural Heritage Inventory
- Oklahoma State University, Cooperative Extension Service
- Oklahoma State University, Department of Forestry
- Oklahoma Tourism and Recreation Department
- Oklahoma Turnpike Authority
- Oklahoma Water Resources Board
- state universities and departments
- state-funded museums
- University of Arkansas's Cross Timbers Tree-Ring Laboratory
- University of Oklahoma, Oklahoma Biological Station
- University of Oklahoma, Sam Noble Oklahoma Museum of Natural History

Federal Government

- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Department of Agriculture, Farm Service Agency
- U.S. Department of Agriculture, Forest Service
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Agriculture, Resource Conservation and Development Councils
- U.S. Department of Defense, Tinker Air Force Base
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

Local Government

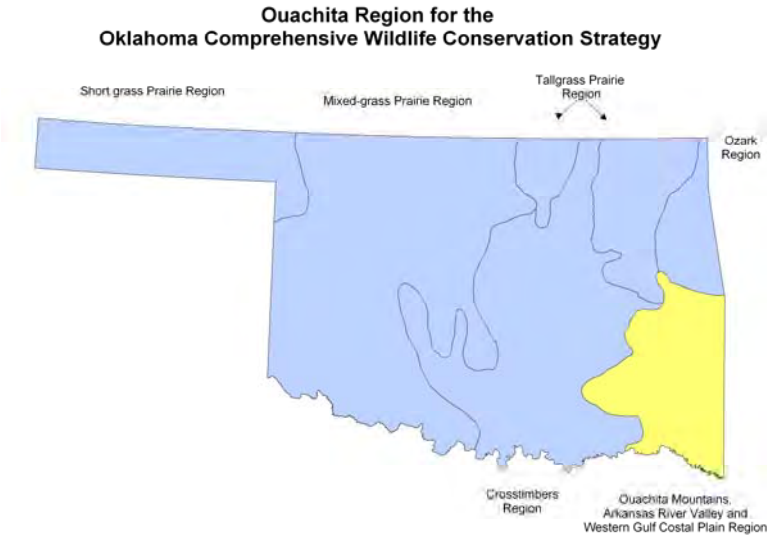
- Local Councils of Governments
- Municipalities in Oklahoma, and Texas
- Municipalities wanting to buy water
- Tribal governments

Businesses, Citizens and Citizen Groups

- Local Audubon Chapters
- Bat Conservation International
- Chambers of Commerce
- Citizens for the Protection of the Arbuckle-Simpson Aquifer
- Ducks Unlimited and local Oklahoma chapters
- Farm Bureau
- Farmers Union
- Hunting cooperatives
- Individual farmers
- Izaak Walton League
- Land Trusts

- Local citizen's groups
- Logging industry
- National Wild Turkey Federation and local Oklahoma chapters
- Oklahoma Anglers United
- Oklahoma Cattlemen's Association
- Oklahoma Native Plant Society
- Oklahoma Ornithological Society
- Oklahoma Section of the Society for Range Management
- Other sportsmen's groups
- Private contractors
- Private landowners
- Producer Cooperatives
- Railroad Companies
- Regional Planning Organizations
- Sierra Club
- Small logging companies
- Small Woodland Owner's Association
- Speleological Societies
- The Nature Conservancy
- The Samuel Roberts Noble Foundation, Inc.
- The Wildlife Society
- Urban development groups
- Wetland Mitigation Bankers

Ouachita Mountains, Arkansas River Valley and Western Gulf Coastal Plain Region



This is a large and diverse region that encompasses three subregions: the Ouachita Mountains, Arkansas Valley and the Western Gulf Coastal Plain. The region includes all or portions of the following counties: Sequoyah, Haskell, LeFlores, Latimer, Pittsburg, Atoka, Pushmataha, Choctaw, and McCurtain. Under Bailey's ecological classification system, this region is equivalent to the combination of Bailey's Ouachita Mountains, Western Mid-coastal Plains and Arkansas Valley sections. Under Omernick's ecological classification system, it is equivalent to the Arkansas Valley, Ouachita Mountains and South Central Plains ecoregions.

The best professional judgment of the advisory group and technical experts was used to identify each Conservation Landscape's status and trend. And, even though some issues and actions apply to multiple Regions, each Region chapter is designed to stand-alone.

Conservation Landscapes listed in general priority order:

- Very High priority Conservation Landscapes:
  - Small River
  - White Oak/Hickory Mesic Forest
  - Oak/Hickory Bottomland Hardwood Forest
  - Gravel (hard)-bottom Streams and Associated Riparian Forests
  - Shortleaf Pine/Oak Woodland or Savannah
- High priority Conservation Landscapes:
  - Shortleaf Pine/Oak Woodland and Forest
  - Large River
  - Mesic Loblolly Pine/Oak Forest
  - Springs and Seeps
- Moderate priority Conservation Landscapes:
  - Herbaceous Wetland
  - Tallgrass Prairie
  - Sandy (soft)-bottom Streams and Associated Riparian Forests
  - Post Oak/Blackjack Oak Woodland

Conservation Landscape: Small River

The relative condition of Small River habitat is currently poor with a declining trend. Five small rivers are found in this Region. Each river originates in the Ouachita Mountains then flows north to the Arkansas River (Poteau River) or south to eventually enter the Red River (Kiamichi, Little, Glover, and Mountain Fork). The upper reaches of these rivers are relatively shallow, clear, and fast moving with a channel substrate of cobble or bedrock. The lower reaches of these rivers are relatively turbid and slow moving and meander over a sandy or silty substrate in broad forested floodplains. Flow rates are typically greater during the winter and spring and lower during the summer and fall, however the seasonal variation is less than that which is seen on the two large rivers. The small rivers contain gravel bars and sloughs but not the dynamic mosaic of sandbars, mudflats, and sloughs that are found on the larger river systems. Most sloughs along the smaller rivers are dominated by woody vegetation including River Birch (*Betula nigra*), Sycamore (*Platanus occidentalis*), Water Oak (*Quercus nigra*), and Red Maple (*Acer rubra*).

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

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Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Many-ribbed Salamander				X				X
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Prothonotary Warbler		X						X
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Bird	Wood Stork		X				X		
Fish	Alabama Shad	X							X
Fish	Alligator Gar	X				X			
Fish	Black Buffalo	X							X
Fish	Blackside Darter		X				X		
Fish	Blackspot Shiner	X							X
Fish	Bluehead Shiner	X							X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Fish	Blue Sucker	X							X
Fish	Brown Bullhead	X							X
Fish	Chain Pickerel	X							X
Fish	Crystal Darter	X							X
Fish	Cypress Minnow	X							X
Fish	Harlequin Darter	X				X			
Fish	Ironcolor Shiner	X							X
Fish	Kiamichi Shiner	X				X			
Fish	Leopard Darter	X				X			
Fish	Longnose Darter	X							X
Fish	Mountain Madtom	X							X
Fish	Orangebelly Darter			X			X		
Fish	Ouachita Mountain Shiner		X				X		
Fish	Paddlefish		X				X		
Fish	Pallid Shiner (Chub)	X							X
Fish	Peppered (Colorless) Shiner	X				X			
Fish	Plains Minnow			X		X			
Fish	Rocky Shiner		X						X
Fish	Shovelnose Sturgeon	X							X
Fish	Southern Brook Lamprey		X						X
Fish	Taillight Shiner	X							X
Fish	Western Sand Darter	X							X
Inve	Black Sandshell	X				X			
Inve	Bleufer			X			X		
Inve	Butterfly mussel		X			X			
Inve	Faxonella blairi				X				X
Inve	Little Spectaclecase			X			X		
Inve	Louisiana Fatmucket	X				X			
Inve	Monkeyface Mussel			X			X		
Inve	Mooneye	X				X			
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Creekshell	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Ouachita Rock Pocketbook	X				X			
Inve	Plain Pocketbook		X			X			
Inve	Purple Lilliput	X				X			
Inve	Rabbitsfoot	X				X			
Inve	Scaleshell	X				X			
Inve	Southern Hickorynut	X				X			
Inve	Texas Lilliput	X							X
Inve	Threeridge Mussel			X			X		
Inve	Wartyback Mussel		X				X		
Inve	Washboard			X			X		

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	Winged Mapleleaf	X				X			
Mamm	Eastern Small-footed Myotis				X				X
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Rafinesque's Big-eared Bat				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Southeastern Myotis				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	American Alligator				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete regarding the distribution and ecology of many species of greatest conservation need that occupy the small river habitat type. Several of these species are highly mobile and occur in water too deep to easily sample or survey. In order to establish effective conservation actions, more complete data are needed to determine the population status and trend for many species and more thorough evaluations are needed to determine the factors that limit population sizes or are responsible for apparent declines.
2. Few data exist regarding the historic (i.e., presettlement) condition of small river habitat in Oklahoma. This information is important because it can serve as a desired condition when establishing goals for conservation efforts.
3. There is a general scarcity of monitor data for the biological composition of small rivers (e.g., fish, mussel, and macroinvertebrate communities).

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of population declines where these are suspected.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need. Taxonomic groups in greatest need of surveys include freshwater mussels, crayfish, and fish.

- Verify the accuracy of existing data and assess changes in populations over time.

- Develop and maintain a database to store and analyze distributional and ecological data for species of greatest conservation need, and make these data available to natural resource planners (e.g., wildlife agencies and environmental agencies).
- Conduct ecological studies on Tier I and Tier II species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Use historic literature and maps in conjunction with present day field studies to evaluate the historic and present conditions (e.g., channel morphology, flow patterns, and water quality) of small rivers.
- Develop a monitoring program to track habitat condition/quality and the status of species of greatest conservation need over time.
- Use the results of these surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Water quality changes as a result of nutrients, sediment, and other pollutants:

4. Several sources contribute nutrients to the rivers including animal feeding operations (e.g., dairies, poultry houses, and their waste application fields), septic systems from houses near streams and rivers, and fertilized crop fields.
5. Insufficient riparian vegetation or vegetated buffers around headwater streams can contribute to sediment, nutrients, and pollutants entering aquatic systems and ending up in the rivers.
6. Municipal and industrial discharges can contribute to pollutant loads, especially nutrients, in rivers.
7. Some pesticides act as endocrine system disrupters and these may enter aquatic systems through storm water runoff from agricultural fields and confined animal feeding operations disrupting the reproduction and development of freshwater mussels, amphibians, and fish.
8. Some landowners do not control the access that their livestock have to the river, resulting in cattle grazing and watering in river channels and riparian areas where they contribute nutrients, damage riparian vegetation, and potentially destabilize river banks thereby releasing sediment.
9. Septic systems and animal waste application fields that occur in porous soils in stream and river floodplains can contribute nutrients to rivers through groundwater connections.
10. Wetlands within river and stream floodplains have been filled or drained for agricultural and residential purposes, removing important filters of storm water runoff increasing sediment and nutrients in rivers and streams and decreasing the available important breeding areas for amphibians and feeding areas for waterfowl and shorebirds.

Conservation Actions:

- Increase promotion and use of Best Management Practices and conservation cost-share programs to control nutrients and sediment in storm water runoff.
- Evaluate the need for better cost-share arrangements, more acceptable landowner incentives, and revise Best Management Practices to increase the use of incentives to benefiting species of greatest conservation need.
- Provide cost-share funding for the construction of fences and alternative sources of water for livestock in order to keep cattle out of rivers and riparian areas.
- Develop and distribute educational materials to schools and landowners about Best Management Practices to control nutrients and sediment, the interconnection of rivers, wetlands and groundwater, and the importance of riparian vegetation and wetlands as filters for nutrients and sediment.

- Increase the use of existing cost-share programs to restore riparian habitat and wetlands that serve as filters of storm water and as wildlife habitat.
- Improve the acceptability of these programs to private landowners or develop new programs targeted at small rivers.
- Purchase conservation easements from private landowners or acquire property in title from willing sellers in the floodplains of river and streams and in the headwaters of streams.
- Restore, enhance, or create wetlands and riparian vegetation on these acres to stabilize stream banks and filter sediment, nutrients, and other pollutants to limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Develop monitoring programs for wildlife populations, habitat quality, and water quality to assess the effects of habitat restoration and conservation easement programs.
- Discourage residential development within river floodplains.
- Discourage the construction of poultry houses and other concentrated animal operations near streams and rivers. This also includes the placement of land application areas for animal wastes.
- Develop local stream teams or watershed groups comprised of citizens and/or governmental organizations to address local concerns, monitor water quality, monitor wildlife populations and provide public outreach and education.
- Support national or state scenic rivers designations (e.g., the Glover River).

Conservation Issue: Geomorphic alteration and instability of river channels:

11. River channels normally meander through their floodplains and maintain stable, vegetated banks, but some human activities alter the channel structure of rivers and contribute to bank instability. These actions include:
    - efforts to channelize the river and confine the channel to a narrower pace,
    - in-stream gravel or sand mining,
    - creating channel constrictions such as those that sometimes occur at bridges and low water dams, and
    - dredging of river channels to make them deeper and narrower to convey water more quickly.
12. These actions can result in the river cutting a deeper channel and creating a disconnection between the river and its riparian vegetation. Channel cutting erodes gravel and sediment from the river bank and deposits it into the river, and creates bare cut banks that are prone to erosion and contribute more sediment into the river.
13. Channelization efforts are often undertaken to enhance the movement of storm water (e.g., reduce flooding) and to allow development (e.g., agricultural or residential) within the floodplain, often initiated without thought to potential impacts downstream.
14. In relatively level areas, riparian vegetation has been removed to convert this habitat to pasture or riverside residential and recreational developments, contributing to river bank instability and facilitates bank erosion.
15. Increased deposition of fine sediment from eroding banks settles into gravel beds and riffles that impair their quality as spawning habitat for fish and habitat for freshwater mussels.

Conservation Actions:

- Develop cost-share programs or grant programs to provide funding for landowners and conservation districts to restore the morphology of river channels.
- Support research into and possible use of alternative bank stabilization and channel restoration techniques that incorporate fluvial geomorphology principles.
- Increase the use of existing cost-share programs to restore riparian habitat and wetlands that stabilize banks, serve as filters of storm water and as wildlife habitat.

- Improve the acceptability of these programs to private landowners or develop new programs targeted at small rivers.
- Purchase conservation easements from private landowners or acquire property in title from willing sellers within the floodplains of rivers and streams and in the headwaters of streams.
- Restore, enhance, or create wetlands and riparian vegetation on these acres to stabilize stream banks and filter sediment to will limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Develop monitoring programs for wildlife populations, habitat quality, and water quality to assess the effects of habitat restoration and conservation easement programs.
- Discourage residential and infrastructure development within river floodplains.
- Develop regulations that restrict or prohibit channel modifications, in-stream gravel and sand mining, and channel dredging.

Conservation Issue: Commercial harvest of freshwater mussels:

16. Freshwater mussels have been harvested commercially for over a century but little is known about the population structure and biology of many mussel species. Commercial harvest is restricted to common species, yet the harvest of common mussels can dislodge, injure, or kill non-targeted rare mussels that occur along with common species.
17. Freshwater mussel populations are difficult to monitor and monitoring programs are costly. As a result, monitoring is often limited to harvest levels with little monitoring to assess in-stream populations.
18. Some methods of mussel harvest can impair water quality and affect mussel habitat. Additionally, the reduction of mussel populations can decrease water quality because freshwater mussels are filter feeders that remove suspended algae, plankton, and detritus from the river.

Conservation Actions:

- Develop a monitoring program for mussel species that occur in rivers that are open to harvest and evaluate the impact of harvest on mussel populations.
- Conduct ecological studies of both rare and harvested mussel species to determine possible conservation actions that may be taken to maintain stable or improve depleted populations.

Conservation Issue: Altered patterns of flow and decreasing water quantity:

19. Reservoirs, flood control impoundments, and recreational ponds hold storm water runoff and can reduce the volume of surface flows that reach rivers and streams.
20. The loss of wetlands and the constriction of floodplains reduce the ability of the land to hold and slowly release water, often resulting in “flashier” stream and river flows in which flow is accelerated during storm events, but then rapidly drops afterward.
21. Surface flows are diverted from the river by impoundments on tributaries, and then withdrawn from the system for irrigation and residential use.
22. Reservoir construction on river mainstems and major tributaries alters the historic flooding frequencies and flow patterns. (Reservoirs can reduce the magnitude of small floods, especially the annual spring and early summer floods that naturally occur on Oklahoma rivers. Reservoirs also may reduce flow rates during normal summer low-flow periods by holding back water.)
23. Proposals to impound streams and sell the water outside of the Region will increase the amount of water diverted and withdrawn from rivers, leaving less water for fish and other wildlife populations.

Conservation Actions:

- Conduct studies of the habitat and flow needs for species of greatest conservation need.
- Establish minimum in-stream flow standards/requirements that will meet the needs of these species and conserve populations with the watershed.
- Conduct studies assessing and comparing current and historic flow patterns on small rivers.
- Where changes in flow patterns are documented, evaluate methods to restore historic patterns such as modifying reservoir management to release water to mimic historic flows.
- Support and promote water conservation programs and public education efforts directed at water conservation.
- Develop monitoring programs for wildlife populations and habitat quality to assess the effects of flow management, habitat restoration, and conservation easement programs.
- Discourage residential and infrastructure development within river floodplains that would contribute to efforts to channelize rivers, construct flood control impoundments, or remove wetlands.
- Develop local stream teams or watershed groups comprised of citizens and/or governmental organizations to address local concerns, monitor water quality, monitor wildlife populations, and provide public outreach and education.
- Support national or state scenic rivers designations.

Conservation Issue: Heavy recreational use of small rivers:

24. The impact of canoeing on fish, freshwater mussel, and other wildlife species has not been evaluated. Heavy recreational use may compact gravel bars and disturb mussel beds, may result in channel modifications due to the removal of woody debris in the river or the local loss of riparian vegetation.
25. Increasing levels of recreational use may result in conflicts among user groups (e.g., canoeists, fishermen, and campers).

Conservation Action:

- Develop studies to evaluate the impact of recreation activities on wildlife.
- Where impacts are found, develop recommendations to reduce impacts using a combination of education and regulations.

Conservation Issue: Impediments to the movement of fish within rivers:

26. Dams, culverts, and some bridge designs can act as impediments to the upstream movements of fish and other aquatic wildlife

Conservation Action:

- Remove or redesign structures that isolate populations of species of greatest conservation need or prevent these species from recolonizing reaches of rivers (e.g., replace culverts and bridges that block the movement of fish with new structures that allow fish to pass through).

Conservation Issue: Invasive and exotic plants and animals:

27. Several exotic aquatic plants have the potential be become established in small rivers within the Region, especially in the West Gulf Coastal Plain.
28. Exotic plant species such as Japanese Honeysuckle and Chinese Privet have become established in riparian areas where they displace native plants and may alter habitat conditions for wildlife species of greatest conservation need.
29. Some agencies, organizations, and businesses promote exotic plants for erosion control, livestock forage, beautification programs, and wildlife habitat that are actually invasive.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (e.g., displacement of native vegetation/plant communities, predation on native animal populations, or hybridization with native species) to identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Provide the results of studies of exotic species impacts to landowners and conservation agencies/organizations.
- Improve coordination between wildlife biologists, conservation agencies, and agricultural organizations so that these groups can share information about the negative effects of using exotic plant materials.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., herbicide treatment and mechanical removal) and develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Develop cost-share, or incentives programs for private landowners to encourage them to control invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired (including easements) or proportion of acres protected/acquired within a given watershed.
- Number of denied applications for exotic species introductions.
- Number of landowners participating in conservation practices.
- Miles of degraded and restored streams.
- New local conservation groups and their effectiveness.
- Pubic opinion toward conservation actions.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- Water quality parameters.

Conservation Landscape: White Oak/Hickory Mesic Forest

The relative condition of White Oak/Hickory Mesic Forest habitat is currently poor with a declining trend. White Oak/Hickory Mesic Forest, or more properly Western Mesophytic Forest, is currently restricted to the Ouachita Mountains in southern LeFlore, northern McCurtain, and possibly northeastern Pushmataha counties where they occur locally on sites with favorable moisture and soil conditions including the north-facing slopes of the larger mountain ridges and in narrow sheltered ravines. As a result of their restricted distribution, mesic forests typically occur as patches or bands of habitat embedded within a larger landscape of mixed pine-hardwood forests and woodlands. Mesic forests have a high diversity of tree species and often have well developed canopies, midstories and understories. Dominant canopy trees include White Oak (*Quercus alba*), Northern Red Oak (*Quercus rubra*), and Mockernut Hickory (*Carya tomentosa*). Other widespread canopy species include Black Gum (*Nyssa sylvatica*), Carolina Basswood (*Tilia caroliniana*), Bitternut Hickory (*Carya cordiformis*), Sugar Maple (*Acer saccharum*), Black Cherry (*Prunus serotina*), Black Oak (*Quercus velutina*), and Black Walnut (*Juglans nigra*). The diverse midstories and understories are comprised of Flowering Dogwood (*Cornus florida*), Downy Serviceberry (*Amelanchier arborea*), Eastern Hophornbeam (*Ostrya virginiana*), Carolina Silverbell (*Halesia carolina*), American Beautyberry (*Callicarpa americana*), Littlehip Hawthorn (*Crataegus spathulata*), American Holly (*Ilex opaca*), Rusty Blackhaw (*Viburnum rufidulum*), Strawberry Bush (*Euonymous americanus*), Pawpaw (*Asimina triloba*), and Ozark Chinquapin (*Castanea ozarkensis*). In isolated areas (e.g., Beech Creek, Walnut Mountain, upper Mill Creek, upper Big Creek, and the Glover and Mt. Fork River corridors), American beech (*Fagus grandifolia*) is a dominant overstory species. Mesic forests on north-facing mountain slopes in LeFlore County also support the only known populations of Cucumber Magnolia (*Magnolia acuminata*) and Umbrella Magnolia (*Magnolia tripetala*) in Oklahoma.

Western mesophytic forest is considered a late-successional forest type and is maintained by infrequent small-scale disturbances (e.g., wind events and glaze storms). Large-scale stand replacement events such as high intensity burning and timbering tend to favor the regeneration of early-successional species, resulting in a loss of late-successional habitat. The extent of western mesophytic forest in the Ouachita Mountains of Oklahoma is unknown due primarily to the paucity of research on the subject and lack quality historical documentation. It is likely that the extent of western mesophytic forest varied prior to European settlement, depending on the intensity of anthropogenic disturbance. Unregulated timbering in the late 19th and early 20th centuries resulted in the loss of most of the old-growth mesophytic forest in southeastern Oklahoma. Public acquisition of a large block of cut-over land in the Ouachita Mountains (now part of the Ouachita National Forest) in the mid 1930's and subsequent fire suppression and grazing control policies slowed the loss of mesophytic habitats allowing some degraded areas to recover. An accurate survey of the extent of mesophytic forest in southeastern Oklahoma at present is not available.

Recognized vegetation associations within this habitat include:

American Beech – White Oak – American Holly Forest
Northern Red Oak – Shumard Oak Forest
Southern Red Oak – Mockernut Hickory Forest
Sugar Maple – Chinquapin Oak Forest
Sugar Maple – Northern Red Oak – Bitternut Hickory Forest
Sugar Maple – White Oak – Mockernut Hickory Forest
White Oak – Mockernut Hickory – American Basswood Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Four-toed Salamander				X				X
Amph	Kiamichi Slimy Salamander				X				X
Amph	Many-ribbed Salamander				X				X
Amph	Ouachita Dusky Salamander				X				X
Amph	Rich Mountain Salamander				X				X
Amph	Ringed Salamander				X				X
Amph	Sequoyah Slimy Salamander				X				X
Amph	Southern Red-backed Salamander				X				X
Bird	American Woodcock	X							X
Bird	Cerulean Warbler	X				X			
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Swainson's Warbler	X							X
Bird	Whip-poor-will		X						X
Bird	Wood Thrush	X							X
Bird	Worm-eating Warbler	X							X
Inve	American Burying Beetle		X						X
Inve	Rich Mountain Slitmouth Snail				X				X
Mamm	Eastern Small-footed Myotis				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Rafinesque's Big-eared Bat				X				X
Mamm	Southeastern Myotis				X				X
Rept	Northern Scarletsnake				X				X
Mamm	Golden Mouse				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Mesic forests have not been extensively studied in Oklahoma. Ecological and distributional data are incomplete for many species of greatest conservation need that depend upon this community. In order to establish effective conservation actions, more complete data are needed to determine the population status and trends for

many species. More thorough evaluations are needed to determine the factors that limit population sizes or are responsible for suspected declines.

2. The mesic forest community typically occurs in locations with specific slope/aspect and soils; therefore, it should be relatively easy to model and map. The current and historic distributions and conditions of this community, however, have not been assessed.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need and examine the possible causes of suspected population declines.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on Tier I and Tier II species of greatest conservation need (e.g., salamanders, songbirds, and bats) to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and the condition of this community to establish a current baseline.
- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this habitat type in conjunction with a landscape-level evaluation of the probable locations and distributions of all forest, woodland, and savannah types.
- Use the results of these surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Fragmentation and conversion of habitat:

3. Fragmentation and loss of habitat caused by the conversion of mesic oak-hickory forest to other land uses such as pine plantations and introduced pastures that are planted to Tall Fescue.
4. Fragmentation and loss of habitat due to increasing number of residential developments, particularly secondary homes, cabins, and ranchettes, coinciding with the trend for increasing fragmentation of land ownership with more individuals owning smaller tracts of land.
5. Fragmentation and loss of habitat due to expanding infrastructure including roads, utility lines, and pipelines.

Conservation Actions:

- Develop a landowner incentive program to encourage the retention of mesic forest stands and not convert these to other vegetation such as Fescue pasture or Loblolly Pine.
- Develop programs to maintain biologically meaningful tracts of mesic oak-hickory forests such as: conservation easements, conservation leases, or willing-seller land acquisitions preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest “bang for the buck” or conservation efficiency.
- Explore tax reform and other ways to help families pass down large tracts of land from one generation to the next.

- Evaluate methods to restore mesic deciduous forest on introduced pastures or pine plantations and develop cost-share programs or grants to assist and encourage willing landowners who wish to restore/replant these areas.
- Support cooperative efforts between government agencies and research institutions to develop or update Best Management Practices and management recommendations to minimize the ecological footprint left by road, pipeline, and utility line construction, and the impacts of right-of-way maintenance practices.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies, and utility companies.
- Develop educational materials for schools and landowners that highlight the value (i.e., ecological and economic) of hardwood trees and the mesic forest community.
- Develop wildlife corridors to connect tracts of mesic hardwood forest or to connect mesic forest with other important communities such as riparian forest.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

6. Several exotic plant species including *Sericea lespedeza*, Autumn Olive, Chinese Privet and Japanese Honeysuckle have become established in mesic hardwood forests and may be displacing native understory plants and altering native plant communities and habitat conditions for wildlife species of conservation need.
7. Feral hogs may cause substantial damage to seeps, springs, and vernal pools which are important breeding areas for amphibians.
8. Exotic tree pathogens, such as those affecting native chestnuts and Flowering Dogwood, can alter forest structure and diversity.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (e.g., displacement of native vegetation, predation on native animal populations, or hybridization with native species) to identify those exotic species causing the greatest impact to species of greatest conservation need.
- Develop control or management plans (e.g., controlled burning programs, herbicide treatment, and mechanical removal) for the exotic species that cause the greatest ecological damage, and develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.
- Develop educational materials about the ecological damage done by invasive and exotic vegetation and introduced plant diseases.
- Minimize damage to trees (e.g., during right-of-way maintenance and to seed trees during timber harvest) to lessen the chance of infection by pathogens and the spread of disease.

Conservation Issue: Altered forest community structure as a result of historic and current land management:

9. Many mesic forest stands are comprised of dense even-aged second growth forest as a result of widespread timber harvest in the early 1900s. These forest stands lack the diverse structure of canopy, midstory and understory vegetation that existed historically in uneven-aged forests; the dense canopies or midstories in these even-aged forests may limit the abundance and diversity of understory vegetation.
10. Dense canopy or midstory conditions can limit light penetration to the forest floor, which can limit the recruitment of oak species/oak regeneration in favor of more shade tolerant species.
11. Excessive use of prescribed fire in mesic habitats is resulting in the xerification of these areas causing further loss and fragmentation of this limited habitat type altering

the vegetation community and possibly fostering the spread of exotic disturbance-dependent species.

12. Vernal pools may be lost or degraded as a result of sedimentation, the alteration of drainage patterns by road construction, or feral hog activity. Mesic forests support the greatest diversity of amphibians in the Region and many of these depend upon vernal pools and seasonal wetlands for reproduction.

Conservation Actions:

- Evaluate the effectiveness of midstory thinning or timber stand improvement as a tool to diversity forest structure and increase understory vegetation.
- Restrict prescribed burning in mesic habitats.
- Identify and develop protection and management plans for vernal pools, seeps, and seasonal wetlands that are important to salamander species of greatest conservation need. These plans can include activities such as fencing, dredging/removal of accumulated sediments, development of conservation easements, or construction of new vernal pools.
- Develop monitoring programs to evaluate the success of vernal pool management plans and their effects on local populations of amphibians.

Conservation Issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

13. The use of off-road and all-terrain vehicles can compact soil, create soil erosion problems, damage understory vegetation and crushing nests and wildlife (e.g., salamanders) that live in the dense leaf litter found in mesic forests.
14. Excessive equestrian use of the habitat can create erosion problems or facilitate the spread of exotic weedy herbaceous plants

Conservation Actions:

- Develop regulations to control off-road vehicle use on public lands.
- Close or gate unneeded roads (e.g., old logging roads) to limit access by all-terrain and off-road vehicles.
- Develop informational materials about the potential impacts of off-road vehicle and equestrian use and develop recommendations to minimize these impacts.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of restored or enhanced habitat.
- Habitat quality such as changes in forest tract size, forest structure, and total acreage.
- Number of landowners/acres involved in conservation programs.
- Number or percentage of acres acquired or placed into conservation programs (incentive programs).
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stand health, composition structure.

Conservation Landscape: Oak/Hickory Bottomland Hardwood Forest

The relative condition of Oak/Hickory Bottomland Hardwood Forest habitat is currently poor with a declining trend. Bottomland Hardwood Forests are widespread in the Region but occur locally within the floodplains of rivers and large streams. A large percentage of this habitat, possibly over 50 percent, has been either converted to agricultural uses (e.g., crop fields or introduced pasture) or permanently inundated by the construction of reservoirs (Brabander et al. 1985)[3]. Approximately 175,000 acres of this habitat type are likely to occur in the Region, with the largest tracts of bottomland forest documented to occur in the floodplains of the Little River, Kiamichi River, upper Poteau River, and Gaines Creek (Brabander 1985). Bottomland hardwood forests are diverse plant communities and their species composition varies with soil conditions and flooding frequency and duration. Most bottomland hardwood forests are dominated by oak species such as Water Oak (*Quercus nigra*), Willow Oak (*Quercus phellos*), and Shumard Oak (*Quercus shumardii*). Other common deciduous trees include Black Gum (*Nyssa sylvatica*), Sweetgum (*Liquidambar styraciflua*), Red Maple (*Acer rubra*), and Sugarberry (*Celtis laevigata*). Common understory vegetation includes American Hornbeam (*Carpinus caroliniana*), Parsley Hawthorn (*Crataegus marshallii*), Deciduous Holly (*Ilex decidua*), and Spicebush (*Lindera benzoin*). Dwarf Palmetto (*Sabal minor*) grows in the understory of bottomland forests of a few sites in southeastern McCurtain County.

This habitat type includes semi-permanently flooded forests of Bald Cypress (*Taxodium distichum*) and seasonally flooded forests of Overcup Oak (*Quercus lyrata*) and Water Hickory (*Carya aquatica*) which occur in the floodplains of the Little River and some Red River tributaries in the West Gulf Coastal Plain section. In the floodplain of the Arkansas River and its tributaries are bottomland forests are dominated by Pin Oak (*Quercus palustris*), Pecan (*Carya illinoiensis*), Sugarberry (*Celtis laevigata*), and Shumard Oak (*Quercus shumardii*).

Recognized plant associations within this habitat type include:

- Bald Cypress Semi-permanently Flooded Forest
- Black Gum – Red Maple Temporarily Flooded Forest
- Black Gum – Sweetgum Temporarily Flooded Forest
- Overcup Oak – Water Hickory Seasonally Flooded Forest
- Pecan – Sugarberry Temporarily Flooded Forest
- Pin Oak – Pecan/Deciduous Holly Seasonally Flooded Forest (Arkansas River Valley)
- Red Maple – Sweetgum Seasonally Flooded Forest
- Sweetgum – Water Oak/American Hornbeam Seasonally Flooded Forest
- Sweetgum – Willow Oak/American Hornbeam Seasonally Flooded Forest
- Water Oak – Red Elm – Sweetgum/American Hornbeam Temporarily Flooded Forest
- Water Oak – Willow Oak/American Hornbeam Temporarily Flooded Forest
- Willow Oak – Black Gum/American Hornbeam Temporarily Flooded Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

[3] Brabander, J.J., R.E. Masters and R.M..Short 1985 Bottomland Hardwoods of Eastern Oklahoma: A Study of their Status, Trends and Values. 142 pp.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Amph	Four-toed Salamander				X				X
Amph	Kiamichi Slimy Salamander				X				X
Amph	Many-ribbed Salamander				X				X
Amph	Mole Salamander				X				X
Amph	Ouachita Dusky Salamander				X				X
Amph	Ringed Salamander				X				X
Amph	Sequoyah Slimy Salamander				X				X
Amph	Southern Red-backed Salamander				X				X
Amph	Three-toed Amphiuma				X				X
Amph	Western Bird-voiced Treefrog				X				X
Amph	Western Lesser Siren				X				X
Bird	American Woodcock	X							X
Bird	Cerulean Warbler	X				X			
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Rusty Blackbird	X							X
Bird	Solitary Sandpiper	X							X
Bird	Swainson's Warbler	X							X
Bird	Swallow-tailed Kite	X							X
Bird	Wood Stork		X				X		
Bird	Wood Thrush	X							X
Bird	Worm-eating Warbler	X							X
Mamm	Golden Mouse				X				X
Mamm	Indiana Myotis	X				X			
Mamm	Marsh Rice Rat				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	Rafinesque's Big-eared Bat				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Southeastern Myotis				X				X
Mamm	Swamp Rabbit				X				X
Rept	American Alligator				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Rept	Eastern River Cooter				X				X
Rept	Louisiana Milksnake				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Scarletsnake				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X
Rept	Western Mudsnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.
3. Bottomland hardwood forest communities typically occur in predictable locations with specific soils and proximity to streams and rivers; therefore, they should be relatively easy to model and map. However, the current and historic distributions and conditions of this community have not been completely assessed.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need and examine the possible causes of suspected population declines.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on Tier I and Tier II species of greatest conservation need (e.g., songbirds, amphibians, and bats) to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and condition of this community to establish a current baseline.
- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of bottomland forests.
- Use the results of these surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Habitat loss and modification as a result of altered patterns of seasonal flooding due to stream and river channel modifications:

4. Reservoir construction and stream channelization projects have reduced the frequency and magnitude of flooding which is necessary to maintain bottomland hardwood forests. In some areas, channel modifications have resulted in deep incised stream channels and created a disconnection between the streams and their bottomland forests.
5. Vernal pools and seasonally flooded wetlands within bottomland forests have been lost or degraded as a result of sedimentation and/or reduction in periodic flooding, resulting in losses of important breeding areas for a diversity of amphibians and feeding areas for waterfowl.

Conservation Actions:

- Where modifications have occurred, restore hydrology to tracts of bottomland hardwood forest by managing for the historic hydroperiod reconnecting streams with their floodplain forests. Restoration efforts may include restoring the structure of stream or river channels, restoring stream meanders, or creating low dikes to retain seasonal storm water.
- Identify and develop protection and management plans for vernal pools, seeps, and seasonal wetlands that are important to salamander species of greatest conservation need. These plans can include activities such as fencing, dredging/removal of accumulated sediments, development of conservation easements, or construction of new vernal pools.
- Develop monitoring programs to evaluate the success of vernal pool management plans and their effects on local populations of amphibians.

Conservation Issue: Fragmentation and conversion of habitat:

6. Fragmentation and loss of bottomland hardwood communities has resulted from the conversion of these forests to other land uses such as crop fields, pine plantations, and Fescue pastures.
7. Habitat fragmentation coincides with the trend for increasing fragmentation of land ownership where more individuals own smaller tracts of land.
8. Fragmentation of forest tracts as a result of increasing numbers of roads, utility lines, and pipelines; species that rely on relatively large unbroken tracts of forest are most susceptible to this trend.
9. In some areas, chemical herbicides are being used to eradicate bottomland hardwood vegetation to convert the land to other uses such as pasture.

Conservation Actions:

- Develop a landowner incentive program to encourage the retention of bottomland hardwood forest stands and not convert these to other vegetation such as Fescue pasture.
- Develop programs to maintain biologically meaningful tracts of bottomland oak-hickory forests such as conservation easements, conservation leases, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest “bang for the buck” or conservation efficiency.
- Explore tax reform and other ways to help families pass down large tracts of land from one generation to the next.
- Evaluate methods to restore bottomland hardwood forests on pastures or crop fields and develop cost-share programs or grants to assist and encourage willing landowners who wish to restore/replant these areas.
- Support cooperative efforts between government agencies and research institutions to develop or update Best Management Practices and management recommendations

to minimize the ecological footprint left by road, pipeline, and utility line construction, and the impacts of right-of-way maintenance practices.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies and utility companies.
- Develop educational materials for schools and landowners that highlight the value (i.e., ecological and economic) of hardwood trees and the bottomland forest community.
- Develop wildlife corridors to connect disjunct tracts of bottomland hardwood forest or to connect these forest tracts with other important forest communities.

Conservation Issue: Altered forest community structure as a result of historic and current land management:

10. Many bottomland forest stands are comprised of dense even-aged second growth forest as a result of widespread timber harvest in the early 1900s. These forest stands lack the diverse structure of canopy, midstory and understory vegetation that existed historically in uneven-aged forests. The shading caused by dense canopies in these even-aged forests may limit the abundance and diversity of understory vegetation and sustained shading may limit the recruitment of oak species in favor of more shade tolerant species over time.

Conservation Action:

- Evaluate the effectiveness of midstory thinning or timber stand improvement as a tool to diversity forest structure and increase understory vegetation.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

11. Several exotic plant species including *Sericea lespedeza*, Autumn Olive, Chinese Privet and Japanese Honeysuckle have become established in mesic hardwood forests that appear to be displacing native understory plants and may alter native plant communities and habitat conditions for wildlife species of conservation need.
12. Feral hogs may be causing substantial ecological damage to vernal pools within bottomland forests and may compete with native wildlife for food.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (e.g., displacement of native vegetation, predation on native animal populations, or hybridization with native species) to identify those exotic species causing the greatest impact to species of greatest conservation need.
- Develop control or management plans (e.g., controlled burning programs, herbicide treatment, and mechanical removal) for the exotic species that cause the greatest ecological damage and develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.
- Develop educational materials about the ecological damage done by invasive and exotic vegetation and introduced plant diseases.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Changes in number of forested acres in floodplains and the species composition of these acres.
- Number or percentage of acres acquired or placed into conservation programs (incentive programs).
- Percent of available habitat in conservation programs (e.g., measure net gain or loss of habitat).

- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Snag count as part of monitoring habitat.
- Stand health, composition structure.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).

Conservation Landscape: Gravel (hard)-bottom Streams and Associated Riparian Forests

The relative condition of Gravel (hard)-bottom Streams and Associated Riparian Forests habitat is currently poor with a declining trend. Streams with bedrock, cobble, or gravel substrates are common in the Ouachita Mountains portion of this Region and are typically found above the 500-foot elevation contour. Most streams in the Ouachita Mountains flow over sections of bedrock, boulders, or cobble and few of these streams could accurately be considered gravel-bottom streams. The hard-bottom streams in this Region are diverse but most have well defined pool and riffle sections. They are moderately entrenched and are wider than they are deep. Most have relatively few meanders and narrow floodplains and riparian zones. Riparian forests are dominated by Red Maple (*Acer rubrum*), Sycamore (*Platanus occidentalis*), River Birch (*Betula nigra*), and Sweetgum (*Liquidambar styraciflua*) with an understory dominated by Silky Dogwood (*Cornus amomum*), Spring Witch-hazel (*Hamamelis vernalis*), Smooth Alder (*Alnus serrulata*), wild indigo (*Amorpha sp.*), Deciduous Holly (*Ilex deciduas*), and St. John's-wort (*Hypericum sp.*).

Recognized riparian plant associations in this habitat type include:

American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
Giant Cane Temporarily Flooded Shrubland
Green Ash – American Elm Temporarily Flooded Forest
Green Hawthorn – Cockspur Hawthorn – Downy Hawthorn Temporarily Flooded Shrubland
River Birch – Sycamore – Smooth Alder Temporarily Flooded Forest
Silver Maple – Boxelder Temporarily Flooded Forest
Smooth Alder – False Indigo Temporarily Flooded Shrubland
Spring Witch-Hazel – Silky Dogwood Temporarily Flooded Shrubland
Swamp Privet – Buttonbush Semi-permanently Flooded Shrubland
Sycamore – Boxelder Temporarily Flooded Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Many-ribbed Salamander				X				X
Amph	Ouachita Dusky Salamander				X				X
Amph	Ringed Salamander				X				X
Amph	Sequoyah Slimy Salamander				X				X
Amph	Kiamichi Slimy Salamander				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Whip-poor-will		X						X
Fish	Kiamichi Shiner	X				X			
Fish	Orangebelly Darter			X			X		
Fish	Ouachita Mountain Shiner		X				X		
Fish	Rocky Shiner		X						X
Inve	Kiamichi Crayfish		X					X	
Inve	Orconectes menae				X				X
Inve	Orconectes nana				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There are limited historic data from which to evaluate the condition of streams and riparian forests prior to large-scale human alteration of this habitat.
3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is incomplete information from which land managers can predict the effect of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

- Survey taxonomic experts to determine why species of greatest conservation need have small and/or declining populations.
- Conduct research on species of greatest conservation need to determine what factors limit their population size and distribution.
- Conduct research on species of greatest conservation need to establish baseline population size, density, distribution, and habitat relationships.
- Conduct biological inventories of amphibian, fish, crayfish, and mussel populations in streams to increase the knowledge of biological communities within specific watersheds.
- Summarize and verify existing data.
- Conduct literature reviews and focused studies to establish what stream and riparian habitats looked like historically to establish a target condition for stream and riparian restoration efforts.
- Promote the addition of data to the Oklahoma Natural Heritage Inventory Database for both existing and future data concerning species of greatest conservation need and other rare species.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.

Conservation Issue: Water quality changes that negatively affect both habitat and species:

5. The presence of many confined animal feeding operations such as cattle feedlots, poultry houses, and hog farms, and waste application fields close to streams and drainages.
6. Additional nutrients enter streams as a result of cattle/livestock watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae, which can result in other water quality impacts such as increased fluctuations in dissolved oxygen.
8. Endocrine disrupters and other pollutants from pesticides enter streams in storm water runoff from agricultural fields and alter the growth, reproduction and/or survival of fish, amphibians, and invertebrates in the streams.

Conservation Actions:

- Develop conservation easements or acquire land to maintain, or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Establish set back distances between streams and captive animal farming operations, waste lagoons, and land application areas.
- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit their access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve the knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

9. Water is being pumped from streams for irrigation.
10. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes, lowering water tables and reducing the flow volume of springs and seeps that feed streams.
11. Increased pond construction may be lowering the inflow that sustains streams.
12. Bridges can impact streams by altering stream channels.
13. Some types of culverts can become barriers to the movement of fish during low-flow conditions.
14. Dams and bridges across streams can create fish barriers that affect the populations of fish and freshwater mussels.
15. Dams and diversion structures alter the natural flow patterns and other processes of streams, especially the frequency and magnitude of natural flooding events.

Conservation Actions:

- Establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Stop the proposals to sell water outside of the state or the transfer of water between basins within Oklahoma.
- Provide results of ecological studies to water use planners and those who issue permits.
- Support the development of a state water management plan with sound biological data that demonstrate the ecological impact of water sales, water withdrawals, and inter-basin transfers of water.
- Pursue improved ability to reserve stream flows for nonconsumptive uses and specifically maintenance of aquatic species and ecosystems.
- Remove ponds and impoundment that are obsolete but have been shown to block the movement of fish species of conservation need.
- Remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Replace ponds that have been constructed on streams with alternative water sources (e.g., for livestock).
- Modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.

Conservation Issue: Habitat loss and fragmentation from land management practices:

16. The abundance and diversity of understory vegetation has declined in riparian areas as a result of livestock grazing, especially during the growing season.
17. Riparian Forests have been cleared and converted to crop fields or introduced pastures of exotic grasses such as Fescue and Bermuda.
18. Fragmentation of riparian forests by roads, houses, pastures, and utility right-of-ways.
19. Clearing of riparian vegetation reduces stream bank stability which subsequently increases erosion and alters the width/depth ratios of streams
20. Streams and riparian habitats are fragile and easily disturbed or modified.
21. Loss of riparian vegetation, increasing erosion and sedimentation.
22. Lack of headwaters protection allows for more sediment, nutrients, pesticides, and other pollutants to enter streams.
23. Livestock grazing along stream banks increases bank erosion and increases the sediment load in the stream.

24. Loss of stream shading as a result of reduced riparian vegetation, increasing water temperatures and affecting the aquatic animal community.
25. Increased sediment in the stream can fill or alter riffles and gravel beds which serve as spawning areas for fish and habitats for freshwater mussels.

Conservation Actions:

- Provide cost-share funding or grants to fence riparian forests to control/limit access by cattle.
- Purchase easements to protect or enhance existing riparian vegetation or to restore riparian forests.
- Encourage the planting/construction of alternative shading for livestock to reduce their use of riparian areas.
- Provide landowner incentives or cost-share programs to protect or restore riparian forests, stream banks and in-stream habitat.
- Use fee-title purchase of stream and riparian habitat to place these lands into conservation ownership to conserve or enhance existing habitat.
- Fee-title acquisition of headwaters to steams to control/limit the introduction of sediment, nutrients, and chemical pollutants.
- Develop new and promote existing Best Management Practices for the grazing of cattle in or adjacent to riparian zones.
- Increase the availability of aquatic resource educational information in the public schools.
- Work with the U.S. Fish and Wildlife Service to develop appropriate riparian buffers, including buffers in temporary-flowing sections, for areas with aquatic species of greatest conservation need.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

26. Exotic plant species such as Chinese Privet, Salt Cedar, and Japanese Honeysuckle have become established and are becoming more abundant in riparian forests, which compete with native plants and alter the structure of the habitat that can be used by animals.
27. Exotic predatory fish such as trout may compete with native predatory fish such as bass, and create increased predation pressure on stream fish or invertebrates.
28. Feral hogs that forage in streams and along stream banks damage riparian vegetation and reduce bank stability.
29. Some native plants and animals have become more abundant in riparian forests.
    - Eastern Redcedar has increased in abundance due to heavy grazing and reduced fire frequency in riparian areas.
    - Brown-headed Cowbirds have become more abundant in riparian areas due to cattle grazing. Brown-headed Cowbirds lay their eggs in the nests of other birds thus reducing the number of chicks from the host species.

Conservation Actions:

- Work with U.S. Fish and Wildlife Service to develop an invasive/nuisance species management plan.
- Conduct studies to quantify the impact of exotic species on riparian forest communities or on aquatic animal communities
- Increase educational efforts and public awareness of the ecological and economic impacts of exotic plant and animal populations.

Conservation Issue: Habitat loss and fragmentation from geomorphic alteration and instability of river channels:

30. Many streams in the Region have been channelized/straightened, becoming incised and no longer connected with their riparian vegetation.

31. Streams with incised channels have cut banks that are prone to erosion which increases sediment loads in the streams.
32. Lack of connection between streams and riparian vegetation due to the channelization and incising of streams resulting in reduced riparian vegetation and a loss of wetlands within the stream floodplain.
33. In-stream gravel mining reduces bank stability upstream and downstream of the mining area increasing bank erosion and altering the width to depth ratio of the stream by making it wider and shallower.
34. In-stream gravel mining can remove or reduce riffles, gravel beds, and other stream structures that are important habitat for aquatic wildlife.

Conservation Actions:

- Provide cost-share funding or grants to restore stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Develop regulations to eliminate gravel mining from within streams.
- Work with local communities and counties to reduce stream channel impacts including in-stream gravel mining, placement of rip-rap on stream banks at bridge crossings, and recreational use of streams by off-road vehicles.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired or proportion of acres protected/acquired within a given watershed.
- Amount of gravel mining reduction.
- Denied applications for exotic species introductions.
- Easements obtained.
- Analysis of stream/riparian habitat change using GIS and aerial photography.
- Landowners participating in conservation practices.
- Locations and quantities of in-stream flows reserved for aquatic ecosystem conservation.
- Miles of degraded and restored streams.
- New local conservation groups and their effectiveness.
- Partnerships with local governments.
- Pubic opinion toward conservation actions.
- Recreation users of streams.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- Water quality parameters.

Conservation Landscape: Shortleaf Pine/Oak Woodland or Savannah

The relative condition of Shortleaf Pine/Oak Woodland or Savannah habitat is currently poor with a declining trend. This is an uncommon and locally occurring plant community that is typically found on slopes with a southern or western aspect in the Ouachita Mountains. The Shortleaf Pine (*Pinus echinata*) savannah and woodland habitat type is a fire-maintained plant community that relies on frequent fire to suppress oaks and to reduce the density of pines (Masters et al. 1996). The understory in this habitat type is dominated by grasses and forbs, particularly Little Bluestem (*Schizachyrium scoparium*), Narrowleaf Woodoats (*Chasmanthium sessiliflorum*), Panic Grasses (*Dichanthelium sp.*), Pale Purple Coneflower (*Echinacea pallida*), Beebalm (*Monarda russeliana*), and Elmleaf Goldenrod (*Solidago ulmifolia*). Understory shrub density is related to fire frequency. Shrubs may have been sparse historically. Woody development and canopy closure increases rapidly as a result of fire suppression. Much of this habitat has changed, as a result of fire suppression and succession, to mixed Shortleaf Pine/oak (*Quercus sp.*) forest or has been converted to industrial pine plantations.

Recognized plant associations within this habitat type include:
Shortleaf Pine/Little Bluestem Woodland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Relative Priority	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Barn Owl	X							X
Bird	Brown-headed Nuthatch	X							X
Bird	Kentucky Warbler		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Red-cockaded Woodpecker	X				X			
Bird	Red-headed Woodpecker		X			X			
Bird	Whip-poor-will		X						X
Inve	American Burying Beetle		X						X
Inve	Diana Fritillary	X							X

Species of Greatest Conservation Need		Status				Trend			
Relative Priority	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mamm	Long-tailed Weasel				X				X
Mamm	Northern Long-eared Myotis				X				X
Rept	Western Diamond-backed Rattlesnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete to determine the habitat needs and geographic distributions of many Tier I and Tier II species of greatest conservation need that use this habitat type. In order to establish effective conservation actions, more complete data are needed to determine the population status and trend for many species and more thorough evaluations are needed to determine the factors that limit population sizes or are responsible for declines.
2. The Shortleaf Pine/Oak community historically existed as a mosaic of woodlands and forests. Data are needed to more accurately determine the historic and current distribution and condition of this habitat type.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data; and assess changes over time.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies of Tier I and Tier II species of greatest conservation need (e.g., Bachman's Sparrow, Brown-headed Nuthatch, and Northern Long-eared Myotis) to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and the condition of this habitat to establish a current baseline.
- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this habitat type, to include the identification of a range of target vegetation conditions for restoration or management efforts.
- Use the results of these surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Altered vegetation structure and condition as a result of current and historic land management practices:

3. Relatively little of this plant community exists in a woodland condition. Intact areas of this community that historically existed as a mosaic of woodlands and forests have gradually changed to a more uniform forest-like condition. This change appears to be the result of a loss of historic fire regimes due to active fire suppression.

4. Much of this habitat type currently exists as even-aged forest. This change from woodlands comprised of trees of diverse ages and heights to forests of relatively even-aged tress appears to be a result of historic large-scale timber harvest that occurred in this Region during the late 1800s and early 1900s.
5. The combination of even-aged stands and decades of fire suppression appear to be responsible for greater tree densities than probably occurred historically; continued lack of periodic fire and dense canopy conditions may result in a further reduction in the successful recruitment of shortleaf pines and oaks in the future.
6. Constraints including insufficient personnel and financial resources, air quality concerns, insufficient technical guidance/assistance, logistical difficulties, and landowner liability issues limit the use of management tools such as prescribed burning and selective timber harvest to restore woodland conditions for the benefit of species of greatest conservation need.
7. The effects of prescribed burning on many species of greatest conservation concern are poorly known.
8. Prescribed burning is likely to be beneficial to all or most species, but the timing, frequency, and size of burns probably affect species differently.
9. Because changes in vegetation structure have occurred gradually, many landowners are not aware of changes.
10. Landowners that wish to restore vegetation structure or enhance habitat conditions for the benefit of species of greatest conservation need do not have information or technical assistance available to them.
11. Several exotic plant species such as *Sericea lespedeza*, Tall Fescue, and Japanese Honeysuckle have become established outside of cultivation and appear to displace native plants and plant communities which alter the habitat conditions for wildlife species of conservation need.
12. In local areas, heavy cattle grazing within Shortleaf Pine/Oak woodlands may reduce the abundance and diversity of understory vegetation, contribute to erosion on steep slopes and enhance the spread of undesirable exotic vegetation such as Japanese Brome and other weeds.

Conservation Actions:

- Use studies of historic fire regimes and the historic distribution of this woodland habitat to develop site-specific recommendations for the use of prescribed burning. These recommendations should evaluate the timing (i.e., season), sizes and frequencies of prescribed burns to balance the needs of fire dependent species (e.g., pines and some birds) and fire sensitive species (e.g., amphibians).
- Evaluate ways to reduce the impediments and constraints that reduce the use of prescribed fire as a management tool. These may include:
    - providing funding to organizations or agencies to assist with conducting controlled burns on private property,
    - developing technical assistance materials for landowners (e.g., publications, burning guidelines, workshops, and equipment rentals),
    - developing demonstration areas on public lands to show the results of management practices,
    - providing financial assistance or incentives to landowners to encourage woodland restoration,
    - developing burn cooperatives to work with agencies and landowners to increase the use of burning, and
    - looking for ways to reduce landowner liability while conducting burns (e.g., use of official burn protocols).
- Where appropriate, evaluate the use of regeneration cutting, thinning, or midstory reduction to diversify stand ages and/or decrease tree densities.
- Develop monitoring programs to evaluate the effects of management techniques such as prescribed fire and midstory tree thinning on populations of species of greatest conservation need and vegetation structure.

- Develop informational materials to inform landowners and the general public about the benefits of woodland restoration, the importance of fire in maintaining shortleaf pine-oak-hickory woodlands, and the wildlife diversity of this habitat type.
- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (e.g., displacement of native plant communities, predation on native animal populations, or hybridization with native species).
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need and develop control or management plans for them (e.g., controlled burns, herbicide treatment, and mechanical removal).
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species and develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Provide incentive payments to establish rotational grazing programs or to defer grazing on some areas during the growing season.

Conservation Issue: Fragmentation and conversion of Shortleaf Pine/Oak communities:

13. Fragmentation and loss of habitat caused by the conversion of Shortleaf Pine/Oak woodlands and forests to other land uses such as Loblolly Pine plantations, rangeland, or Fescue pastures.
14. Fragmentation and loss of habitat due to increasing numbers of residential developments including secondary homes, cabins, and ranchettes.
15. Fragmentation and loss of habitat due to expanding infrastructure including roads, utility lines, and pipelines.
16. Fragmentation of land ownership (i.e., more individuals owning smaller tracts of land).
17. Potential for increasing numbers of trails as recreational use of all-terrain vehicles and off-road vehicles increases, which may increase soil erosion in some areas or increase the spread of exotic weedy vegetation.

Conservation Actions:

- Develop ways to help families stay on the land and pass down large tracts of land from one generation to the next.
- Evaluate means to make it economically feasible for private landowners to maintain their land in Shortleaf Pine/Oak woodlands (e.g., encourage markets for oak and hickory timber or encourage groups of landowners to work together as a block to manage habitat for hardwood timber production or hunting leases).
- Develop programs to maintain large tracts of Shortleaf Pine/Oak woodlands such as conservation easements, conservation leases, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest “bang for the buck” or conservation efficiency.
- Evaluate methods to restore Shortleaf Pine/Oak woodlands from pastures or pine plantations, and develop cost-share programs, grants or financial incentives to encourage willing landowners to restore/replant these areas to pine/oak woodlands in order to increase acreage or tract size.
- Limit or regulate the recreational use of all-terrain and off-road vehicles on public lands but be sensitive need for these vehicles by some outdoor users such as nonambulatory/handicapped sportsmen.
- Coordinate with other agencies and research institutions to develop Best Management Practices and management recommendations to minimize the disturbance caused by and the ecological footprint left by road, pipeline, and utility line construction and right-of-way maintenance.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies, and utility companies for their consideration and use.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired and number of acres restored.
- Amount of technical assistance being provided.
- Number of landowners participating in landowner incentive programs.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Use of fire on the landscape.
- Vegetation response to fire (e.g., grasses and woody plants).

Conservation Landscape: Shortleaf Pine/Oak Woodland and Forest

The relative condition of Shortleaf Pine/Oak Woodland and Forest habitat is currently poor with a declining trend except for the McCurtain County Wilderness and the 400,000 acres managed by the Ouachita National Forest. This is the most widespread and abundant habitat type in this Region and is comprised of a mosaic of woodlands and forests dominated by Shortleaf Pine (*Pinus echinata*), and several species of oaks and hickories. These woodlands and forests are found on ridge tops, rocky east, south, and west-facing slopes, as well as the upper slopes of the broad valleys that separate the ridges within the Ouachita Mountains. The species composition of this habitat type is greatly influenced by slope aspect. This woodland community is dominated by an association of Shortleaf Pine–Post Oak (*Quercus stellata*)–Blackjack Oak (*Quercus marilandica*) on mid to lower slopes with an eastern, southern, or western aspect. Other common trees include Black Hickory (*Carya texana*) and Black Oak (*Quercus velutina*) with an herbaceous and short-shrub understory dominated by Little Bluestem (*Schizachyrium scoparium*), Lowbush Blueberry (*Vaccinium pallidum*), False Indigo (*Baptisia alba*), St John's Wort (*Hypericum hypericoides*), and Stiff Sunflower (*Helianthus divaricatus/hirsutus*). On upper slopes with a northern or eastern aspect, the woodland community is dominated by Shortleaf Pine, White Oak (*Quercus alba*), Black Oak (*Quercus velutina*) and Northern Red Oak (*Quercus rubra*). Other common trees in this community include Mockernut Hickory (*Carya tomentosa*) and Black Hickory (*Carya texana*) with a predominately shrubby understory of blueberry (*Vaccinium arboreum V. pallidum*), Winged Sumac (*Rhus copallina*), Blackberries (*Rubus sp.*), and American Beautyberry (*Callicarpa americana*).

Though data are sparse, historic accounts suggest that much of this habitat once occurred in a more open woodland condition (James 1823). Widespread tree harvest occurred in this habitat type in the early decades of the 1900s and this period has been followed by six or more decades of reduced fire frequency due to active fire suppression. As a result of the combination of large-scale harvesting and fire suppression, most of the current habitat is a more densely stocked, relatively even-aged, second-growth forest. In recent decades, some of these forests have been harvested a second time and replaced with forest stands that are heavily dominated by Shortleaf Pine or planted to Loblolly Pine plantations.

Recognized plant associations within this habitat type include:

Shortleaf Pine – Northern Red Oak – Black Oak Forest
Shortleaf Pine – Post Oak – Blackjack Oak Forest
Shortleaf Pine – White Oak – Black Oak Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Brown-headed Nuthatch	X							X
Bird	Kentucky Warbler		X						X
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Red-cockaded Woodpecker	X				X			
Bird	Red-headed Woodpecker		X			X			
Bird	Whip-poor-will		X						X
Inve	American Burying Beetle		X						X
Inve	Diana Fritillary	X							X
Mamm	Long-tailed Weasel				X				X
Mamm	Northern Long-eared Myotis				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining, and establish baseline population data/information.
- Assess the historic literature and conduct field investigations to evaluate the current and historic distributions and structural conditions of this habitat type.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

1. Relatively little of this habitat exists in a woodland condition, as much of it has gradually changed to a more forest-like condition, apparently the result of a loss of historic fire regimes due to active fire suppression.
2. Much of this habitat type currently exists as even-aged forest. This change from a woodlandcomprised of trees of diverse ages and heights to a forest of relatively even-aged tress appears to be an artifact of the widespread timber harvest that occurred in this region during the late 1800s and early 1900s.
3. The combination of even-aged stands and decades of fire suppression appear to be responsible for greater tree densities than probably occurred historically. If the lack of periodic fire and dense forest canopy conditions continues, it may reduce the successful recruitment of shortleaf pines and some species of oaks in the future.

4. There are constraints to using management tools such as prescribed burning to restore woodland conditions to stands that are currently forests. These include insufficient personnel and financial resources, lack of technical guidance/assistance, logistical difficulties, and landowner liability issues.
5. The effects of prescribed burning on many species of conservation concern are poorly known. It is likely to be beneficial to all or most species but the timing, frequency, and size of burns probably affect species differently.
6. Many landowners are not aware of the changes that have occurred in the condition of this habitat and do not have information or technical assistance available to them to restore habitats or enhance habitat structure for species of conservation need.
7. Fragmentation and loss of habitat caused by the conversion of mixed pine-hardwood woodlands to other land uses such as pine plantations, rangeland, secondary homes, cabins, and expanding infrastructure including roads, utility lines, and pipelines.
8. Fragmentation of land ownership (more individuals owning smaller tracts of land).
9. Continuous grazing within shortleaf pine-oak-hickory woodlands may reduce the abundance of understory vegetation, limit the recruitment of some forb and tree species, and spread undesirable exotic vegetation such as Brome and pasture weeds.

Conservation Actions:

- Use studies of historic fire regimes and the historic distribution of this woodland habitat to develop site-specific recommendations for the use of prescribed burning. These recommendations should evaluate the timing (i.e., season), sizes and frequencies of prescribed burns to balance the needs of fire dependent species (e.g., pines, some birds) and fire sensitive species (e.g., amphibians).
- Evaluate ways to reduce the impediments and constraints that reduce the use of prescribed fire as a management tool. These may include:
    - developing technical assistance materials for landowners (e.g., publications, burning guidelines, workshops, equipment rentals, and demonstration areas)
    - providing financial assistance or incentives to landowners to encourage woodland restoration,
    - developing burn cooperatives to work with agencies and landowners to increase the use of burning,
- Develop informational materials to inform landowners and the general public about the benefits of woodland restoration, the importance of fire in maintaining shortleaf pine-oak-hickory woodlands and the wildlife diversity of this habitat type.
- Evaluate means to make it economically feasible for private landowners to maintain their land in shortleaf pine-oak woodlands (e.g., encourage markets for oak and hickory timber, or encourage groups of landowners to work together as a block to manage habitat for hardwood timber production or hunting leases).
- Develop programs to maintain large tracts of shortleaf pine-oak-hickory woodlands such as conservation easements, conservation leases, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies and utility companies for their consideration and use.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned or treated, and the response by native vegetation.
- Changes in acreage of exotic vegetation & acres of native plant communities restored or enhanced0.
- Number of landowners participating in landowner incentive programs.
- Number of acres acquired or placed under easements.
- Relative condition (population size and trends) of species of greatest conservation need and key indicator species.

Conservation Landscape: Large River

The relative condition of Large River (Arkansas and Red Rivers) habitat is currently poor with a declining trend. The Arkansas River flows through the Arkansas River Valley that forms the northern edge of the Region. The Red River flows along and forms the southern border of the Region. Both rivers were historically deep, slow-moving, and turbid with a seasonal period of high flow in the spring months followed by a period of low flow during the summer months. The seasonal fluctuation in water volume maintains a dynamic mosaic of sandbars, mudflats, willow thickets, and sloughs along and within the river channels. Collectively these smaller habitat types are included in the habitat type that is referred to in this Strategy as the large river habitat. This mosaic of smaller habitats within the large river habitat system supports a diversity of species including the Least Tern on sandbars, shorebirds on mudflats, wading birds, amphibians and aquatic reptiles in sloughs, and the Bell's Vireo and Willow Flycatcher in willow thickets.

Both large river systems in the Region have been modified by the construction of upstream reservoirs, flood control projects, and the removal of riparian vegetation for agricultural purposes. The Arkansas River throughout this Region has been modified further by the construction of a commercial navigation system with a series of locks and dams along its length. All of these modifications have altered the normal season fluctuation in flow rates and the magnitude of annual flood events and have thus affected the ephemeral habitats such as sandbars, mudflats, and willow thickets associated with the rivers.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Interior Least Tern	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Snowy Egret								
Bird	Snowy Plover	X							X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Western Sandpiper	X							X
Bird	Wood Stork		X				X		
Fish	Alabama Shad	X							X
Fish	Alligator Gar	X				X			
Fish	Arkansas River Shiner	X				X			
Fish	Black Buffalo	X							X
Fish	Blue Sucker	X							X
Fish	Chub Shiner				X				X
Fish	Crystal Darter	X							X
Fish	Paddlefish		X				X		
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Fish	Red River Pupfish			X			X		
Fish	Red River Shiner			X			X		
Fish	River Darter	X					X		
Fish	Shorthead Redhorse	X							X
Fish	Shovelnose Sturgeon	X							X
Fish	Western Sand Darter	X							X
Inve	Black Sandshell	X				X			
Inve	Bleufer			X			X		
Inve	Monkeyface Mussel			X			X		
Inve	Mooneye	X				X			
Inve	Ohio River Pigtoe	X				X			
Inve	Ozark Pigtoe	X							X
Inve	Plain Pocketbook		X			X			
Inve	Threeridge Mussel			X			X		
Inve	Washboard			X			X		
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Rafinesque's Big-eared Bat				X				X
Mamm	River Otter		X					X	
Mamm	Southeastern Myotis				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	American Alligator				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete regarding the distribution and ecology of several species of greatest conservation need that occupy the large rivers in the Region. In order to establish effective conservation actions, more complete data are needed to determine the population status and trend for many species.
2. More thorough evaluations are needed to determine the factors that limit population sizes or are responsible for apparent declines.
3. More complete data are needed to determine management practices that may enhance populations of species of greatest conservation need, particularly for some species of fish and freshwater mussels.
4. Few data exist regarding the historic (presettlement) condition of large river habitat in Oklahoma. This information is important because this condition may serve as the desired goal for conservation efforts to achieve.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of population declines where these are suspected.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need. Taxonomic groups in greatest need of surveys include freshwater mussels and fish
- Verify the accuracy of existing data and assess changes in populations over time.
- Develop and maintain a database to store and analyze distributional and ecological data for species of greatest conservation need. Make these data available to natural resource planners (e.g., wildlife agencies and environmental agencies).
- Conduct surveys to identify important spawning areas for fish species of greatest conservation need. These sites could be the focus areas for habitat management, enhancement or restoration efforts.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Use historic literature and maps in conjunction with present-day field studies to evaluate the historic and present conditions (e.g., channel morphology, flow patterns, and water quality) of large rivers.
- Develop a monitoring program to track habitat condition/quality and the status of species of greatest conservation need over time.
- Use the results of surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management and share these results with water conservation and regulatory agencies.

Conservation Issue: Altered patterns of flow and decreasing water quantity:

5. Flow patterns have been modified on all of Oklahoma's large rivers as a result of reservoir construction. Reservoirs have been constructed to reduce the magnitude of naturally occurring floods to aid in the development of river floodplains. Reservoir construction on river mainstems and major tributaries alters the historic flooding frequencies and flow patterns. Reservoirs can reduce the magnitude of small floods especially the annual spring and early summer floods that naturally occur on

Oklahoma rivers. Reservoirs can reduce flow rates during normal summer low-flow periods by holding back water.

6. Groundwater in shallow aquifers and alluvial deposits that are connected to the river may be pumped for irrigation and residential uses, potentially affecting water inflows into the river and be especially problematic during drought and summer low-flow periods.
7. Reservoirs, flood control impoundments, and recreational ponds hold storm water runoff and can reduce the volume of surface flows that reach rivers and streams.
8. The loss of wetlands and the reduction in floodplain size due to levees and dikes reduces the ability of the land to hold and slowly release water, resulting in "flashier" stream and river flows in which flow is accelerated during storm events, but then rapidly drops afterward.
9. Surface flows are diverted from the river by impoundments on tributaries and then withdrawn from the system for irrigation and residential use. (In this Region, there has been discussion of further withdrawal of surface water in order to sell it to developing areas in northern Texas.)

Conservation Actions:

- Conduct studies of the habitat and flow needs for species of greatest conservation need.
- Establish minimum in-stream flow standards/requirements that will meet the needs of these species and conserve populations within the watershed.
- Ensure that the results of ecological studies are provided to water conservation and regulatory agencies (e.g., U.S. Army Corps of Engineers and Oklahoma Water Resources Board) so that water use decisions can be made using the best available information.
- Cultivate greater coordination and data sharing between the wildlife conservation organizations and the water regulatory agencies.
- Conduct studies assessing and comparing current and historic flow patterns on small rivers. Where changes in flow patterns are documented, evaluate methods to restore historic patterns such as modifying reservoir management to release water to mimic historic flows.
- Purchase conservation easements from private landowners or acquire property in title from willing sellers in the floodplains of river and streams.
- Restore, enhance or create wetlands on these acres to hold storm water and slowly release it to the river to limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Support and promote water conservation programs and public education efforts directed at water conservation.
- Develop monitoring programs for wildlife populations and habitat quality to assess the effects of flow management, habitat restoration, and conservation easement programs.
- Research alternative methods for flood control including levee removal and creation of floodplain wetlands.
- Increase the consideration that fisheries, wildlife, and recreation receive on federal reservoirs relative to the consideration received by hydropower and flood control.
- Explore the use of mitigation funds to offset the impacts of reservoirs and hydropower operations and the loss of fish populations due to entrainment and stranding.
- Discourage residential and infrastructure development within river floodplains that would contribute to efforts to channelize rivers, construct flood control impoundments, or remove wetlands.

Conservation Issue: Geomorphic alteration and fragmentation of river channels:

10. Large rivers normally meander through their floodplains and expand into their floodplains during major flood events. In an effort to control flooding on large rivers and to develop river floodplains, some human activities have taken place altering the channel structure. In addition to reservoir construction, these actions include:
    - construction of levees and dikes along rivers and within river floodplains to block channel movement or flood waters,
    - in-stream sand mining, and
    - creating channel constrictions or channelizing portions of rivers by dredging channels to make them deeper and narrower.
11. Dams alter the movement of sand, gravel, and other sediment within rivers by increasing their deposition within reservoirs. Over time, this alters the substrate below dams making these reaches of river rockier.
12. The construction of reservoirs reduces the amount of shallow moving water and increases the amount of deep, still, or slow-moving water.
13. Increased deposition of fine sediment from eroding banks settles into gravel beds and riffles impairs their quality as spawning areas for fish and habitat for freshwater mussels.
14. Dams, culverts, and some bridge designs can act as impediments to the upstream movements of fish and other aquatic wildlife.

Conservation Actions:

- Develop cost-share programs or grant programs to provide funding for landowners and conservation districts to restore the morphology of river channels.
- Support research into and possible use of alternative bank stabilization and channel restoration techniques that incorporate fluvial geomorphology principles.
- Increase the use of existing cost-share programs to restore riparian habitat and wetlands that stabilize banks, serve as filters of storm water, and as wildlife habitat.
- Improve the acceptability of these programs to private landowners or develop new programs.
- Purchase conservation easements from private landowners or acquire property in title from willing sellers within the floodplains of rivers and streams and in the headwaters of streams.
- Restore, enhance or create wetlands and riparian vegetation on these acres to stabilize stream banks and filter sediment to limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Develop monitoring programs for wildlife populations, habitat quality, and water quality to assess the effects of habitat restoration and conservation easement programs.
- Research the use of tax incentives or other programs to discourage residential and infrastructure development within river floodplains.
- Develop regulations that restrict or prohibit channel modifications, in-stream gravel and sand mining, and channel dredging.
- Evaluate the impact of structures that isolate populations of species of greatest conservation need or prevent these species from recolonizing reaches of rivers.
- Conduct studies of methods to minimize, reduce, or mitigate for these impacts.
- Research alternative methods of flood control such as levee removal or wetland restoration within floodplains.

Conservation Issue: Water quality changes as a result of nutrients, sediment, and other pollutants:

15. Nutrients are contributed to the rivers by several sources including concentrated animal operations (e.g., dairies, poultry houses, and their land application fields), septic systems from homes, nursery operations, fertilized crop fields, and municipal discharges.

16. The impairment of water quality in streams and small rivers ultimately affects water quality in large rivers.
17. Endocrine system disrupters in storm water runoff from agricultural fields and confined animal feeding operations enter rivers and may affect the reproduction and development of freshwater mussels and fish.
18. Septic systems and animal waste application fields that occur on porous soils in river floodplains can contribute nutrients and other pollutants to rivers through groundwater connections.
19. Wetlands within river floodplains have been filled or drained to create land for agricultural and residential purposes, reducing their values as important filters of storm water runoff keeping sediment and nutrients out of rivers, and as important breeding areas for amphibians and feeding areas for waterfowl and shorebirds.

Conservation Actions:

- Increase the use of Best Management Practices and conservation cost-share programs throughout the watershed to control nutrients and sediment in storm water runoff.
- Evaluate the need for better cost-share arrangements, more acceptable landowner incentives and revision of Best Management Practices to increase their use or benefit to species of conservation need.
- Provide cost-share funding for the construction of fences and alternative sources of water for livestock in order to keep cattle out of rivers and riparian areas.
- Develop and distribute educational materials to schools and landowners about Best Management Practices to control nutrients and sediment, the interconnection of rivers, wetlands and groundwater, and the importance of riparian vegetation and wetlands as filters for nutrients and sediment.
- Increase the use of existing cost-share programs to restore riparian habitat and wetlands that serve as filters of storm water and as wildlife habitat.
- Improve the acceptability of these programs to private landowners or develop new programs.
- Purchase conservation easements from private landowners or acquire property in title from willing sellers in the floodplains of river and streams and in the headwaters of streams.
- Restore, enhance or create wetlands and riparian vegetation on these acres to stabilize stream banks and filter sediment, nutrients, and other pollutants and to limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Develop monitoring programs for wildlife populations, habitat quality, and water quality to assess the effects of habitat restoration and conservation easement programs.
- Discourage residential development and confined animal feeding operations within river floodplains.
- Develop local stream teams or watershed groups comprised of citizens and/or governmental organizations to address local concerns, monitor water quality, monitor wildlife populations, and provide public outreach and education.

Conservation Issue: Invasive and exotic plants and animals:

20. Several exotic aquatic plant species may become established in the Red and Arkansas Rivers and these may affect habitat for other plant and wildlife species.
21. Exotic aquatic animals including Zebra Mussels and Bighead Carp could expand their ranges within the Red and Arkansas Rivers and affect native mussel, fish, and plant populations.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (e.g., displacement of native plant communities and predation or competition with native animal populations) to identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Provide the results of studies of exotic species impacts to landowners and conservation agencies/organizations.
- Improve coordination between wildlife biologists, conservation agencies, and agricultural organizations so that these groups can share information about the negative effects of using exotic animals and plants.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., herbicide treatment and mechanical removal).
- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Invasive species survey.
- Oklahoma Water Resources Board (e.g., water quality standards).
- Quantities of in-stream flows reserved for aquatic ecosystem conservation.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- U.S. Geological Survey gauging station for flows.

Conservation Landscape: Mesic Loblolly Pine/Oak Forest:

This habitat type is confined to the West Gulf Coastal Plain portion of the Region in southern McCurtain and eastern Choctaw counties. It occurs on relatively level, dry to mesic loamy and sandy soils. The dominant canopy trees include Loblolly Pine (*Pinus taeda*), Southern Red Oak (*Quercus falcata*), Water Oak (*Quercus nigra*), American Elm (*Ulmus americana*), Sweetgum (*Liquidambar styraciflua*), Green Ash (*Fraxinus pennsylvanica*), and Shumard Oak (*Quercus shumardii*). Common understory plants include Southern Waxmyrtle (*Myrica cerifera*), American Holly (*Ilex opaca*), Red Maple (*Acer rubra*), and Parsley Hawthorn (*Crataegus marshallii*), and Rattan Vine. In the Red River Valley, much of this habitat type has been converted to Loblolly Pine plantations or cleared for pasture or crop land.

Recognized plant associations (Hoagland 2000) include:

Loblolly Pine – Green Ash - American Elm Forest Association
Loblolly Pine – Sweetgum Forest Association

Habitat condition, species of greatest conservation need, conservation issues, conservation actions, and potential indicators for monitoring are incomplete.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Mole Salamander				X				X
Amph	Sequoyah Slimy Salamander				X				X
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Brown-headed Nuthatch	X							X
Bird	Kentucky Warbler		X						X
Bird	Prairie Warbler		X			X			
Bird	Red-headed Woodpecker		X			X			
Inve	American Burying Beetle		X						X
Inve	Diana Fritillary	X							X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	Rafinesque's Big-eared Bat				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Data are incomplete regarding both the historic and current distribution and condition of this habitat type.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need; to verify the accuracy of existing data; and to assess changes over time.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes, and evaluate factors that may be responsible for population declines,
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions),
    - develop a method to accurately identify and map the distribution, and if possible the condition, of this habitat to establish a current baseline, and
    - assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this habitat type. This should include the identification of a range of target vegetation conditions for restoration or management efforts.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Much of this habitat type currently exists as even-aged forest as a result of historic logging.
4. Habitat loss and fragmentation has occurred as a result of the conversion of loblolly pine/oak forest to other land uses such as loblolly pine plantations and pastures that are planted to Tall Fescue.
5. Secondary home developments, roads, and utility lines have further fragmented this habitat type.

Conservation Actions:

- Develop monitoring programs to evaluate the effects of management techniques such as prescribed fire and midstory tree thinning on populations of species of greatest conservation need and vegetation structure.
- Develop informational materials to inform landowners and the general public about the ecology and wildlife diversity of this habitat type.
- Evaluate means to make it economically feasible for private landowners to maintain their land in mixed loblolly pine-oak forest (e.g., encourage markets for oak and hickory timber, or encourage groups of landowners to work together as a block to manage habitat for hardwood timber production or hunting leases).
- Develop programs to maintain large tracts of mixed loblolly pine-oak-hickory forest such as conservation easements, conservation leases, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value.

- Evaluate methods to restore loblolly pine-oak forests from pastures or crop fields, and develop cost-share programs, grants, or financial incentives to encourage landowners to restore/replant these areas to pine-oak forest.
- Coordinate with other agencies and research institutions to develop Best Management Practices and management recommendations to minimize the disturbance caused by and the ecological footprint left by road, pipeline, and utility line construction, and right-of-way maintenance.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies and utility companies for their consideration and use.
- Purchase grazing rights to remove cattle or establish rotational grazing programs to defer grazing on some areas during the growing season or during some years, while still providing income for landowners.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

6. Several exotic plant species including Sericea lespedeza, Chinese Privet and Japanese Honeysuckle have become established outside of cultivation and appear to be displacing native plants and altering habitat conditions for wildlife species of conservation need.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species including displacement of native vegetation/plant communities, predation on native animal populations, or hybridization with native species.
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., controlled burning programs, herbicide treatment, and mechanical removal).
- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Develop an invasive/nuisance species management plan.
- Develop cost-share, or incentives programs for private landowners to encourage them to control invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Changes in acreage/coverage of exotic vegetation.
- Easements secured and acreage protected.
- Acres of native plant communities (species composition) restored.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Springs and Seeps:

Springs and Seeps are uncommon and very localized habitats that are typically found in association with wetlands or the headwaters of streams. Relative to the karst formations of the Ozark Plateau and the Arbuckle Mountains, the Ouachita Mountains have relatively few groundwater aquifers and springs. The few springs that are found at the headwaters of Ouachita Mountain streams are important to regionally endemic amphibians and invertebrates including the Ouachita Dusky Salamander (*Desmognathus brimelyorum*). Other Springs and Seeps occur in the West Gulf Coastal Plain portion of this Region in southern McCurtain, eastern Choctaw, and southern Atoka counties. These springs are typically found in areas of sandy soil near the bases of ridges and sandhills. These springs often support bog-like plant communities of ferns, aroids, orchids and Sphagnum Moss. The distribution and biological composition of springs and seeps is poorly known throughout this Region.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Four-toed Salamander				X				X
Amph	Many-ribbed Salamander				X				X
Amph	Ouachita Dusky Salamander				X				X
Amph	Ringed Salamander				X				X
Bird	Louisiana Waterthrush		X						X
Fish	Goldstripe Darter	X							X
Fish	Orangebelly Darter			X			X		
Inve	Kiamichi Crayfish		X					X	
Inve	Orconectes menae				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need thus making it difficult to identify management issues and establish effective corrective strategies.
2. Data are incomplete regarding the distribution and ecology of species of greatest conservation need that use this habitat type. In order to establish effective

conservation actions, data are needed to determine the population status and trends for species in this habitat.

3. Because springs and seeps are small locally occurring habitats that are found primarily on private property, they are difficult to locate and monitor. Additionally, springs and seeps are often overlooked in landscape planning because of their small size and difficulty to locate and map. As a result, the knowledge of spring locations and their biological compositions is incompletely known. Surveys and biological inventories of springs are needed for better conservation planning and implementation.

Conservation Actions:

- Conduct survey of technical experts to describe this habitat and identify its species of greatest conservation need.
- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of species of greatest conservation need (e.g., salamanders, crayfish, and aquatic insects), and examine possible causes of population declines where these are suspected.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances, and habitat affinities of species of greatest conservation need. Taxonomic groups in greatest need of surveys include amphibians, crayfish, and fish.
- Verify the accuracy of existing data and assess changes in populations over time.
- Develop and maintain a database to store and analyze distributional and ecological data for species of greatest conservation need.
- Develop and maintain a database to track the locations of springs, the biological communities, and water quality.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (e.g., through enhancement of habitat conditions).
- Use historic literature and existing maps in conjunction with field studies to determine the distribution and condition of springs.
- Use the results of surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Modifications of springs and seeps as a result of management practices:

4. Some springs have been physically modified by the installation of pipes or the construction of low concrete dams to create pools for recreation uses or to water livestock.
5. Springs are small fragile habitats that can be easily modified by activities around them. Riparian and aquatic vegetation has been mechanically cleared around some springs, and grazed/browsed by livestock around others. Loss or degradation of vegetation surrounding springs and seeps increases their susceptibility to siltation and changes in water temperature.
6. Man-made ponds and lakes have been constructed over springs and seeps, inundating them with deeper water, and altering their normal habitat structure.

Conservation Actions:

- Identify those springs and seeps that support species of greatest conservation need and are sites of high conservation priority.
- Develop a program to provide landowners with financial incentives to protect springs or place springs under conservation programs through the purchase of conservation easements on springs or acquisition of springs from willing sellers.

- Provide cost-share funding or grants to landowners to restore the structure of springs and the riparian vegetation around them. These actions can include removal of pipes, concrete, low dams, or fencing of springs to limit their access by livestock.
- Develop a monitoring program to measure the effectiveness of efforts to protect or restore springs and seeps on populations of species of greatest conservation need.
- Develop and distribute educational materials to landowners including Best Management Practices for use around springs, the biological diversity of springs, and the interconnection of springs, groundwater, and surface streams.

Conservation Issue: Changes in water quality and quantity affect springs:

7. Local groundwater withdrawal can reduce the flow of springs and streams.
8. In areas with coarse sandy soils, surface water enters the water table with very little filtration by the soil, easily carrying pesticides, fertilizers, animal wastes, and other water-soluble chemicals into the groundwater, surfacing at springs and negatively affecting aquatic life in springs and streams.
9. Water quality within springs may be affected by cattle and feral hogs watering in and grazing around springs and seeps through increased siltation of springs and increased nutrients in the water.

Conservation Actions:

- Identify springs and seeps that support populations of species of greatest conservation need, assess their current water quality/quantity, and evaluate the sources of existing or potential future water quality/quantity degradation.
- Conduct hydrological studies to delineate the recharge area surrounding biologically important springs to determine the surface acreage that needs the attention of conservation programs.
- Develop, publish, and distribute information about Best Management Practices and conservation recommendations for landowners to implement in order to protect groundwater quality/quantity around springs.
- Evaluate the existing conservation assistance programs for landowners (e.g., Farm Bill programs) to determine the applicability of these to the protection of springs and the quality of groundwater around springs.
- Help promote existing programs or increase the acceptability of these programs to landowners by providing better cost-share opportunities or more acceptable landowner incentives.
- Develop new cost-share programs to help landowners conserve groundwater quantity and protect groundwater quality within the recharge areas of biologically important.
- Construct fences around springs and provide alternative water sources for livestock in order to keep livestock and feral hogs out of springs.
- Develop monitoring programs for populations of species of greatest conservation need, water quality and water quantity to assess the effectiveness of groundwater conservation programs.
- Where feasible, involve the landowners by providing them with the equipment and supplies to conduct monitoring activities, or encourage the development of local citizen volunteer groups to conduct monitoring.
- Provide the results of water quality and quantity monitoring programs to the appropriate regulatory or landowner assistance agencies (e.g., Oklahoma Water Resources Board, Oklahoma Department of Environmental Quality, Oklahoma Conservation Commission, local Conservation District, and Natural Resources Conservation Service).
- Encourage programs to conserve groundwater.
- Discourage the selling of groundwater to users outside of the Region.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Amount of gravel mining reduction.
- Citizen's groups formed.
- Easements obtained.
- Protected springs/streams.
- Recreation users of streams.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stream and spring flow.
- Stream miles degraded.
- Water quality.

Conservation Landscape: Herbaceous Wetland

The relative condition of Herbaceous Wetland habitat is currently poor with a declining trend. Herbaceous wetlands in this Region are typically small patches of seasonally flooded habitat embedded within bottomland forests, prairies, and river floodplains. Vernal pools, which are seasonally flooded wetlands, could also be considered herbaceous wetlands though they do not often support diverse plant communities. Common herbaceous wetland plant associations include Ravensfoot Sedge (*Carex crus-corvi*) seasonally flooded marsh, Common Rush (*Juncus effusus*) seasonally flooded marsh, Softstem Bullrush (*Scripus tabernaemontani*), Spikerush (*Eleocharis sp.*) semi-permanently flooded marsh, and Broadleaf Cattail (*Typha latifolia*) semi-permanently flooded marsh. Other important herbaceous wetland plants include Barnyard Grass (*Echinochloa crus-galli*), Marsh Willowprimrose (*Ludwigia palustris*), and Sweetscent (*Pluchea odorata*) in seasonally flooded wetlands and Torrey Rush (*Juncus torreyi*), Broadleaf Arrowhead (*Sagittaria latifolia*), and Pickerelweed (*Pontederia cordata*) in semi-permanently flooded wetlands. More work is needed to identify the spatial distribution of herbaceous wetlands and the wildlife populations that use these.

Recognized herbaceous plant associations within this habitat include:

American Water-willow Temporarily Flooded Wetlands
Broadleaf Arrowhead – Longbar Arrowhead Semi-permanently Flooded Wetland
Broadleaf Cattail – Powdery Thalia Semi-permanently Flooded Marsh
Broadleaf Cattail Semi-permanently Flooded Marsh
Common Reed Semi-permanently Flooded Marsh
Common Rush Seasonally Flooded Marsh
Narrowleaf Cattail – Southern Cattail Semi-permanently Flooded Marsh
Pennsylvania Smartweed – Curlytop Smartweed Semi-permanently Flooded Wetland
Ravenfoot Sedge Seasonally Flooded Marsh
Softstem Bulrush – Common Spike Rush Semi-permanently Flooded Marsh
Water Smartweed Semi-permanently Flooded Wetland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Amph	Mole Salamander	X				X			
Amph	Three-toed Amphiuma				X				X
Amph	Western Lesser Siren				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Black Rail	X							X
Bird	Buff-breasted Sandpiper	X				X			
Bird	Canvasback	X							X
Bird	Hudsonian Godwit				X				X
Bird	Interior Least Tern	X							X
Bird	King Rail				X				X
Bird	LeConte's Sparrow		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Nelson's Sharp-tailed Sparrow	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Piping Plover	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Upland Sandpiper				X		X		
Bird	Western Sandpiper	X							X
Bird	Willow Flycatcher	X							X
Bird	Wilson's Phalarope				X				X
Bird	Wood Stork		X				X		
Bird	Yellow Rail				X				X
Inve	Oklahoma Clubtail	X							X
Inve	Ozark Emerald	X							X
Mamm	Marsh Rice Rat				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	Rafinesque's Big-eared Bat				X				X
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	American Alligator				X				X
Rept	Gulf Crayfish Snake				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X
Rept	Western Mudsnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete information regarding the distribution and locations of wetland habitats.
3. Incomplete information regarding the distributions and ecological needs of wetland wildlife species (e.g., which wildlife species occupy which wetland types).
4. The small size of wetlands makes them difficult to locate within larger habitat types such as prairies and woodlands.
5. There is incomplete knowledge about wetland ecology and the needs of wetland wildlife such that land landowners and conservation agency personnel lack knowledge regarding the effects of management practices on wetlands animals and plant communities.

Conservation Actions:

- Conduct regional survey for wetlands.
- Develop a database of wetland locations and conditions.
- Conduct biological inventories of wetlands to determine plant community composition and the distribution and abundances of wildlife species of conservation need.
- Conduct studies to determine the ecological needs of wetland wildlife species (e.g., types of plant communities and the timing and duration of flooding needed for each wildlife species).
- Produce educational information for landowners and conservation agency staff regarding the ecology of herbaceous wetlands by region and wetland type.
- Develop descriptions of what quality wetland habitats look like to serve as the target condition for wetland restoration and enhancement efforts.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Water quality changes which negatively affect both habitat and species:

6. Feedlots, dairies, hog farms, and chicken houses are often located near wetlands. Animal waste from these operations collects in wetlands basins and closed depressions.
7. Land application of animal wastes often occurs on fields near wetlands or that drain into wetlands where nutrients, hormones, pesticides, and other waste products collect.
8. Many wetlands lack buffer vegetation around them to control the movement of sediment, pesticides, and nutrients into the wetlands through storm water runoff from pastures, crop fields and residential areas.
9. Endocrine disrupters from animal hormones, pesticides, and agricultural chemicals enter wetlands in storm water runoff negatively affecting the growth, reproduction, and survival of amphibians, fish, and invertebrates.
10. Increased nutrient inputs due to crop/pasture fertilizers and land application of animal waste result in increased algae and bacteria in wetlands.
11. Grazing of wetlands by cattle increases nutrient inputs and alters the structure and diversity of wetland vegetation.

Conservation Actions:

- Increase the knowledge of and utilization of Farm Bill programs that improve water quality and protect wetlands (e.g., Wetland Reserve Program, planting of buffer strips, and buffer vegetation).
- Provide cost-share funding to landowners to construct fencing around wetlands to control access by cattle.
- Restore/plant native vegetation around wetlands to serve as a filter for storm water runoff to aid in the removal of sediment and nutrients in storm water runoff.
- Develop certification programs to recognize conservationists and land stewards of wetlands.
- Improve small landowner access and use of existing cost-share programs.
- Develop new or update existing Best Management Practices for controlling nutrients and sediment around wetlands.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

12. Invasive and exotic plant species become established in wetlands and compete with native vegetation.
13. Exotic plant species can dominate wetlands and reduce overall plant diversity and structural diversity reducing the wetlands' value as wildlife habitat.

Conservation Actions:

- Work with U.S. Fish and Wildlife Service to develop an invasive/nuisance species management plan.
- Remove exotic wetland plants and restore native plant communities.

Conservation Issue: Habitat loss and fragmentation from land management practices:

14. Woody plants such as willows and Salt Cedar encroach on and dominate herbaceous wetlands because of fire suppression and/or past overgrazing.
15. Heavy grazing of wetlands by cattle removes plant cover for wildlife, reduces the abundance of some wetland plants, and can lower overall plant diversity.
16. Seasonal wetlands are plowed and cropped which reduces perennial vegetation and alters the plant community composition and structure.
17. Wetlands are drained or filled to convert these lands to residential, agricultural, or industrial uses.
18. Water may be pumped from wetlands for irrigation.
19. Irrigation around wetlands may lower the water table in some areas and alter the time during which the soil is saturated.
20. Some wetlands are dredged or deepened to create ponds to hold irrigation water, to store water for cattle, or to create ponds for fishing resulting in a loss of shallow water habitat and may result in the introduction and establishment of predatory fish.

Conservation Actions:

- Use fire or mechanical cutting to remove woody vegetation that has encroached upon herbaceous wetlands.
- Provide cost-share funding or grants to construct fencing around wetlands to control the access to this habitat by cattle.
- Use land acquisition, perpetual easement program, or non-development easement program to place wetlands into conservation ownership or stewardship.
- Acquire wetlands or purchase conservation easements on cropped wetlands then restore these.
- Improve the incentives for Wetland Reserve Program enrollments.
- Provide incentives or funding to cover the costs of maintaining wetlands.
- Provide cost-share funding or grants to restore farmed wetlands.

- Provide information to landowners and the public regarding the ecological values of wetlands, especially seasonal wetlands.
- Improve the technology of irrigation to conserve groundwater, and reduce groundwater withdrawals.
- Produce education and outreach materials about swampbusting laws and practices.
- Increase the knowledge of and utilization of Farm Bill programs to conserve wetlands such as the Wetland Reserve Program.
- Use land acquisition and conservation easement programs to place herbaceous wetlands under conservation ownership or stewardship.
- Acquire former wetlands and restore these through a combination of dredging, diking, and re-vegetation.
- Facilitate crop selection and diversification to move agriculture away from crops with high water needs.
- Improve landowner access to cost-share programs (e.g., improve cost-share ratios and economic incentives).
- Develop tax breaks for landowners that maintain wetlands.
- Connect wetland owners with entities seeking wetland mitigation credits.
- Improve the economic incentive to retain wetlands in agricultural areas.
- Provide funding or incentives to cover the costs of maintaining wetlands.
- Increase Conservation Reserve Enhancement Program enrollments.
- Help the Natural Resources Conservation Service conduct wetland conservation planning.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres in conservation programs.
- National Wetland Inventory.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Tallgrass Prairie

The relative condition of Tallgrass Prairie habitat is currently poor with a declining trend. Tallgrass prairie habitat is uncommon in this Region and occurs locally as small tracts in the Arkansas River valley, Red River valley, and the broad valleys that separate the western ridges of the Ouachita Mountains. More research is needed to evaluate the historic distribution and composition of tallgrass prairies in this Region and to identify existing tracts of native prairie. Historically, Tallgrass Prairie occurred on sites that possessed deep soils and were subject to frequent fires. The tallgrass prairie community is dominated by Big Bluestem (*Andropogon gerardi*) and Indian Grass (*Sorghastrum nutans*). Other common grasses and forbs include Eastern Gamagrass (*Tripsacum dactyloides*), Switchgrass (*Panicum virgatum*), Tall Dropseed (*Sporobolus asper*), Little Bluestem (*Schizachyrium scoparium*), Purple Prairie Clover (*Dalea purpurea*), Blazing Star (*Liatris pycnostachya*), Narrow-leaved Sunflower (*Helianthus angustifolius)*, Rosinweed (*Silphium laciniatum*), Giant Coneflower (*Rudbeckia grandiflora*), and Wild Indigo (*Baptisia alba*).

Recognized plant associations within this habitat type include:

Big Bluestem – Little Bluestem – Indian Grass Grassland
Big Bluestem – Switchgrass Grassland
Little Bluestem – Big Bluestem Grassland
Little Bluestem – Indian Grass Grassland
Switchgrass – Eastern Gamagrass Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Harris's Sparrow		X						X
Bird	Henslow's Sparrow	X							X
Bird	LeConte's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		
Inve	American Burying Beetle		X						X
Inve	Prairie Mole Cricket	X				X			
Mamm	Eastern Harvest Mouse				X				X
Mamm	Long-tailed Weasel				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete regarding the status and distribution of several species of greatest conservation need that occur in Tallgrass Prairie communities. In order to establish effective conservation actions, more complete data are needed to determine the population status and trend for many species, and more thorough evaluations are needed to determine the factors that limit population sizes or are responsible for apparent population declines.
2. Much of the Tallgrass Prairie community has been altered or converted to other uses. Better data are needed regarding the current and historic extent and location of Tallgrass Prairie and the factors that determine vegetation structure and maintained prairies historically.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, and habitat affinities of Tier I and Tier II species of greatest conservation need (e.g., Loggerhead Shrike and Northern Bobwhite) and examine possible causes of suspected population declines.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need.
- Verify the accuracy of existing data and assess changes over time.
- Develop databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (e.g., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and the condition of Tallgrass Prairie habitat to establish a current baseline.

- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this habitat type. Soil survey maps may be helpful tools in conducting this process.
- Use the results of these surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Habitat fragmentation and conversion of Tallgrass Prairies to other land uses:

3. Prairies are often level and possess deep or rich soils which make them desirable areas for residential and agricultural uses.
4. Much of the Tallgrass Prairie acreage in this Region has been converted to crop fields or Fescue pastures, causing loss of seasonal wetlands that are important to amphibians and birds.
5. Fragmentation and loss of prairie habitat due to expanding infrastructure including roads, utility lines, and pipelines.
6. Herbicide use in right-of-way management may reduce the abundance and diversity of native forbs and shrubs that are food and habitat for some species of greatest conservation need (e.g., Bell's Vireo and Northern Bobwhite).
7. Fragmentation of land ownership, with a trend for more individuals owning smaller tracts of land.

Conservation Actions:

- Evaluate means to make it economically attractive for private landowners to maintain prairie habitat on their land or to restore introduced pastures to native grasses and forbs (e.g., conduct studies on the cost/benefit ratio of raising livestock on native prairie versus introduced pasture, encourage markets for native prairie hay, or encourage groups of landowners to work together as a block to manage habitat for hunting leases).
- Develop ways to help families stay on the land and pass down large tracts of land from one generation to the next (e.g., tax breaks or ranch diversification incorporating hunting leases or agritourism as additional sources of income).
- Develop programs to maintain biologically meaningful tracts of native prairie habitat such as conservation easements, conservation leases, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest "bang for the buck" or conservation efficiency.
- Evaluate techniques for restoring Fescue pastures and crop fields to native prairie grasses and forbs.
- Develop cost-share programs, grants, or financial incentives to assist willing landowners who wish to restore these areas to native Tallgrass Prairie.
- Coordinate with other agencies and research institutions to develop or update Best Management Practices and management recommendations to minimize the disturbance caused by and the ecological footprint left by road, pipeline, and utility line construction and right-of-way maintenance activities such as herbicide use and mowing.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies, and utility companies for their consideration and use.
- Modify or remove federal cost-share and subsidy programs that encourage the fragmentation or conversion of untilled prairies.
- Modify or remove government loan programs that require or encourage private landowners to convert native prairies and shrublands to tame pastures.
- Encourage the use of native grasses and forbs in the reclamation of surface coal mines and natural gas drilling sites.

Conservation Issue: Altered vegetation structure as a result of current and historic land management practices:

8. Long-term fire suppression and the loss of historic fire regimes have changed the structure of many prairies by allowing for increases in some prolific woody plant species including sumacs, Winged Elm, and Eastern Redcedar, and have fostered the spread of invasive non-native grasses and forbs (e.g., *Seracia Lespedeza* and Tall Fescue).
9. Several constraints discourage landowners and agencies from using prescribed burning as a land management tool to maintain prairies. These constraints include limited personnel and financial capacity to conduct burns, landowner liability issues, air quality concerns, logistical difficulties conducting burns in developed areas, and lack of technical assistance in conducting burns.
10. There is a scarcity of data from which to evaluate the effects of controlled burning on many species of greatest conservation need. Because periodic fire is required to maintain prairie habitats, it is almost certain that most prairie-dependent species will benefit from prescribed burning, but the populations of individual species are likely to respond differently to the timing, frequency, and spatial scale of prescribed burns.
11. Herbicide use may decrease native forb abundance and diversity. Aerial applications of herbicides have been used to control/remove shrubs and oaks from prairies, and prairie edges. Shrub and forb diversity is a natural part of prairie habitat in this Region and is important to several species of conservation need including Bell's Vireo and Northern Bobwhite.
12. Tallgrass prairie communities historically were maintained by periodic fire and seasonal grazing. Fire probably played a greater role than grazing in maintaining the structure and species diversity of Tallgrass Prairie in this Region.
13. Continuous grazing by livestock often results in a decline in abundance of some grasses and forbs (e.g., Eastern Gamagrass and Compass Plant) and increases in other less desirable species (e.g., winter annuals, exotic pasture weeds, and Japanese Brome). Presettlement grazing activity was probably seasonal or occurred sporadically, while present day livestock grazing is often continuous.
14. Cattle grazing may enhance local populations of Brown-headed Cowbirds, which parasitize the nests of Prairie Warblers and other songbird species of conservation need.

Conservation Actions:

- Use studies of historic fire regimes and the historic distribution of this woodland habitat to develop site-specific recommendations for the use of prescribed burning based on evaluations of the timing (i.e., season), sizes and frequencies of prescribed burns to balance the needs of the range of fire dependent species (e.g., prairie grasses and birds).
- Modify or remove federal cost-share and subsidy programs that encourage the application of herbicides on prairies in ways that reduce native plant diversity or negatively alter prairie structure.
- Support herbicide use to control exotic and invasive vegetation, but not to encourage tame grasses at the expense of native grasses.
- Evaluate ways to reduce the impediments and constraints that reduce the use of prescribed fire as a management tool. These may include:
    - providing funding to agencies to assist with conducting controlled burns on private property,
    - developing technical assistance materials for landowners (e.g., publications, burning guidelines, workshops, and equipment rentals),
    - developing demonstration areas on public lands to show the results of prescribed burning and other land management recommendations,
    - providing financial assistance or incentives to landowners to encourage woodland restoration.

  - developing burn cooperatives to work with agencies and landowners to increase the use of burning, and
  - looking for ways to reduce landowner liability while conducting burns (e.g., use of official burn protocols).
- Evaluate the use of mowing or brush-hogging as alternatives to conducting burns in developed areas.
- Develop monitoring programs to evaluate the effects of prescribed fire on populations of species of greatest conservation need, prairie diversity, and vegetation structure.
- Develop informational materials to inform landowners and the general public about the biological diversity of native Tallgrass Prairies and the importance of fire in maintaining prairie communities.
- Provide payments to defer grazing while still providing income for landowners or to establish rotational grazing programs to defer grazing on some areas during the growing season or for periods of one or more years.

Conservation Issue: Invasive and exotic plants and animals:

15. Several exotic plant species such as *Sericea lespedeza* and Tall Fescue have become established in prairie habitats and are displacing native plants and altering prairie habitat conditions for wildlife species of conservation need.
16. Tall Fescue that has been planted for introduced pastures has spread beyond pastures and into native habitats.
17. Some agencies and organizations are promoting exotic plants for erosion control, livestock forage, beautification programs, and wildlife habitat that are invasive.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (e.g., displacement of native vegetation/plant communities, predation on native animal populations, or hybridization with native species) to identify those exotic species causing the greatest impact to prairie communities and species of greatest conservation need.
- Provide the results of studies of exotic species impacts to landowners and conservation agencies/organizations.
- Improve coordination between wildlife biologists, conservation agencies, and agricultural organizations so that these groups can share information about the negative effects of using exotic plant materials.
- Reduce the number of invasive and exotic species being recommended for erosion control (e.g., *Sericea lespedeza*) and other uses.
- Develop control or management plans (e.g., controlled burning programs, herbicide treatment, and mechanical removal) for the exotic species that cause the greatest ecological damage.
- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Changes in acreage/coverage of exotic vegetation.
- Easements secured and acreage protected.
- Acres of native plant communities (species composition) restored.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Species declining outside Oklahoma but still common in this habitat.

Conservation Landscape: Sandy (soft)-bottom Streams and Associated Riparian Forests

The relative condition of Sandy (soft)-bottom Streams and Associated Riparian Forests habitat is currently poor with a declining trend. Streams with a sandy, silty, or other fine substrate are found in relatively level, low-elevation landscapes throughout the Region including broad valleys between mountain ridges in the Ouachita Mountains and most of the West Gulf Coastal Plain and Arkansas River Valley areas. Though data are limited, the majority of these streams appear to have once been slightly entrenched with a low width to depth ratio and with a moderate to high number of meanders (i.e., degree of sinuosity). While some streams retain this look, many have been modified or channelized during the past century. These streams support riparian forests along their banks, but the width of these riparian forests is often narrower now than historically due to the conversion of forest to other land uses. Riparian forests in this habitat type are variable in their species composition, but are typically dominated by Sycamore (*Platanus occidentalis*), Black Willow (*Salix nigra*), Sugarberry (*Celtis laevigata*), River Birch (*Betula nigra*), Red Elm (*Ulmus rubra*), Water Oak (*Quercus nigra*), and Green Ash (*Fraxinus pennsylvanica*). Understory vegetation is often abundant and includes Deciduous Holly (*Ilex decidua*), Hawthorns (*Crataegus sp.*), Buttonbush (*Cephalanthus occidentalis*), Smooth Alder (*Alnus serrulata*), and Roughleaf Dogwood (*Cornus drummondii*). Extensive shrublands of Giant Cane (*Arundinaria gigantea*) once occurred along many of the larger soft-bottom streams but the extent of this plant community is currently much reduced.

Recognized riparian plant associations within this habitat include:

American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
Eastern Cottonwood – American Elm – Sugarberry Temporarily Flooded Forest
Eastern Cottonwood – Black Willow Temporarily Flooded Forest
Giant Cane Temporarily Flooded Shrubland
Green Ash – American Elm Temporarily Flooded Forest
Green Ash – Cedar Elm – Sugarberry Temporarily Flooded Forest
Green Hawthorn – Cockspur Hawthorn – Downy Hawthorn Temporarily Flooded Shrubland
River Birch – Sycamore – Smooth Alder Temporarily Flooded Forest
Silver Maple – Boxelder Temporarily Flooded Forest
Smooth Alder – False Indigo Temporarily Flooded Shrubland
Spring Witch-Hazel – Silky Dogwood Temporarily Flooded Shrubland
Swamp Privet – Buttonbush Semi-permanently Flooded Shrubland
Sycamore – Boxelder Temporarily Flooded Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Fish	Blackspot Shiner	X							X
Fish	Creole Darter	X							X
Fish	Cypress Minnow	X							X
Fish	Goldstripe Darter	X							X
Fish	Pallid Shiner (Chub)	X							X
Mamm	Northern Long-eared Myotis				X				X
Mamm	Rafinesque's Big-eared Bat				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Southeastern Myotis				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	American Alligator				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Water quality changes which negatively affect both habitat and species:

3. The presence of confined animal feeding operations such as cattle feedlots, poultry houses, and hog farms multiply the effects of waste application fields that may runoff into streams and drainages.
4. Additional nutrients enter streams as a result of cattle and livestock watering in streams and grazing in riparian areas.
5. Increased nutrient levels in streams increases the abundance of algae, which can result in other water quality impacts such as increased fluctuations in dissolved oxygen.
6. Endocrine disrupters and other pollutants enter streams in storm water runoff from agricultural fields that alter the growth, reproduction and/or survival of fish, amphibians and invertebrates in the streams.

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point source) through Best Management Practices, Farm Bill cost-share programs, and landowner incentives programs.
- Provide alternative water sources for livestock to keep them out of streams.
- Increase landowner education efforts regarding: the watershed concept, importance of riparian habitat, Best Management Practices for controlling nutrients, and existing Farm Bill conservation programs to control nutrients.
- Develop conservation easements or acquire land to maintain, or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Establish set back distances between streams and confined animal feeding operations, waste lagoons, and land application areas.
- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit their access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Conduct management pilot studies to determine successful strategies.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve the knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.

Conservation Issue: Water quality changes that negatively affect both habitat and species:

7. Many streams in the Region have been channelized and straightened, causing them to become deeply incised and the no longer connected with their riparian vegetation.
8. Streams with incised channels have cut banks that are prone to erosion that increases sediment loads in the streams.
9. Lack of connection between streams and riparian vegetation due to the channelization and incising of streams resulting in reduced riparian vegetation and a loss of wetlands within the stream floodplain.
10. Water is being pumped from streams for irrigation.
11. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes, lowering water tables and reducing the flow volume of springs and seeps that feed streams.
12. Increased pond construction may be lowering the inflow that sustains streams.
13. Bridges can impact streams by altering stream channels, erosion, and flow.
14. Some types of culverts can become barriers to the movement of fish during low-flow conditions.

15. Dams and bridges across streams can create fish barriers that affect the populations of fish and freshwater mussels.
16. Dams and diversion structures alter the natural flow patterns and other processes of streams, especially the frequency and magnitude of natural flooding events that are required to maintain downstream channels and banks.

Conservation Actions:

- Provide cost-share funding or grants to restore stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams.
- Conduct management pilot studies to determine successful management strategies.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Anticipate and articulate the potential affect of proposals to sell water outside of the state, or the transfer of water between basins within Oklahoma to Legislature and the Congressional delegation.
- Provide the results of ecological studies to water use planners and those who issue permits.
- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals, and inter-basin transfers of water.
- Work collaboratively with landowners to remove ponds and impoundments that have been shown to block the movement of fish species of conservation need.
- Work collaboratively with landowners to remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Work collaboratively with landowners to replace ponds that have been constructed on streams with alternative water sources (e.g., for livestock).
- Work collaboratively with public managers to modify pond and reservoir management to ensure that minimum in-stream flows are maintained.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

17. Invasive species encroachment (e.g., Privet and Japanese Honeysuckle).

Conservation Actions:

- Control invasive species and avoid new introductions of exotic species.
- Create burn cooperatives.
- Re-evaluate burning laws in Oklahoma.
- Educate landowners and general public about impacts of invasive and exotic plants and animals.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Number of denied applications for exotic species introductions.
- Quantities of in-stream flows reserved for aquatic ecosystem conservation.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- U.S. Geological Survey monitoring stations.

Conservation Landscape: Post Oak/Blackjack Oak Woodland

The relative condition of Post Oak/Blackjack Oak Woodland habitat is currently poor with a declining trend. Dry upland forests of Post Oak (*Quercus stellata*) and Blackjack Oak (*Quercus marilandica*) are uncommon in this Region and are found primarily on rocky sandstone ridges in the western margin of the Ouachita Mountains and the Arkansas River valley. Where these forests occur, the dominant Post Oaks and Blackjack Oaks are found with Black Hickory (*Carya texana*), Winged Elm (*Ulmus alata*), and Black Oak (*Quercus velutina*). Common understory plants include Lowbush Blueberries (*Vaccinium pallida*), Mexican Plum (*Prunus mexicana*), and Winged Sumac (*Rhus copallina*). This habitat type resembles an eastern extension of the Post Oak/Blackjack Oak Woodlands that are the dominant habitat in the Crosstimbers Region.

Recognized plant associations within this habitat type include:

Post Oak – Blackjack Oak – Black Hickory (Farkleberry) Forest
Post Oak – Winged Elm Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance and trend of each species are described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Bachman's Sparrow	X							X
Bird	Harris's Sparrow		X						X
Bird	Kentucky Warbler		X						X
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Inve	American Burying Beetle		X						X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Northern Scarletsnake				X				X
Rept	Western Diamond-backed Rattlesnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete regarding the habitat needs, geographic distribution, and population status of many Tier I and Tier II species of greatest conservation need that use this habitat type. In order to establish effective conservation actions, more complete data are needed to determine the population status and trend for many species and a more thorough evaluation is needed to determine the factors that limit population sizes or are responsible for declines.
2. More complete information is needed to determine the distribution and acreage of this habitat and the factors that shape vegetation structure (i.e., where forests and woodlands occurred historically) to assess site-specific habitat condition goals.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances, habitat affinities of species of greatest conservation need (e.g., Bachman's Sparrow and Eastern Spotted Skunk), and develop hypotheses to test to examine the causes of suspected population declines.
- Conduct field surveys to establish a baseline conditions for the current distributions, abundances and vegetation affinities of all species of greatest conservation need.
- Verify the accuracy of existing data and assess population changes over time.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need (e.g., Prairie Warbler, Bachman's Sparrow, Eastern Spotted Skunk, and Scarlet Snake) to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and the condition of this habitat to establish a current baseline.
- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this vegetation community, including identification of the probable locations and distributions of oak-hickory vegetation in forest, woodland, and savannah conditions.
- Use the results of surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Altered habitat structure and condition as a result of historic and current land management practices:

3. Relatively little of this habitat exists in a woodland condition. Much of the intact oak/hickory community has gradually changed from a mosaic of woodlands and forests to a more uniformly forest-like condition, most likely because of is the loss of historic fire regimes due to active fire suppression and reduced fire frequencies.
4. Many acres of habitat exist as even-aged forests. This change from woodlands and forests comprised of trees of diverse ages and heights to large even-aged stands is probably the result of widespread timber harvest during a relatively short period of time in the late 1800s or early 1900s.
5. The combination of even-aged stand structure and long-term fire suppression appear to be responsible for greater tree densities than probably occurred historically and for an increase in abundance of some tree species such as Eastern Redcedar.
6. Several constraints limit the use of management tools such as prescribed burning and selective tree harvest to restore woodland conditions to stands that are currently

forests, and to diversify the structure of existing forests and woodlands. These constraints include: insufficient personnel and financial resources, air quality concerns, insufficient guidance/assistance, logistical difficulties, and landowner liability issues.

7. Because habitat structure has changed slowly, many people are unaware that changes have occurred. Landowners who wish to restore or enhance oak/hickory woodlands and forests and benefit wildlife species of greatest conservation need do not have information or technical assistance available to them.
8. In some areas, continuous grazing within oak/hickory woodlands and forests appears to have reduced the abundance of herbaceous understory vegetation and increased the abundance of Eastern Redcedar, which may enhance the spread of undesirable exotic vegetation such as Japanese Brome or enhance populations of Brown-headed Cowbirds which parasitize the nests of Prairie Warblers and other songbird species of conservation need.
9. Several exotic plant species such as *Sericea lespedeza* and Japanese Honeysuckle have become established outside of cultivation and appear to displace native plants and to alter the habitat conditions for wildlife species of conservation need.

Conservation Actions:

- Conduct research into historic fire regimes and the historic distributions of woodlands and forests.
- Develop recommendations for the use of prescribed burning. Such recommendations should evaluate the timing (i.e., season), sizes and frequencies of prescribed burns to balance the needs of fire dependent (i.e., some birds and plants) and fire sensitive species (e.g. amphibians).
- Evaluate ways to reduce the impediments and constraints that reduce the use of prescribed fire as a management tool. These may include:
    - providing funding to agencies or organizations to assist with conducting controlled burns on private property,
    - developing technical assistance materials for landowners (e.g., publications, burning guidelines, workshops, and equipment rentals),
    - developing demonstration areas on public lands to show the results of recommended land management practices,
    - providing financial assistance or incentives to landowners to encourage woodland restoration,
    - developing burn cooperatives to work with agencies and landowners to increase the use of burning, and
    - looking for ways to reduce landowner liability while conducting burns (e.g., use of official burn protocols).
- Evaluate the use of mowing or brush-hogging as an alternative to conducting burns particularly in urbanizing areas.
- Develop monitoring programs to evaluate the effects of management techniques such as prescribed fire and tree harvest on populations of species of greatest conservation need and vegetation structure.
- Develop informational materials to inform landowners and the general public about the benefits of woodland restoration, the importance of fire in maintaining oak and hickory habitats, and the wildlife diversity of oak/hickory habitats.
- Provide payments to reduce cattle densities or establish rotational grazing programs to defer grazing on some areas during the growing season.
- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species. Type of damage may include displacement of native vegetation/plant communities, predation on native animal populations, or hybridization with native species.
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need and develop control or management plans for these

species (e.g., controlled burning programs, herbicide treatment, and mechanical removal).
- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.

Conservation Issue: Fragmentation and conversion of habitat:

10. Fragmentation and loss of habitat caused by the conversion of oak/hickory woodlands and forests to other land uses such as Loblolly Pine plantations, rangeland, or introduced pastures that are planted to Tall Fescue.
11. Fragmentation and loss of habitat due to increasing number of residential developments including secondary homes, cabins, and ranchettes.
12. Fragmentation and loss of habitat due to expanding infrastructure including roads, utility lines, and pipelines.
13. Fragmentation of land ownership with more individuals owning smaller tracts of land.

Conservation Actions:

- Develop ways to help families pass down large tracts of land from one generation to the next.
- Evaluate means to make it economically feasible for private landowners to maintain their land in oak/hickory vegetation (e.g., encourage markets for mature oak and hickory timber or encourage groups of landowners to work together as a block to manage habitat for hardwood timber production or hunting leases).
- Develop programs to maintain large tracts of oak/hickory woodlands and forests such as conservation easements, conservation leases, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest "bang for the buck" or efficiency.
- Evaluate methods to restore oak/hickory woodlands from pastures or crop fields.
- Develop cost-share programs, grants or financial incentives to assist willing landowners who wish to restore/replant these areas to oak/hickory woodlands.
- Coordinate with other agencies and research institutions to develop Best Management Practices and management recommendations to minimize the ecological footprint left by road, pipeline, utility line construction, and right-of-way maintenance.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies, and utility companies for their consideration and use.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Changes in acreage/coverage of exotic vegetation.
- Acres of native plant communities (species composition) restored.
- Number of easements secured and acreage protected.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Species declining outside Oklahoma but still common in this habitat.

Potential partnerships to deliver conservation for Ouachita Region:

State Government

- Arkansas Natural Heritage Commission
- Arkansas/Oklahoma Compact Commission
- Oklahoma Biological Survey
- Oklahoma Corporation Commission
- Oklahoma Department of Agriculture and Forestry Service
- Oklahoma Department of Environmental Quality
- Oklahoma Legislature
- Oklahoma Natural Heritage Inventory
- Oklahoma State University, Cooperative Extension Service
- Oklahoma Tourism and Recreation Department & State Parks
- Oklahoma Department of Wildlife Conservation
- Oklahoma Water Resources Board
- Other state universities and departments
- Other state-funded museums
- State of Arkansas
- States of Arkansas and Texas
- University of Oklahoma, Oklahoma Biological Station

Federal Government

- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Department of Agriculture, Farm Service Agency
- U.S. Department of Agriculture, Forest Service, Ouachita National Forest
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Agriculture, Resource Conservation and Development Councils
- U.S. Department of the Interior, Bureau of Land Management
- U.S. Department of the Interior, National Park Service
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Fish and Wildlife Service, Little River National Wildlife Refuge
- U.S. Fish and Wildlife Service, Sequoyah National Wildlife Refuge
- U.S. Geological Survey

Local Government

- Municipalities in Oklahoma, Arkansas, and Texas
- Municipalities wanting to buy water
- Tribal governments

Businesses, Citizens and Citizen Groups

- Local Audubon Societies
- Bat Conservation International
- Canoe Operators Association
- Central Hardwoods Joint Venture
- Chambers of Commerce
- Ducks Unlimited and local Oklahoma chapters
- Farm Bureau
- Farmers Union
- Hunting cooperatives
- Kerr Center for Sustainable Agriculture
- Land Legacy Initiative

- Local citizen's groups
- Lower Mississippi Valley Joint Venture
- National Rivers Society
- National Wild Turkey Federation and local Oklahoma chapters
- Oklahoma Anglers United
- Oklahoma Cattlemen's Association
- Oklahoma Forestry Association
- Oklahoma Native Plant Society
- Oklahoma Ornithological Society
- Oklahoma Section of the Society for Range Management
- Other sportsmen's groups
- Private landowners
- Sardis Lake Water Alliance
- Sierra Club
- Small Woodland Owner's Association
- Southern Oklahoma Water Alliance
- The Nature Conservancy
- The Wildlife Society
- Timber Companies
- Urban development groups
- Vernal Pool Society
- West Gulf Coastal Plain Bird Conservation Initiative

Ozark Region

The Ozark Region encompasses all or portions of Ottawa, Delaware, Mayes, Cherokee, Adair, and Sequoyah counties. It is equivalent to the combination of the Ozark Highlands and the Boston Mountains in both Bailey's and Omernick's ecological classification systems.

The best professional judgment of the advisory group and technical experts was used to identify each Conservation Landscape's status and trend. And, even though some issues and actions apply to multiple Regions, each Region chapter is designed to stand-alone.

Conservation Landscapes listed in general priority order:

- Very High priority Conservation Landscapes:
  - Small River
  - Limestone Cave
  - Springs
  - White Oak/Hickory Mesic Forest
  - Gravel-bottom Streams and Associated Riparian Forests
- High priority Conservation Landscapes:
  - Shortleaf Pine-Oak-Hickory Woodlands
  - Herbaceous Wetland
  - Oak/Hickory Bottomland Hardwood Forest
- Moderate priority Conservation Landscapes:
  - Post Oak/Blackjack Oak-Hickory Woodlands and Forests
  - Tallgrass Prairie
  - Large River (Grand-Neosho River)

Conservation Landscape: Small River

The relative condition of Small River habitat is currently good with a declining trend. Small river habitat in the Ozark Region of Oklahoma is limited to the Spring and Illinois rivers, each of which is a tributary of the Grand/Neosho River. The lower portions of both rivers have been affected by impoundments that have reduced their effective lengths. The Spring River flows for approximately 15 miles in Oklahoma before reaching Grand Lake of the Cherokees. The lower part of the Illinois River has been impounded by the construction of Tenkiller Reservoir, which has reduced its length to approximately 40 miles of flowing water. Both the Spring and the Illinois are clear swiftly-flowing rivers with gravel to cobble substrates. Flow rates are typically greater during the winter and spring months and lower during the summer and fall. These small rivers contain gravel bars and sloughs but not the dynamic mosaic of sandbars, mudflats and sloughs that are found within the larger rivers. Sloughs along these rivers are typically rocky and surrounded by woody vegetation including River Birch (*Betula nigra*), Sycamore (*Platanus occidentalis*), and Red Maple (*Acer rubra*).

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Many-ribbed Salamander				X				X
Amph	Oklahoma Salamander				X				X
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Prothonotary Warbler		X						X
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Fish	Alabama Shad	X							X
Fish	Blackside Darter		X				X		
Fish	Blue Sucker	X							X
Fish	Bluntface Shiner	X							X
Fish	Longnose Darter	X							X
Fish	Paddlefish		X				X		

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Fish	Pallid Shiner (Chub)	X							X
Fish	Redspot Chub		X				X		
Fish	River Darter	X					X		
Fish	Shorthead Redhorse	X							X
Fish	Southern Brook Lamprey		X						X
Fish	Spotfin Shiner	X							X
Fish	Wedgespot Shiner	X							X
Inve	Bleufer			X			X		
Inve	Butterfly Mussel		X			X			
Inve	Elktoe	X				X			
Inve	Faxonella blairi				X				X
Inve	Little Spectaclecase			X			X		
Inve	Louisiana Fatmucket	X				X			
Inve	Monkeyface Mussel			X			X		
Inve	Neosho Mucket	X				X			
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Creekshell	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Plain Pocketbook		X			X			
Inve	Purple Lilliput	X				X			
Inve	Rabbitsfoot	X				X			
Inve	Threeridge Mussel			X			X		
Inve	Wartyback Mussel		X				X		
Inve	Washboard			X			X		
Inve	Western Fanshell	X				X			
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		
Mamm	River Otter		X					X	
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are

declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.

2. Few data exist regarding the historic (i.e., presettlement) condition of small river habitat in Oklahoma. This information is important because it can serve as a desired condition to set as a goal for conservation efforts.
3. There is a general scarcity of monitor data for the biological composition of small rivers (e.g., fish, mussel, and macroinvertebrate communities).

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of population declines where these are suspected.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need. Taxonomic groups in greatest need of surveys include freshwater mussels, crayfish, and fish.
- Verify the accuracy of existing data, and assess changes in populations over time.
- Promote the addition of data to the Oklahoma Natural Heritage Inventory Database.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Use historic literature and maps in conjunction with present-day field studies to evaluate the historic and present conditions (e.g., channel morphology, flow patterns, and water quality) of small rivers.
- Develop a monitoring program to track habitat condition/quality and the status of species of greatest conservation need over time.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Water quality changes that negatively affect both habitat and species:

4. Several sources contribute nutrients to the rivers including concentrated animal operations (e.g., dairies, poultry houses and their land application fields), septic systems from houses near streams and rivers, nursery operations, fertilized crop fields, introduced pastures, lawns, and golf courses.
5. Lack of riparian vegetation and vegetated buffers in the headwaters of streams contribute to sediment, nutrients and pollutants entering aquatic systems and ending up in the rivers.
6. Municipalities and industries discharge into rivers and contribute to nutrient loads.
7. Endocrine system disruptors (e.g., non-nutrient pollutants, including pesticides, endocrine disruptors, antibiotics, and petroleum products) can enter the river in storm water runoff from agricultural fields and confined animal operations disrupting the reproduction and development of freshwater mussels, amphibians and fish.
8. Some landowners do not control the access that their livestock have to the river resulting in cattle grazing and watering in river channels and riparian areas where they contribute nutrients and trample/destabilize riverbanks thereby contributing sediment.
9. Nutrients and pollutants can also enter the river via groundwater. Septic systems and animal waste application fields that occur in porous soils in stream and river floodplains can contribute nutrients to rivers through groundwater connections.
10. Excessive concentrations of heavy metals are a local but serious issue.
11. Wetlands within river and stream floodplains are being filled or drained to create land for agricultural and residential purposes and are thus not available to act as

important filters of storm water runoff and help keep sediment and nutrients out of rivers and streams nor provide important breeding areas for amphibians and feeding areas for waterfowl and shorebirds.

Conservation Actions:

- Increase promotion and use of Best Management Practices and conservation cost-share programs to control nutrients and sediment in storm water runoff.
- Evaluate the need for better cost-share arrangements, more acceptable landowner incentives and revision of Best Management Practices to increase use of existing programs.
- Provide cost-share funding for the construction of fences and alternative sources of water for livestock in order to keep cattle out of rivers and riparian areas.
- Develop and distribute educational materials to schools and landowners about Best Management Practices to control nutrients and sediment, the interconnection of rivers, wetlands and groundwater, and the importance of riparian vegetation and wetlands as filters for nutrients and sediment.
- Increase the use of existing cost-share programs to restore riparian habitat and wetlands that serve as filters of storm water and as wildlife habitat; as needed, improve the acceptability of these programs to private landowners or develop new programs targeted at small rivers.
- Purchase conservation easements or acquire property in title from willing sellers in the floodplains of river and streams and in the headwaters of streams.
- Restore, enhance or create wetlands and riparian vegetation on these areas to stabilize stream banks and filter sediment, nutrients and other pollutants and to limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Develop monitoring programs for wildlife populations, habitat quality, and water quality to assess the effects of habitat restoration and conservation easement programs.
- Discourage residential development within river floodplains.
- Discourage the construction of poultry houses and other concentrated animal operations near streams and rivers. This also includes placement of land application areas for animal wastes.
- Develop local stream teams or watershed groups comprised of citizens and/or governmental organizations to address local concerns, monitor water quality, monitor wildlife populations, and provide public outreach and education.
- Support national or state scenic rivers designations.

Conservation Issue: Habitat loss from geomorphic alteration of river channels:

12. River channels normally meander through their floodplains and maintain stable, vegetated banks, but some human activities alter the channel structure of rivers and contribute to bank instability. These actions include:
    - Efforts to channelize the river and confine the channel to a narrower space.
    - In-stream gravel or sand mining.
    - Creating channel constrictions such as bridges and low water dams.
    - Dredging of river channels to make them deeper and narrower.
13. These actions can result in the river cutting a deeper channel and disconnecting the river from its riparian vegetation, eroding gravel and sediment from the riverbank, and creating bare cut banks that are prone to erosion and contribute more sediment into the river.
14. Channelization efforts that are undertaken to enhance the movement of storm water (i.e., to reduce flooding) and to allow residential and/or agricultural development within the floodplain often have only temporary success and efforts to confine channels into narrower spaces often create unstable channels that erode new meanders.

15. Much riparian vegetation has been removed, often to convert this habitat to pastures or riverside residential or recreational developments, contributing to riverbank instability and facilitates bank erosion.
16. Increased deposition of fine sediment from eroding banks settles into gravel beds and riffles, impairing their quality as spawning habitat for fish and habitat for freshwater mussels.

Conservation Actions:

- Develop cost-share programs or grant programs to provide funding for landowners and conservation districts to restore the morphology of river channels.
- Support research into and possible use of alternative bank stabilization and channel restoration techniques that incorporate fluvial geomorphology principles.
- Increase the use of existing cost-share programs to restore riparian habitat and wetlands that stabilize banks, serve as filters of storm water and as wildlife habitat; as needed, improve the acceptability of these programs to private landowners or develop new programs targeted at small rivers.
- Purchase conservation easements from private landowners or acquire property in title from willing sellers within the floodplains of rivers and streams and in the headwaters of streams.
- Restore, enhance or create wetlands and riparian vegetation on these easements to stabilize stream banks and filter sediment and to limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Develop monitoring programs for wildlife populations, habitat quality, and water quality to assess the effects of habitat restoration and conservation easement programs.
- Discourage residential and infrastructure development within river floodplains.
- Support national or state scenic rivers designations
- Develop regulations that restrict or prohibit channel modifications, in-stream gravel and sand mining and channel dredging.

Conservation Issue: Commercial harvest practices that negatively affect freshwater mussels:

17. Freshwater mussels have been harvested commercially for over a century, yet little is known about the population structure and biology of mussel species. Commercial harvest is restricted to common species, yet the harvest of common mussels can dislodge, injure or kill non-targeted rare mussels that occur along with the common species. Freshwater mussel populations are difficult to monitor, and monitoring programs are costly. As a result, monitoring is limited to harvest levels and there are no monitoring programs in place to assess in-stream populations.
18. Some methods of mussel harvest (e.g., dredging) can impair water quality and affect mussel habitat.
19. The loss of mussel populations can decrease water quality, as freshwater mussels are filter feeders that remove suspended algae, plankton and detritus from the river.

Conservation Actions:

- Develop a monitoring program for all mussel species that occur in rivers that are open to harvest and evaluate the impact of harvest on mussel populations.
- Conduct ecological studies of both rare and harvested mussel species to determine possible conservation actions that may be taken to maintain stable or improve depleted populations.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

20. Groundwater in shallow aquifers and alluvial deposits that are connected to the river are pumped for irrigation and residential uses; depending upon the volume of groundwater used, this can affect water inflows into the river.
21. Reservoirs, flood control impoundments, and recreational ponds hold storm water runoff and can reduce the volume of surface flows that reach rivers and streams even though they may help recharge groundwater supplies.
22. The loss of wetlands and the constriction of floodplains reduce the ability of the land to hold and slowly release water, often resulting in "flashier" stream and river flows in which flow is accelerated during storm events, but then rapidly drops afterward.
23. Surface flows are diverted from the river by impoundments on tributaries and may be withdrawn from the system for irrigation and residential use.
24. Reservoir construction on river main stems and major tributaries alters the historic flooding frequencies and flow patterns by can reducing the magnitude of small floods, especially the annual spring and early summer floods that naturally occur on rivers and reducing flow rates during normal summer low-flow periods by holding back water.
25. Proposals to impound streams and sell the water outside of the Region will increase the amount of water diverted and withdrawn from rivers, leaving less water for fish and other wildlife populations.
26. Dams, culverts, and some bridge designs can act as impediments to the upstream movements of fish and other aquatic wildlife.

Conservation Actions:

- Conduct studies of the habitat and flow needs for species of greatest conservation need.
- Establish minimum in-stream flow standards/requirement that will meet the needs of species of greatest conservation need and conserve populations with the watershed.
- Conduct studies assessing and comparing current and historic flow patterns on small rivers.
- Where changes in flow patterns are documented, evaluate methods to restore historic patterns such as modifying reservoir management to release water to mimic historic flows.
- Purchase conservation easements or acquire property in title from willing sellers in the floodplains of river and streams.
- Restore, enhance or create wetlands on these acres to hold storm water and slowly release it to the river to limit development within sensitive floodplains and improve habitat conditions for wildlife species of greatest conservation need.
- Support and promote water conservation programs and public education efforts directed at water conservation.
- Develop monitoring programs for wildlife populations and habitat quality to assess the effects of flow management, habitat restoration and conservation easement programs.
- Discourage residential and infrastructure development within river floodplains that would contribute to efforts to channelize rivers, construct flood control impoundments, or remove wetlands.
- Develop local stream teams or watershed groups comprised of citizens and/or governmental organizations to address local concerns, monitor water quality, monitor wildlife populations and provide public outreach and education.
- Support national or state scenic rivers designations for small rivers.
- Remove structures that isolate populations of species of greatest conservation need or prevent these species from reaching segments of rivers.
- Replace culverts and bridges that block the movement of fish with new structures that allow fish to pass through.

Conservation Issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

27. The impact of canoeing on fish, freshwater mussels, and other wildlife species has not been evaluated. Heavy recreation use may compact gravel bars and disturb mussel beds. The removal of woody debris in the river or local loss of riparian vegetation by heavy recreation use may result in subtle channel modifications. Visitors may also contribute trash/litter to the river.
28. Increasing levels of recreational use may result in conflicts among user groups (e.g., canoeists, fishermen, and campers).

Conservation Action:

- Develop studies to evaluate the impact of recreation activities on wildlife.
- Where impacts are found, develop recommendations to reduce impacts using a combination of education and regulations.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

29. Several exotic plant species such as Japanese Honeysuckle and Chinese Privet have become established in riparian areas where they displace native plants and may alter habitat conditions for wildlife species of greatest conservation need.
30. Zebra Mussels and several exotic aquatic plants have become established in Oklahoma reservoirs and could spread into river and stream channels where they could alter food and habitat for aquatic animal populations.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species, including displacement of native vegetation/plant communities, predation on native animal populations, or hybridization with native species.
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Provide the results of studies of exotic species impacts to landowners and conservation agencies/organizations.
- Improve coordination between wildlife biologists, conservation agencies and agricultural organizations so that these groups can share information about the negative effects of using exotic plant materials.
- Reduce the number of invasive and exotic species being recommended for erosion control (e.g., *Sericea lespedeza*) and other uses.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., herbicide treatment and mechanical removal).
- Develop monitoring programs to measure and evaluate the effectiveness of control measures.
- Work with U.S. Fish and Wildlife Service to develop an invasive/nuisance species management plan.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired (including easements) or proportion of acres protected/acquired within a given watershed.
- Amount of urban sprawl.
- Landowners participating in conservation practices.
- Miles of degraded and restored streams.
- New local conservation groups and their effectiveness.
- Pubic opinion toward conservation actions.
- Affects of recreational use on habitat.

- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stream flow and habitat quality – measure return of stream flow with range of natural variation.
- Water quality parameters.

Conservation Landscape: Limestone Cave

The relative condition of Limestone Cave habitat is currently good with a declining trend. Much of the Ozark Region in Oklahoma is underlain by the Springfield Plateau, a formation of porous limestone with deep fissures that is often referred to as karst. Slightly acidic groundwater moves through the fissures and cracks in the limestone dissolving and/or eroding subterranean stream channels, and caves. Because of its geology, the Ozark Region contains many complex systems of interconnected aquifers, caves, sinkholes and springs, and these systems in turn support diverse subterranean communities of salamanders, bats, Ozark Cavefish, cave crayfish and other cave and/or aquifer dwelling invertebrates. Caves are openings into the karst formation that connect the above ground community with the subterranean community. In contrast to the Springfield Plateau, the Boston Mountains section of the Ozark Region is a sandstone formation in which very few caves exist. Despite the widespread nature of the Springfield Plateau, cave systems are uncommon and locally-occurring. The distribution and biological composition of caves is poorly known and in need of further investigation

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Grotto Salamander				X				X
Amph	Many-ribbed Salamander				X				X
Amph	Ozark Salamander				X				X
Inve	Bowman's Cave Amphipod	X							X
Inve	Caecidotea acuticarpa	X							X
Inve	Caecidotea ancyla	X							X
Inve	Caecidotea antricola	X							X
Inve	Caecidotea macropoda	X							X
Inve	Caecidotea simulator	X							X
Inve	Caecidotea stiladactyla	X							X
Inve	Cave Crayfish	X					X		
Inve	Kansas Well Amphipod	X							X
Inve	Oklahoma Cave Amphipod	X				X			
Inve	Oklahoma Cave Crayfish	X					X		
Inve	Ozark Cave Amphipod	X							X
Inve	Ozark Cavefish	X					X		
Mamm	Gray Myotis		X					X	

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Insufficient knowledge of the biology of species of greatest conservation need associated with cave communities:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Data are sparse regarding the distribution and ecology of many cave and aquifer-dwelling species of greatest conservation need, limiting the potential effectiveness of conservation actions.
3. There are few resource monitoring programs in place track the status and population trends for many species of greatest conservation need.

Conservation Action:

- Conduct a thorough review of existing literature and location records and follow with biological surveys of caves to improve the knowledge of the distribution and abundance and as assessments and a baseline condition for future monitoring efforts of bats, salamanders, cave fish, and subterranean invertebrates.
- Evaluate techniques to conduct biological surveys in shallow aquifers to measure the degree of connection between apparent populations between caves.

Conservation Issue: Incomplete knowledge of the distribution and condition of biologically important caves:

4. The distribution of biologically important caves and karst formations which are likely to support caves are poorly known.
5. Cave habitats are difficult to locate and survey.

Conservation Actions:

- Conduct surveys to locate and map biologically important caves and aquifers.
- Develop a database to track the location and biological composition of caves. To protect cave fauna and private landowners from unwanted trespass, information regarding cave locations should be kept confidential and secure.

Conservation Issue: Impaired groundwater quality:

6. Groundwater passes through porous limestone in karst systems very quickly and the soil provides very little filtration. As a result, groundwater in karst aquifers are easily polluted by water-soluble pollutants and water quality degradation is a serious problem for aquatic species. Potential pollutants in this Region include nutrients from septic systems and livestock/poultry operations, pesticides and endocrine system disruptors that are applied to crops or livestock and leaching from household dumps and landfills.

Conservation Actions:

- Develop monitoring programs to measure groundwater quality and track populations of aquatic organisms in the aquifers.
- Establish water quality standards for subterranean streams and their associated shallow aquifers.
- Delineate and map the recharge areas surrounding biologically important caves such as those containing populations of Tier I and Tier II species of greatest conservation need.
- Develop GIS databases that identify the recharge zones for cave streams and sites that pose potential problems for water quality maintenance.
- Develop public education and awareness materials to alert residents in biologically important karst areas of the:
    - sensitivity of groundwater, their drinking water, to pollutants,
    - the biological diversity of the cave/aquifer ecosystem, and
    - landowner assistance programs and Best Management Practices that may maintain or improve water quality.
- Place caves and the land surrounding caves into conservation programs (e.g., purchase of conservation easements, provision of landowner incentive payments, and development of cooperative agreements or fee title acquisition by conservation agencies or non-governmental organizations) to protect water quality in the recharge areas.

Conservation Issue: Human disturbance to populations of cave-dwelling wildlife:

7. Populations of cave-dwelling species of greatest conservation need such as bats, cavefish and salamanders, are sensitive to human disturbance within caves and/or habitat alteration surrounding caves (e.g. clearing of forested land and construction of homes). Maternity colonies and hibernating clusters of bats are especially vulnerable to disturbance and habitat change.
8. Uncontrolled recreational use of caves that serve as maternity or hibernation sites may affect local populations of Gray, Ozark Big-eared, Northern Long-eared and other bats. Human disturbance may cause nursing female bats to abandon their dependent young or to abandon suitable caves for less suitable (i.e., cooler) sites for successfully rearing young, or cause hibernating bats to awaken and burn fat reserves needed to sustain them through the winter.

Conservation Actions:

- Develop landowner assistance and incentives programs to help private landowners implement cave management measures such as installing cave gates or enhancing habitat conditions surrounding caves.
- Because some cave gating designs can actually discourage bat use of caves, all cave gates that are installed should be monitored to determine their effectiveness at conserving bat populations.
- Enroll biologically important caves and their surrounding habitat into conservation programs to discourage human use of caves at inappropriate times and to conserve foraging habitat for bats and salamanders. These programs could include conservation easements, cooperative agreements, or fee title acquisition by conservation agencies or non-governmental organizations.
- Prior to initiation of conservation efforts, an evaluation should be made regarding the relative biological importance of caves and cave systems within the Region so that programs can be focused on the most biologically important sites in order to most effectively use conservation funds.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Air quality, temperature, humidity in caves.
- Developments within the recharge area of caves known to be used by species of greatest conservation need.
- Effectiveness of cave gates.
- Groundwater quantity and quality.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Springs

The relative condition of Springs habitat is currently poor with a declining trend. Springs and seeps are widespread in the Ozark Region but are extremely small habitats that are typically found in association with wetlands or the headwaters of streams. Springs are also associated with many caves. As a result of the limestone karst geology of the Springfield Plateau section of this Region, groundwater aquifers, subterranean streams, and springs are numerous in this area. The Springfield Plateau supports many species of conservation need that inhabit groundwater aquifers and these species may be encountered at springs or within caves (e.g., amphipods, isopods, and Grotto Salamander). Despite the number of springs in the Region, the distribution and biological composition of springs and seeps is poorly known in large part because these habitats are small and difficult to locate or access.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
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Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Grotto Salamander				X				X
Amph	Many-ribbed Salamander				X				X
Amph	Oklahoma Salamander				X				X
Amph	Ozark Salamander				X				X
Amph	Ringed Salamander				X				X
Bird	Louisiana Waterthrush		X						X
Fish	Arkansas Darter	X							X
Fish	Cardinal Shiner			X			X		
Fish	Ozark Minnow			X			X		
Fish	Plains Topminnow	X				X			
Fish	Redspot Chub		X				X		
Fish	Southern Brook Lamprey		X						X
Fish	Sunburst (Stippled) Darter		X				X		
Inve	Bowman's Cave Amphipod	X							X
Inve	Caecidotea acuticarpa	X							X
Inve	Caecidotea macropoda	X							X
Inve	Caecidotea simulator	X							X
Inve	Cave Crayfish	X					X		
Mamm	Eastern Small-footed Myotis				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		
Mamm	River Otter		X					X	

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. The knowledge of spring locations and their biological compositions is incompletely known, because springs and seeps are small and are found primarily on private property, making them difficult to locate and monitor.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of population declines where these are suspected.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need. Taxonomic groups in greatest need of surveys include amphibians, crayfish, and fish
- Verify the accuracy of existing data and assess changes in populations over time.
- Develop and maintain a database to store and analyze distributional and ecological data for species of greatest conservation need.
- Develop and maintain a database to track the locations of springs and the biological communities and water quality associated with these.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Use historic literature and existing maps in conjunction with field studies to determine the distribution and condition of springs.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Modification of springs and surrounding vegetation:

3. Some springs have been physically modified by the installation of pipes or the construction of low concrete dams to create pools for recreation uses or to water livestock.

4. Riparian and aquatic vegetation has been mechanically cleared around some springs, and grazed/browsed by livestock around others increasing their susceptibility to siltation and changes in water temperature.
5. Loss of shade over springs should have little effect on water temperatures. Springs are too close to the groundwater source to be affected. Spring brooks, on the other hand, may be affected especially as distance from the spring increases.
6. Man-made ponds and lakes have been constructed over springs and seeps, thereby inundating them with deep water and altering their normal habitat structure.
7. Flooding of springs by reservoirs may alter water chemistry, change hydrology, or introduce species- including microbes.

Conservation Actions:

- Identify those springs and seeps that support species of greatest conservation need and are sites of high conservation priority.
- Develop a program to provide landowners with financial incentives to protect springs, or place springs under conservation programs through the purchase of conservation easements on springs or acquisition of springs from willing sellers.
- Provide cost-share funding or grants to landowners to restore the structure of springs and the riparian vegetation around them. These actions can include removal of pipes, concrete, and low dams or fencing of springs to limit their access by livestock.
- Develop a monitoring program to measure the effectiveness of efforts to protect or restore springs and seeps on populations of species of greatest conservation need.
- Develop and distribute educational materials to landowners including Best Management Practices for use around springs, the biological diversity of springs, and the interconnection of springs, groundwater, and surface streams.

Conservation Issue: Changes in water quality that negatively affect both habitat and species:

8. Local groundwater withdrawal can reduce the flow of springs and streams.
9. Polluted groundwater surfaces at springs can affect aquatic life in springs and streams because in areas of karst geology, rain water quickly enters the groundwater with very little filtration by the soil, allowing rainwater to easily carry pesticides, fertilizers, animal waste, and water-soluble chemicals into the groundwater.
10. Additions of nutrients in the groundwater can create problems with excessive algae in springs and streams.
11. Water quality within springs can be affected by cattle watering in and grazing around springs, and feral hogs watering and wallowing in springs and seeps by increasing siltation of springs and adding nutrients to the water.
12. Some landowners are unaware of how easily groundwater can be polluted by surface activity in the Springfield Plateau and other sites with karst geology.

Conservation Actions:

- Identify springs and seeps that support populations of species of greatest conservation need and assess their current water quality/quantity and evaluate sources of existing or potential future water quality/quantity degradation.
- Conduct hydrological studies to delineate the recharge area surrounding biologically important springs to determine the surface acreage that needs the attention of conservation programs.
- Develop, publish, and distribute information about Best Management Practices and conservation recommendations for landowners to implement in order to protect groundwater quality/quantity around springs.
- Evaluate the existing conservation assistance programs for landowners (e.g., Farm Bill programs) to determine the applicability of these to the protection of springs and the quality of groundwater around springs.

- Help promote existing programs or increase the activeness of these programs to landowners by providing better cost-share opportunities, or more acceptable landowner incentives.
- Develop new cost-share programs to help landowners conserve groundwater quantity and protect groundwater quality within the recharge areas of biologically important.
- Construct fences around springs and provide alternative water sources for livestock in order to keep livestock and feral hogs out of springs.
- Develop monitoring programs for populations of species of greatest conservation need, water quality, and water quantity to assess the effectiveness of groundwater conservation programs. Where feasible, involve the landowners by providing them with the equipment and supplies to conduct monitoring activities or encourage the development of local citizen volunteer groups to conduct monitoring.
- Provide the results of water quality and quantity monitoring programs to the appropriate regulatory or landowner assistance agencies (e.g., Oklahoma Water Resources Board, Oklahoma Department of Environmental Quality, Oklahoma Corporation Commission, local Conservation District, and Natural Resources Conservation Service).
- Encourage programs to conserve groundwater.
- Discourage the selling of groundwater to users outside of the Region.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Amount of gravel mining reduction.
- Citizen groups formed.
- Easements obtained.
- Protected springs/streams.
- Recreation users of streams.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stream and spring flow.
- Stream miles degraded.
- Water quality.

Conservation Landscape: White Oak/Hickory Mesic Forest

The relative condition of White Oak/Hickory Mesic Forest habitat is currently poor with a declining trend. This forest type occurs as small patches of mesic forest in ravines and hollows within drier upland oak forest, or as long bands of habitat found on the lower slopes around small valleys, or the more protected northern and eastern slopes of hills and valleys. This habitat is widespread but restricted to certain physical features of the landscape and sites with favorable moisture and soil conditions. As a result this habitat type can only be managed or restored in specific areas and it rarely occurs as large contiguous landscapes.

Mesic forests have a relatively high diversity of tree species and a diverse vegetative structure. In the Ozark Region, these forests are typically dominated by White Oak (*Quercus alba*), Northern Red Oak (*Quercus rubra*), Mockernut Hickory (*Carya tomentosa*), Bitternut Hickory (*Carya cordiformis*), Sugar Maple (*Acer saccharum*), and White Ash (*Fraxinus americana*). The moist soil conditions often allow the development of abundant understory vegetation including dominant small trees such as Flowering Dogwood (*Cornus florida*), Rusty Blackhaw (*Viburnum rufidulum*), Northern Spicebush (*Lindera benzoin*), Strawberry Bush (*Euonymous atropurpureus*) and Pawpaw (*Asimina triloba*). Other common forest trees include Shumard Oak (*Quercus shumardi*), Chinkapin Oak (*Quercus muehlenbergii*) and American Basswood (*Tilia americana*).

This habitat type is found throughout the Region and in both the Boston Mountains and Springfield Plateau sections. Sugar Maples are often associated with the most mesic sites and those that experience infrequent fire. The more mesic sites often have greater understory development/ structure.

Recognized plant associations within this habitat include:

Chinquapin Oak – Shumard Oak Forest
Chinquapin Oak – Sugar Maple Forest
Northern Red Oak – Shumard Oak Forest
Southern Red Oak – Mockernut Hickory Forest
Sugar Maple – Chinquapin Oak Forest
Sugar Maple – Northern Red Oak – Bitternut Hickory Forest
Sugar Maple – White Oak – Mockernut Hickory Forest
White Oak – Mockernut Hickory – American Basswood Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Many-ribbed Salamander				X				X
Amph	Oklahoma Salamander				X				X
Amph	Ozark Salamander				X				X
Amph	Ringed Salamander				X				X
Bird	American Woodcock	X							X
Bird	Cerulean Warbler	X				X			
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Whip-poor-will		X						X
Bird	Wood Thrush	X							X
Bird	Worm-eating Warbler	X							X
Inve	American Burying Beetle		X						X
Mamm	Eastern Small-footed Myotis				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		
Mamm	Southeastern Myotis				X				X
Rept	Northern Scarletsnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Mesic forests have not been extensively studied in Oklahoma and data are incomplete for many species of greatest conservation need that use this habitat type. In order to establish effective conservation actions, more complete data are needed to determine the population status and trend for many species and a more thorough evaluation is needed to determine the factors that limit population sizes or are responsible for declines.
3. The mesic forest habitat type typically occurs in locations with specific slope, aspect, and soils and should be relatively easy to model and map; however, the assessment of current and historic distributions of this habitat type is incomplete.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need.

- Verify the accuracy of existing data and assess changes over time.
- Develop and ensure that funding exists to maintain and update databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and the condition of this habitat to establish a current baseline.
- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this habitat type. This should be done in conjunction with a landscape-level evaluation of the probable locations and distributions of all oak-hickory forest, woodland, and savannah types.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

4. Fragmentation and loss of habitat caused by the conversion of mesic oak-hickory forest to other land uses such as introduced pastures that are planted to Tall Fescue.
5. Fragmentation and loss of habitat due to increasing number of residential developments (i.e., particularly secondary homes, cabins, retirement homes, and ranchettes).
6. Fragmentation and loss of habitat due to expanding infrastructure including roads, utility lines, and pipelines.
7. Fragmentation of land ownership (i.e., the current trend is for more individuals owning smaller tracts of land).
8. As a result of widespread timber harvest in the early 1900s, many tracts of mesic forest are comprised of dense, even-aged second growth forest resulting in stands that lack the diverse structure of canopy, midstory, and understory vegetation that is found in the historically occurring uneven-aged forests, with greater tree density and denser canopies or mid-stories that limit the abundance of understory vegetation.
9. In local areas, understory vegetation may be limited by heavy grazing of the forest by cattle.
10. Dense canopy or midstory conditions can limit light penetration to the forest floor. Sustained shading can limit the recruitment of oak species in favor of more shade tolerant species.

Conservation Actions:

- Develop a landowner incentives program to encourage the retention of mesic forest stands and not convert these to other vegetation such as introduced pasture.
- Develop programs to maintain biologically meaningful tracts of mesic oak-hickory forests such as conservation easements, conservation leases, purchase of development rights, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest “bang for the buck” or efficiency.
- Develop ways to help families pass down large tracts of land from one generation to the next.
- Evaluate means to make it economically feasible for private landowners to maintain their land in oak-hickory forest (e.g., encourage markets for oak and hickory timber, or encourage groups of landowners to work together as a block to manage habitat for hardwood timber production or hunting leases).
- Evaluate methods to restore mesic oak-hickory forest on introduced pastures or crop fields, and develop cost-share programs, grants, or financial incentives to encourage landowners to restore these areas.

- Support cooperative efforts between government agencies, and research institutions to develop Best Management Practices and management recommendations to minimize the ecological footprint left by road, pipeline, and utility line construction, and the impacts of right-of-way maintenance practices.
- Develop and distribute informational materials with these Best Management Practices and recommendations to landowners, agencies, and utility companies.
- Develop educational materials for schools and landowners that highlight the value (i.e., ecological and economic) of hardwood trees and mesic forests.
- Develop wildlife corridors to connect tracts of mesic hardwood forest or to connect mesic forest with other habitat types such as riparian forest.
- Evaluate the effectiveness of midstory thinning as a tool to diversity forest structure and increase understory vegetation.
- Provide cost-share funding to install fences to control cattle grazing within this habitat type.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

11. Several exotic plant species such as *Sericea lespedeza*, Tall Fescue, Chinese Privet and Japanese Honeysuckle have become established in mesic hardwood forests and are displacing native plants that appear to be altering native plant communities and habitat conditions for wildlife species of conservation need.
12. Several exotic animal species appear to be causing substantial ecological damage, including feral hogs that damage seeps and vernal pools or compete with native wildlife for food and feral cats that exert additional predation pressure upon local populations of small reptiles, birds, and mammals.
13. Exotic tree pathogens, such as those effecting native chestnuts and flowering dogwood, can alter forest structure and diversity.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species, including displacement of native plant communities, predation on native animal populations, or hybridization with native species.
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., controlled burning programs, herbicide treatment, and mechanical removal).
- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Work with U.S. Army Corps of Engineers to develop an invasive/nuisance species management plan.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.
- Develop educational materials about the ecological damage done by invasive and exotic vegetation and introduced plant diseases.

Conservation Issue: Loss of seasonal wetlands or vernal pools:

14. Some vernal pools (which support the greatest diversity of amphibians which depend upon vernal pools and other seasonal wetlands for reproduction) have been lost or degraded as a result of sedimentation or feral hog activity.

Conservation Actions:

- Identify and develop protection and management plans for vernal pools, seeps and seasonal wetlands that are important to salamander species of greatest conservation need, including such activities such as fencing, dredging/removal of accumulated

sediments, development of conservation easements, or construction of new vernal pools.
- Develop monitoring programs to evaluate the success of vernal pool management plans and their effects on local populations of amphibians.

Conservation Issue: Habitat loss or damage caused by heavy recreational use that negatively affects species of greatest conservation need:

15. The use of off-road vehicles and all terrain vehicles can compact soil, create soil erosion problems, and damage understory vegetation.
16. Off-road vehicle use can crush nests and wildlife (e.g., salamanders) that live in the dense leaf litter found in mesic forests.

Conservation Actions:

- Develop regulations to control off-road vehicle use on public lands.
- Close or gate unneeded roads (e.g., old logging roads) to limit access by off-road vehicles.
- Develop informational materials about the potential impacts of off-road vehicle use and develop recommendations to minimize these impacts (e.g., time of year when damage is least).

Potential indicators for monitoring the effectiveness of the conservation actions:

- Landowners/acres involved in conservation programs.
- Miles of degraded and restored stream.
- Number or percentage of acres acquired or placed into conservation programs (incentive programs).
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Stand health, composition structure.
- Stream flow and habitat quality – measure return of stream flow with range of natural variation.

Conservation Landscape: Gravel-bottom Streams and Associated Riparian Forests

The relative condition of Gravel-bottom Stream and Associated Riparian Forests habitat is currently poor with a declining trend. All or nearly all of the streams within the Ozark Region have cobble or gravel substrates. Because of the karst geology of the Springfield Plateau, many surface streams have a strong groundwater connection. Most streams receive a substantial amount of their flow from springs and seeps. Many streams have sections in which the stream loses flow to or gains flow from shallow groundwater aquifers. Streams in areas of low elevation gradient have well developed series of pools and riffles. These streams are typically slightly too moderately entrenched, are much wider than they are deep, and have well-developed floodplains. Streams in areas with higher elevation gradients are typically wider than they are deep but are moderately entrenched, have few meanders, narrow floodplains, and are structured as a series of pools and steps. Stands of riparian forests are relatively narrow along high gradient streams but are wide in meandering low-gradient streams. These forests are commonly dominated by River Birch (*Betula nigra*), Silver Maple (*Acer saccharinum*), Red Maple (*Acer rubrum*), and Sycamore (*Platanus occidentalis*) with an understory of Silky Dogwood (*Cornus amomum*), Spring Witch-hazel (*Hamamelis vernalis*), Swamp Indigo (*Amorpha frutescens*), Deciduous Holly (*Ilex decidua*) and St. John's-wort (*Hypericum sp.*).

Recognized riparian plant associations within this habitat include:

American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
Eastern Cottonwood – American Elm – Sugarberry Temporarily Flooded Forest
Giant Cane Temporarily Flooded Shrubland
Green Ash – American Elm Temporarily Flooded Forest
River Birch – Sycamore – Smooth Alder Temporarily Flooded Forest
Silver Maple - Boxelder Temporarily Flooded Forest
Spring Witch-Hazel – Silky Dogwood Temporarily Flooded Shrubland
Swamp Privet - Buttonbush Semi-permanently Flooded Shrubland
Sycamore – Boxelder Temporarily Flooded Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Grotto Salamander				X				X
Amph	Many-ribbed Salamander				X				X
Amph	Oklahoma Salamander				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Ringed Salamander				X				X
Bird	American Woodcock	X							X
Bird	Bell's Vireo		X			X			
Bird	Kentucky Warbler		X						X
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Fish	Arkansas Darter	X							X
Fish	Blackside Darter		X				X		
Fish	Bluntface Shiner	X							X
Fish	Cardinal Shiner			X			X		
Fish	Longnose Darter	X							X
Fish	Ozark Minnow			X			X		
Fish	Plains Topminnow	X				X			
Fish	Redspot Chub		X				X		
Fish	River Darter	X					X		
Fish	Shorthead Redhorse	X							X
Fish	Southern Brook Lamprey		X						X
Fish	Sunburst (Stippled) Darter		X				X		
Fish	Wedgespot Shiner	X							X
Inve	Linda's Roadside Skipper	X							X
Inve	Little Spectaclecase			X			X		
Inve	Louisiana Fatmucket	X				X			
Inve	Ohio River Pigtoe	X				X			
Inve	Orconectes nana				X				X
Inve	Ouachita Creekshell	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Procambarus tenuis	X				X			
Inve	Threeridge Mussel			X			X		
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There is limited historic data from which to evaluate the condition of streams and riparian forests prior to large scale human alteration of this habitat.
3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is a lack of information from which land managers can predict the effects of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

- Survey taxonomic experts to determine why species of greatest conservation need have small and/or declining populations.
- Conduct research on species of greatest conservation need to determine what factors limit their population size and distribution.
- Conduct research on species of greatest conservation need to establish baseline population size, density, distribution, and habitat relationships.
- Inventory amphibian, fish, crayfish, and mussel populations in streams to increase the knowledge of biological communities within specific watersheds.
- Verify and summarize existing data.
- Conduct literature reviews and focused studies to establish what stream and riparian habitats looked like historically to establish a target condition for stream and riparian restoration efforts.
- Develop relational databases to monitor wildlife populations and the conditions of their habitats.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop local watershed councils, stream teams and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.

Conservation Issue: Changes in water quality that negatively affect both habitat and species:

5. The presence of confined animal feeding operations such as cattle feedlots, poultry houses, hog farms, and waste application fields close to streams and drainages adding excess nutrients to streams.
6. Additional nutrients enter streams as a result of livestock watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae, resulting in other water quality impacts such as increased fluctuations in dissolved oxygen.
8. Endocrine disrupters and other pollutants from pesticides enter streams in storm water runoff from agricultural fields, altering the growth, reproduction and/or survival of fish, amphibians, and invertebrates in the streams.
9. Lack of headwaters protection allows for more sediment, nutrients, pesticides, and other pollutants to enter streams.
10. Increased sediment in the stream can fill or alter riffles and gravel beds which serve as spawning areas for fish and habitats for freshwater mussels.

Conservation Actions:

- Develop conservation easements or acquire land to maintain or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Establish set back distances between streams and confined animal farming operations, waste lagoons and land application areas.
- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop improved cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and monitor water quality and wildlife populations.
- Improve the knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.
- Reduce sedimentation from gravel road crossings.

Conservation Issue: Habitat loss from land management practices:

11. The abundance and diversity of understory vegetation has declined in riparian areas as a result of livestock grazing, especially during the growing season.
12. Riparian Forests have been cleared and converted to crop fields, or introduced pastures of exotic grasses such as Fescue and Bermuda.
13. Fragmentation of riparian forests by roads, houses, pastures, and utility right-of-ways.
14. The clearing of riparian vegetation reduces stream bank stability that in turn increases erosion and alters the width/depth ratios of streams.
15. Streams and riparian habitats are fragile and easily disturbed or modified.
16. The loss of riparian vegetation increases erosion and sedimentation.
17. Livestock grazing along stream banks increases bank erosion and increases the sediment load in the stream.
18. Loss of stream shading as a result of reduced riparian vegetation increasing water temperatures and affecting the aquatic animal community.

Conservation Actions:

- Provide cost-share funding or grants to fence riparian forests to control/limit their access by cattle.
- Purchase easements to protect or enhance existing riparian vegetation, or to restore riparian forests.
- Encourage the planting/construction of alternative shading for livestock to reduce their use of riparian areas.
- Provide landowner incentives or cost-share programs to protect or restore riparian forests, stream banks and in-stream habitat.
- Use fee-title purchase of stream and riparian habitat to place it into conservation ownership to conserve or enhance existing habitat.
- Fee-title acquisition of headwaters to steams to control/limit the introduction of sediment, nutrients and chemical pollutants.
- Develop new or promote existing Best Management Practices for the grazing of cattle in or adjacent to riparian zones.
- Increase the availability of aquatic resource educational information in the public schools.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

19. Exotic plant species such as Chinese Privet, Salt Cedar and Japanese Honeysuckle have become established and are becoming more abundant in riparian forests which compete with native plants and alter the structure of the habitat that can be used by animals.
20. Exotic predatory fish such as trout may compete with native predatory fish such as bass, and create increased predation pressure on stream fish or invertebrates.
21. Feral hogs that forage in streams and along stream banks damage riparian vegetation and reduce bank stability.
22. Some native plants and animals have become more abundant in riparian forests.
    - Eastern Redcedar has increased in abundance due to heavy grazing and reduced fire frequency in riparian areas.
    - Brown-headed Cowbirds have become more abundant in riparian areas due to cattle grazing. Brown-headed Cowbirds lay their eggs in the nests of other birds thus reducing the number of chicks from the host species.

Conservation Actions:

- Work with U.S. Fish and Wildlife Service to develop an invasive/nuisance species management plan.
- Conduct studies to quantify the impact of exotic species on riparian forest communities (i.e., both plants and animals) or on aquatic animal communities.
- Increase educational efforts and public awareness of the ecological and economic impacts of exotic plant and animal populations.
- All agencies must stop encouraging the planting of invasive and exotics.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

23. Bridges can impact streams by altering stream channels.
24. Some types of culverts can become barriers to the movement of fish during low-flow conditions.
25. Dams and bridges across streams can create fish barriers that affect the populations of fish and freshwater mussels.
26. Dams and diversion structures alter the natural flow patterns and other processes of streams, especially the frequency and magnitude of natural flooding events.
27. Many streams in the Region have been channelized/straightened, becoming incised and no longer connected with their riparian vegetation.
28. Streams with incised channels have cut banks that are prone to erosion which increases sediment loads in the streams.
29. Lack of connection between streams and riparian vegetation due to the channelization and incising of streams resulting in reduced riparian vegetation and a loss of wetlands within the stream floodplain.
30. In-stream gravel mining reduces bank stability upstream and downstream of the mining area increasing bank erosion, and altering the width to depth ratio of the stream by making it wider and shallow.
31. In-stream gravel mining can remove or reduce riffles, gravel beds and other stream structures that are important habitat for aquatic wildlife.

Conservation Actions:

- Remove ponds and impoundment that are obsolete but have been shown to block the movement of fish species of conservation need.
- Remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Replace ponds (e.g., for livestock) that have been constructed on streams with alternative water sources.

- Modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.
- Provide cost-share or grants to restore the natural planform, pattern, and profile to stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Develop regulations to eliminate gravel mining from within streams.
- Work with local communities and counties to reduce stream channel impacts including in-stream gravel mining, placement of rip-rap on stream banks at bridge crossings, and recreational use of streams by off-road vehicles.

Conservation Issue: Water quality changes that negatively affect both habitat and species:

32. Water is being pumped from streams for irrigation.
33. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes, lowering water tables and reducing the flow volume of springs and seeps that feed streams.
34. Increased pond construction may be lowering the inflow that sustains streams.

Conservation Actions:

- Establish minimum in-stream flow levels on all biologically important streams (i.e., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Stop the proposals to sell water outside of the state or the transfer of water between basins within Oklahoma.
- Provide the results of ecological studies to water use planners and permit issuers.
- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals, and interbasin transfers of water.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired (including easements) or proportion of acres protected/acquired within a given watershed.
- Amount of gravel mining reduction.
- Analysis of stream and riparian habitat change over time using GIS and aerial images
- Landowners participating in conservation practices.
- Miles of degraded, restored, and protected streams.
- New local conservation groups and their effectiveness.
- Partnerships with local governments.
- Populations of spring/stream organisms.
- Pubic opinion toward conservation actions.
- Recreation users of habitat.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Return of stream flow with range of natural variation.
- Water quality parameters.

Conservation Landscape: Shortleaf Pine-Oak-Hickory Woodlands

The relative condition of Shortleaf Pine-Oak-Hickory Woodlands habitat is currently poor with a declining trend. This habitat is uncommon and occurs locally in portions of the Springfield Plateau in Cherokee and Delaware counties. This habitat type is comprised of a mosaic of woodlands and forests dominated by Shortleaf Pine (*Pinus echinata*), and several species of oaks and hickories. These woodlands and forests are found on ridge tops, and on dry, rocky upper portions of east, south, and west-facing slopes. This habitat type is shaped by the combination of dry soils and periodic fire. The plant community is dominated by an association of Shortleaf Pine, Post Oak (*Quercus stellata*) and Blackjack Oak (*Quercus marilandica*) with smaller numbers of Black Hickory (*Carya texana*), Bitternut Hickory (*Carya cordiformis*), Black Oak (*Quercus velutina*) and Chinkapin Oak (*Quercus muehlenbergii*). Beneath the open canopy of pines, oaks and hickories is an herbaceous and short-shrub understory dominated by Little Bluestem (*Schizachyrium scoparium*), Lowbush Blueberry (*Vaccinium pallidum*), False Indigo (*Baptisia alba*), St John's Wort (*Hypericum hypericoides*), and Stiff Sunflower (*Helianthus divaricatus/hirsutus*).

Historically, most of this habitat occurred in a more open woodland condition. However, the combination of large-scale harvesting and decades of fire suppression have resulted in a much of this habitat currently being densely stocked, relatively even-aged second-growth forest.

Recognized plant associations within this habitat type include:

Shortleaf Pine – Northern Red Oak – Black Oak Forest
Shortleaf Pine – Post Oak – Blackjack Oak Forest
Shortleaf Pine – White Oak – Black Oak Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Blue-winged Warbler	X							X
Bird	Brown-headed Nuthatch	X							X
Bird	Kentucky Warbler		X						X
Bird	Northern Bobwhite		X			X			
Bird	Prairie Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Whip-poor-will		X						X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	American Burying Beetle		X						X
Inve	Diana Fritillary	X							X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Long-tailed Weasel				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		
Rept	Western Diamond-backed Rattlesnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

10. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
11. Data are incomplete regarding both the historic and current distribution and condition of this habitat type, which is typically found within larger mosaics of oak/hickory woodlands and forests.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field surveys to:
    - establish a baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need,
    - verify the accuracy of existing data, and
    - assess changes over time.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines,
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions),
    - develop a method to accurately identify and map the distribution, and if possible the condition, of this habitat to establish a current baseline, and
    - assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this habitat type, including the identification of a range of target vegetation conditions for restoration or management efforts.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

12. Relatively little of this habitat exists in a woodland condition, as much of it has gradually changed to a more forest-like condition, apparently the result of a loss of historic fire regimes due to active fire suppression.
13. Much of this habitat type currently exists as even-aged forest. This change from a woodland habitat comprised of trees of diverse ages and heights to a forest of relatively even-aged tress appears to be an artifact of the widespread timber harvest that occurred in this Region during a relatively short period of time in the late 1800s or early 1900s.
14. The combination of even-aged stands and decades of fire suppression appear to be responsible for greater tree densities than probably occurred historically. If the lack of periodic fire and dense forest canopy conditions continues, it may reduce the successful recruitment of shortleaf pines and some species of oaks in the future.
15. There are constraints to using management tools such as prescribed burning and such restraints limit the ability to restore woodland conditions to stands that are currently forests. Such constraints include lack of personnel and financial resources, air quality concerns, lack of technical guidance/assistance, logistical difficulties, and landowner liability issues.
16. The effects of prescribed burning on many species of greatest conservation concern are poorly known.
17. Prescribed burning is likely to be beneficial to all or most species but the timing, frequency, and size of burns probably affect species differently.
18. Many landowners are not aware of the changes that have occurred in the condition of this habitat and do not have information or technical assistance available to them if they want to restore habitats or enhance habitat structure for species of greatest conservation need.
19. Fragmentation and loss of habitat caused by the conversion of oak-hickory woodlands and forests to other land uses such as loblolly pine plantations, rangeland, or introduced pastures that are planted to Tall Fescue.
20. Fragmentation and loss of habitat due to increasing number of residential developments including secondary homes, cabins, and ranchettes.
21. Fragmentation and loss of habitat due to expanding infrastructure including roads, utility lines, and pipelines.
22. Fragmentation of land ownership (i.e., more individuals owning smaller tracts of land).
23. In local areas, continuous grazing within shortleaf pine-oak-hickory woodlands may reduce the abundance of understory vegetation, limit the recruitment of some forb and tree species, and cause erosion on steep slopes.
24. Cattle grazing may enhance the spread of undesirable exotic vegetation such as Brome and other pasture weeds, and it may attract Brown-headed Cowbirds, which parasitize the nests of songbirds.

Conservation Actions:

- Use studies of historic fire regimes and the historic distribution of this woodland habitat to develop site-specific recommendations for the use of prescribed burning. These recommendations should evaluate the timing (i.e., season), sizes and frequencies of prescribed burns to balance the needs of fire dependent species (e.g., pines, some birds) and fire sensitive species (e.g., amphibians).
- Evaluate ways to reduce the impediments and constraints that reduce the use of prescribed fire as a management tool. These may include:
    - providing funding to agencies to assist with conducting controlled burns on private property,
    - developing technical assistance materials for landowners (e.g., publications, burning guidelines, workshops, equipment rentals, and demonstration areas),

  - providing financial assistance or incentives to landowners to encourage woodland restoration,
  - developing burn cooperatives to work with agencies and landowners to increase the use of burning,
  - looking for ways to reduce landowner liability while conducting burns (e.g., use of official burn protocols).
- Evaluate the use of mowing or brush-hogging as an alternative to conducting burns, especially in developed areas.
- Develop monitoring programs to evaluate the effects of management techniques such as prescribed fire and midstory tree thinning on populations of species of greatest conservation need and vegetation structure.
- Develop informational materials to inform landowners and the general public about the benefits of woodland restoration, the importance of fire in maintaining shortleaf pine-oak-hickory woodlands and the wildlife diversity of this habitat type.
- Develop ways to help families stay on the land and pass down large tracts of land from one generation to the next.
- Evaluate means to make it economically feasible for private landowners to maintain their land in shortleaf pine-oak woodlands (e.g., encourage markets for oak and hickory timber, or encourage groups of landowners to work together as a block to manage habitat for hardwood timber production or hunting leases).
- Develop programs to maintain large tracts of shortleaf pine-oak-hickory woodlands such as conservation easements, conservation leases, purchase of development rights, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest "bang for the buck" or conservation efficiency.
- Evaluate methods to restore shortleaf pine-oak-hickory woodlands from pastures or crop fields, and develop cost-share programs, grants, or financial incentives to encourage landowners to restore/replant these areas to pine-oak woodlands.
- Coordinate with other agencies and research institutions to develop Best Management Practices and management recommendations to minimize the disturbance caused by and the ecological footprint left by road, pipeline, and utility line construction, and right-of-way maintenance.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies and utility companies for their consideration and use.
- Purchase grazing rights to remove cattle or establish rotational grazing programs to defer grazing on some areas during the growing season or during some years, while still providing income for landowners.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

25. Several exotic plant species such as *Sericea lespedeza*, Tall Fescue, Chinese Privet and Japanese Honeysuckle have become established outside of cultivation and appear to be displacing native plants and altering habitat conditions for wildlife species of conservation need.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species.
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., controlled burning programs, herbicide treatment, and mechanical removal).

- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Work with U.S. Fish and Wildlife Service to develop an invasive/nuisance species management plan.
- Develop cost-share, or incentives programs for private landowners to encourage them to control invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Changes in acreage/coverage of exotic vegetation.
- Easements secured and acreage protected.
- Acres of native plant communities (species composition) restored.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Species declining outside Oklahoma but still common in this habitat.

Conservation Landscape: Herbaceous Wetland

The relative condition of Herbaceous Wetland habitat is currently poor with a declining trend. Herbaceous wetlands are small, uncommon and locally-occurring plant communities in the Ozark Region and are usually found embedded within larger habitats or fire-maintained plant communities such as Tallgrass Prairies. The distribution, abundance and biological composition of herbaceous wetlands is poorly known in this Region and is in need of further study. Wetlands most frequently develop within or near the floodplains of streams and rivers. However in the Ozark Region, many floodplains are forested and are not conducive to the maintenance of herbaceous wetlands. Herbaceous wetlands are often seasonally flooded depressions within prairies and floodplains where periodic disturbances such as fire and flooding limit the encroachment of woody plant species. As a result of fire suppression and habitat loss, it is likely that much of the current herbaceous wetland habitat exists in human-maintained areas such as pastures in both uplands and floodplains.

Recognized plant associations within this habitat include:

American Water-willow Temporarily Flooded Wetland
Broadleaf Arrowhead – Longbar Arrowhead Semi-permanently Flooded Wetland
Broadleaf Cattail Semi-permanently Flooded Marsh
Common Reed Semi-permanently Flooded Marsh
Common Rush Seasonally Flooded Marsh
Pennsylvania Smartweed – Curlytop Smartweed Semi-permanently Flooded Wetland
Prairie Cordgrass Temporarily Flooded Marsh
Ravenfoot Sedge Seasonally Flooded Marsh
Softstem Bulrush - Common Spike Rush Semi-permanently Flooded Marsh
Water Smartweed Semi-permanently Flooded Wetland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Golden Plover		X						X
Bird	American Woodcock	X							X
Bird	Buff-breasted Sandpiper	X				X			
Bird	Canvasback	X							X
Bird	Hudsonian Godwit				X				X
Bird	King Rail				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	LeConte's Sparrow		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Nelson's Sharp-tailed Sparrow	X							X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Upland Sandpiper				X		X		
Bird	Willow Flycatcher	X							X
Bird	Yellow Rail				X				X
Inve	Ozark Clubtail	X							X
Inve	Ozark Emerald	X							X
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Marsh Rice Rat				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete information regarding the distribution and locations wetland habitats.
3. Incomplete information regarding the distributions and ecological needs of wetland wildlife species (i.e., which wildlife species occupy which wetland types).
4. The small size of wetlands makes them difficult to locate within larger habitat types such as prairies and woodlands.

Conservation Actions:

- Conduct regional survey for wetlands.
- Develop a database of wetland locations and conditions.
- Conduct biological inventories of wetlands to determine plant community composition and the distribution and abundances of wildlife species of conservation need.

- Conduct studies to determine the ecological needs of wetland wildlife species (e.g., types of plant communities and the timing and duration of flooding needed for each wildlife species).
- Produce educational information for landowners and conservation agency staff regarding the ecology of herbaceous wetlands by region and wetland type.
- Develop descriptions of what quality wetland habitats look like to serve as the target condition for wetland restoration and enhancement efforts.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Changes in water quality that negatively affect both habitat and species:

5. Feedlots, dairies, hog farms, and chicken houses are often located near wetlands, and the animal waste from these operations collects in wetlands basins and closed depressions.
6. Land application of animal wastes often occurs on fields near wetlands or that drain into wetlands where nutrients, hormones, pesticides, and other waste products collect.
7. Many wetlands lack buffer vegetation around them to control the movement of sediment, pesticides, and nutrients into the wetlands through storm water runoff from pastures, crop fields, and residential areas.
8. Endocrine disrupters from animal hormones, pesticides, and agricultural chemicals enter wetlands in storm water runoff, thus disrupting growth, reproduction and survival of amphibians, fish and invertebrates.
9. Increased nutrient inputs due to crop/pasture fertilizers and land application of animal waste result in increased algae and bacteria in wetlands.
10. Grazing of wetlands by cattle increases nutrient inputs and alters the structure and diversity of wetland vegetation.

Conservation Actions:

- Increase the knowledge of and utilization of Farm Bill programs that improve water quality and protect wetlands (e.g., Wetland Reserve Program, planting of buffer strips, and buffer vegetation).
- Provide cost-share funding to landowners to construct fencing around wetlands to control access by cattle.
- Restore native vegetation around wetlands to serve as a filter for storm water runoff to aid in the removal of sediment and nutrients.
- Develop certification programs to recognize conservationists and land stewards of wetlands.
- Improve small landowner access and use of existing cost-share programs.
- Develop new or update existing Best Management Practices for controlling nutrients and sediment around wetlands.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

11. Invasive/exotic plant species become established in wetlands and compete with native vegetation.
12. Exotic plant species can dominate wetlands and reduce overall plant diversity and structural diversity, reducing the wetlands' value as wildlife habitat.

Conservation Actions:

- Develop management plans to control exotic plants and reduce their abundances and distributions.
- Remove exotic wetland plants and restore native plant communities.

Conservation Issue: Habitat loss and fragmentation from land management practices:

13. Because of fire suppression and/or past overgrazing, woody plants such as willows and salt cedar encroach on and dominate herbaceous wetlands.
14. Heavy grazing of wetlands by cattle removes plant cover for wildlife, reduces the abundance of some wetland plants, and lowers overall plant diversity.
15. Seasonal wetlands are plowed and cropped which reduces perennial vegetation and alters plant community composition and structure.

Conservation Actions:

- Use fire or mechanical cutting to remove woody vegetation that has encroached upon herbaceous wetlands.
- Provide cost-share funding or grants to construct fencing around wetlands to control the access to this habitat by cattle.
- Use land acquisition, perpetual easement programs, or non-development easement programs to place wetlands into conservation ownership or stewardship.
- Acquire wetlands or purchase conservation easements on cropped wetlands and then restore them to wetland status.
- Provide funding to preserve or enhance wetlands.
- Improve the economic incentive to retain wetlands in agricultural areas.
- Improve the incentives for Wetland Reserve Program enrollments.
- Provide incentives or funding to cover the costs of maintaining wetlands.

Conservation Issue: Altered patterns of water flow that negatively affect both habitat and species:

16. Wetlands are drained or filled to convert these lands to residential, agricultural, or industrial uses.
17. Water may be pumped from wetlands for irrigation.
18. Irrigation around wetlands may lower the water table in some areas and alter the time during which the soil is saturated.
19. Some wetlands are dredged or deepened to create ponds to hold irrigation water, to store water for cattle, or to create ponds for fishing, resulting in a loss of shallow water habitat and may result in the introduction and establishment of predatory fish.

Conservation Actions:

- Provide cost-share funding or grants to restore and maintain farmed wetlands and connect wetland owners with entities seeking wetland mitigation credits.
- Assess the distribution and condition of herbaceous wetland habitat to identify wetland complexes and wetlands of high quality and/or biological diversity.
- Provide information to landowners and the public regarding the ecological values of wetlands, especially seasonal wetlands.
- Increase the knowledge of and utilization of Farm Bill programs to conserve wetlands such as the Wetland Reserve Program.
- Use land acquisition and conservation easement programs to place herbaceous wetlands under conservation ownership or stewardship.
- Acquire former wetlands and restore them through a combination of dredging, diking and revegetation.
- Improve landowner access to cost-share programs (e.g., improve cost-share ratios and economic incentives) such as the Wetland Reserve Program.
- Develop tax breaks for landowners that maintain wetlands and improve the economic incentive to retain wetlands in agricultural areas.
- Increase Conservation Reserve Enhancement Program enrollments.
- Help the Natural Resources Conservation Service to do wetland conservation planning.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Changes in acreage/coverage of exotic vegetation.
- Easements secured and acreage protected.
- Habitat response to management.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Oak/Hickory Bottomland Hardwood Forest

The relative condition of Oak/Hickory Bottomland Hardwood Forest habitat is currently poor with a declining trend. Bottomland hardwood forests are found within the floodplains of the rivers and streams throughout the Region. However, rough topography and rocky soils limit the size and distribution of bottomland hardwood forests in the Ozark Region more than in adjacent Regions. Less than 50,000 acres of this habitat type are thought to be present in the Region (Brabander et al. 1985). Much of the historic bottomland habitat in the Ozark Region has been converted to agricultural uses (e.g., crop fields or introduced pasture) or permanently inundated by the construction of reservoirs on the Grand-Neosho River system. The largest tracts of this habitat known in the Region occur in the floodplain of the Grand-Neosho River and its larger tributary streams. Bottomland hardwood forests are diverse plant communities and their species composition varies with soil conditions and with flooding frequency and duration. Bottomland hardwood forests in this Region are dominated by oak species (e.g., Bur Oak (*Quercus macrocarpa*), Pin Oak (*Quercus palustris*), Shumard Oak (*Quercus shumardii*) and Chinkapin Oak (*Quercus muehlenbergii*)), but other common canopy trees include Pecan (*Carya illinoiensis*), Black Gum (*Nyssa sylvatica*), White Ash (*Fraxinus americana*), Red Maple (*Acer rubra*) and Sugarberry (*Celtis laevigata*). Common understory vegetation includes Green Hawthorn (*Crataegus viridis*), Deciduous Holly (*Ilex decidua*), Sassafras (*Sassafras albidum*) and Spicebush (*Lindera benzoin*)

Recognized plant associations within this habitat include:

Black Gum – Red Maple Temporarily Flooded Forest
Bur Oak – Shumard Oak – Bitternut Hickory Temporarily Flooded Forest
Pecan – Sugarberry Temporarily Flooded Forest
Pin Oak – Pecan/Deciduous Holly Seasonally Flooded Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Amph	Many-ribbed Salamander				X				X
Amph	Ozark Salamander				X				X
Amph	Ringed Salamander				X				X
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Cerulean Warbler	X				X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Rusty Blackbird	X							X
Bird	Solitary Sandpiper	X							X
Bird	Swainson's Warbler	X							X
Bird	Wood Thrush	X							X
Bird	Worm-eating Warbler	X							X
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Marsh Rice Rat				X				X
Mamm	Northern Long-eared Myotis				X				X
Mamm	Ozark Big-eared Bat	X					X		
Mamm	River Otter		X					X	
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Scarletsnake				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Existing data are incomplete regarding the distributions and ecological needs of several species of greatest conservation need that depend upon the bottomland hardwood vegetation community.
2. In order to establish effective conservation actions, more complete data are needed to determine the population status and trend for many species and more thorough evaluations are needed to determine the factors that limit population sizes or are responsible for suspected declines.
3. Bottomland hardwood forest communities typically occur in predictable locations with specific soils and proximity to streams and rivers, therefore they should be relatively easy to model and map. However, the current and historic distributions and conditions of this community have not been completely assessed.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine the possible causes of suspected population declines.
- Conduct field surveys to establish baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need, verify the accuracy of existing data, and assess changes over time.
- Develop and maintain databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on Tier I and Tier II species of greatest conservation need (e.g., songbirds, amphibians, and bats) to:
    - identify factors that limit population sizes,
    - evaluate factors that may be responsible for population declines, and
    - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and the condition of this community to establish a current baseline.
- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of bottomland forests.
- Use the results of these surveys and studies to update the Comprehensive Wildlife Conservation Strategy via adaptive resource management.

Conservation Issue: Habitat loss and modification as a result of altered patterns of seasonal flooding due to stream and river channel modifications:

4. Reservoir construction and stream channelization projects have reduced the frequency and magnitude of flooding which is necessary to maintain bottomland hardwood forests, and in some areas channel modifications have resulted in deep incised stream channels and created a disconnection between the streams and their bottomland forests.
5. Vernal pools and seasonally flooded wetlands within bottomland forests have been lost or degraded as a result of sedimentation and/or reduction in periodic flooding reducing their value as important breeding areas for a diversity of amphibians and feeding areas for waterfowl.

Conservation Actions:

- Where modifications have occurred, restore hydrology to tracts of bottomland hardwood forest by managing for the historic hydroperiod reconnecting streams with their floodplain forests. Restoration efforts may include restoring the structure of stream or river channels, restoring stream meanders, or creating low dikes to retain seasonal storm water.
- Identify and develop protection and management plans for vernal pools, seeps, and seasonal wetlands that are important to salamander species of greatest conservation need. These plans may include activities such as fencing, dredging/removal of accumulated sediments, development of conservation easements, or construction of new vernal pools.
- Develop monitoring programs to evaluate the success of vernal pool management plans and their effects on local populations of amphibians.

Conservation Issue: Fragmentation and conversion of habitat:

6. Fragmentation and loss of bottomland hardwood communities has resulted from the conversion of these forests to other land uses such as crop fields, pine plantations, and Fescue pastures.

7. Fragmentation of forest tracts as a result of increasing numbers of roads, utility lines, and pipelines, having the most effect on species which rely on relatively large unbroken tracts of forest.
8. In some areas, chemical herbicides are being used to eradicate bottomland hardwood vegetation to convert the land to other uses such as pasture.

Conservation Actions:

- Develop a landowner incentive program to encourage the retention of bottomland hardwood forest stands and not convert these to other vegetation such as Fescue pasture.
- Develop programs to maintain biologically meaningful tracts of bottomland oak-hickory forests such as conservation easements, conservation leases, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest "bang for the buck" or conservation efficiency.
- Evaluate methods to restore bottomland hardwood forests on pastures or crop fields and develop cost-share programs or grants to assist and encourage willing landowners who wish to restore/replant these areas.
- Support cooperative efforts between government agencies and research institutions to develop or update Best Management Practices and management recommendations to minimize the ecological footprint left by road, pipeline, and utility line construction, and the impacts of right-of-way maintenance practices.
- Develop and distribute informational materials with these Best Management Practices and recommendations to landowners, agencies, and utility companies.
- Develop educational materials for schools and landowners that highlight the value (i.e., ecological and economic) of hardwood trees and the bottomland forest community.
- Develop wildlife corridors to connect disjunctive tracts of bottomland hardwood forest or to connect these forest tracts with other important forest communities

Conservation Issue: Altered forest community structure as a result of historic and current land management:

9. Many bottomland forest stands are comprised of dense even-aged, second growth forest as a result of widespread timber harvest in the early 1900s, resulting in stands that lack the diverse structure of canopy, midstory and understory vegetation that existed historically in uneven-aged forests. The shading caused by dense canopies in these even-aged forests may limit the abundance and diversity of understory vegetation and sustained shading may limit the recruitment of oak species in favor of more shade tolerant species over time.

Conservation Action:

- Evaluate the effectiveness of midstory thinning or timber stand improvement as a tool to diversity forest structure and increase understory vegetation.

Conservation Issue: Invasive and exotic plants and animals:

10. Several exotic plant species including *Sericea lespedeza*, Autumn Olive, Chinese Privet and Japanese Honeysuckle have become established in mesic hardwood forests, and appear to be displacing native understory plants and may alter native plant communities and habitat conditions for wildlife species of conservation need.
11. Feral hogs may be causing substantial ecological damage to vernal pools within bottomland forests and may compete with native wildlife for food.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (e.g., displacement of native vegetation, predation on native

animal populations, or hybridization with native species) to identify those exotic species causing the greatest impact to species of greatest conservation need.
- Develop control or management plans (e.g. controlled burning programs, herbicide treatment, or mechanical removal) for the exotic species that cause the greatest ecological damage.
- Develop monitoring programs to measure and evaluate the effectiveness of control measures.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.
- Develop educational materials about the ecological damage done by invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Number or percentage of acres acquired or placed into conservation programs (i.e., incentive programs).
- Percent of available habitat in conservation programs (i.e., measure net gain or loss of habitat).
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Snag count as part of monitoring habitat.
- Stand health (i.e., composition structure).
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).

Conservation Landscape: Post Oak/Blackjack Oak-Hickory Woodlands and Forests

The relative condition of Post Oak/Blackjack Oak-Hickory Woodlands and Forests habitat is currently poor with a declining trend. Dry to mesic, oak-dominated woodlands, and forests are widespread in the Ozark Region and typically occur on upper slopes, ridges, bluff escarpments, and slopes with a southern or western aspect. This plant community is structured by topographic position and naturally occurring fire and represents the majority of upland woodland and forest in the Ozark Region. This habitat type usually develops on sites with shallow or well-drained soils, and is dominated by only a few species of trees but is a structurally diverse mosaic of oak/hickory woodlands and oak/hickory forests that vary geographically depending upon soil conditions, aspect, and fire history. The dominant tree species are Post Oak (*Quercus stellata*), Blackjack Oak (*Quercus marilandica*), Black Oak (*Quercus velutina*), and Black Hickory (*Carya texana*). Other less common canopy trees include Chinkapin Oak (*Quercus muelhenbergii*) and Mockernut Hickory (*Carya tomentosa*) and Bitternut Hickory (*Carya cordiformis*). Sites that are more mesic and subject to infrequent fire take on the more closed-canopy structure of a forest and support greater numbers of hickories and Black Oaks. Sites that have drier soil conditions or are more frequently exposed to fire have the more open characteristics of woodlands and have an understory of grasses and forbs that is dominated by Little Bluestem (*Schizachyrium scoparium*) but also with Indian Grass (*Sorghastrum nutans*). Common woody understory species, especially on more mesic sites, include Eastern Redbud (*Cercis canadensis*), Farkleberry (*Vaccinium arborea*), Mexican Plum (*Prunus mexicana*), and Winged Elm (*Ulmus alata*). Eastern Redcedar (*Juniperus virginiana*) was historically uncommon in this habitat type but has increased in abundance during the past century as a result of the reduction in periodic fires.

Over the past century, some Post Oak/Blackjack Oak dominated woodland acreage has been lost to human development such as residential and second home development and conversion to pastureland. However, structural changes to the habitat as a result of reduced fire frequencies appear to be the greatest threat to this habitat. Much of this habitat exists in a more closed-canopy forest condition than in open woodlands and species such as Eastern Redcedar and Winged Elm appear to occur in greater abundance than historically in some areas.

Recognized plant associations within this habitat include:

- Post Oak – Blackjack Oak – Black Hickory (Farkleberry) Forest
- Post Oak – Blackjack Oak – Black Hickory Forest
- Post Oak – Shumard Oak – Bitternut Hickory Forest
- Post Oak – Winged Elm Forest

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Blue-winged Warbler	X							X
Bird	Harris's Sparrow		X						X
Bird	Kentucky Warbler		X						X
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Whip-poor-will		X						X
Inve	American Burying Beetle		X						X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Western Diamond-backed Rattlesnake				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Because this habitat type is a mosaic of woodlands and forests with varying degrees of canopy closure and understory development, more information is needed to determine the factors that shape vegetation structure and where forests and woodlands occurred historically.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field surveys to:
  - establish a baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need,
  - verify the accuracy of existing data, and
  - assess changes over time.
- Develop databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to:
  - identify factors that limit population sizes,
  - evaluate factors that may be responsible for population declines, and
  - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution, and the condition of this habitat to establish a current baseline.

- Assess historic literature and conduct field studies including identification of the probable locations and distributions of oak-hickory forests, woodlands and savannahs to evaluate the probable historic distribution and condition of this habitat type.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

3. Relatively little of this habitat exists in a woodland condition, probably the result of a loss of historic fire regimes due to active fire suppression. Much of it has gradually changed to a more forest-like condition, even on sites that were probably woodlands.
4. Many acres of habitat exist as even-aged forests. This change from woodlands and forests comprised of trees of diverse ages and heights to large even-aged stands is probably the result of widespread timber harvest during a relatively short period of time in the late 1800s or early 1900s.
5. The combination of even-aged stands and decades of fire suppression appear to be responsible for greater tree densities than probably occurred historically, and for an increase in abundance of some tree species such as Eastern Redcedar and possibly other invasive native species.
6. The lack of fire and dense, forest canopy may reduce the successful recruitment of oak trees in future generations of forest.
7. There are constraints (e.g., lack of personnel and financial resources, air quality concerns, lack of technical guidance/assistance, logistical difficulties, and landowner liability issues) to using management tools such as prescribed burning and selective tree harvest, limiting the ability to restore woodland conditions to stands that are currently forests and to diversify the structure of existing forests and woodlands.
8. Many landowners are not aware of the changes that have occurred in the condition of this habitat and do not have information or technical assistance available to them if they want to restore habitats or enhance habitat structure for wildlife species of greatest conservation need.
9. Fragmentation and loss of habitat caused by the conversion of oak-hickory woodlands and forests to other land uses such as loblolly pine plantations, rangeland, or introduced pastures that are planted to Tall Fescue.
10. Fragmentation and loss of habitat due to increasing number of residential developments including secondary homes, cabins, and ranchettes.
11. Fragmentation and loss of habitat due to expanding infrastructure including roads, utility lines, and pipelines
12. Fragmentation of land ownership (i.e., more individuals owning smaller tracts of land).
13. In some areas, continuous grazing within oak-hickory woodlands and forests may reduce the abundance of understory development limiting the recruitment of sapling trees and causing erosion on steep slopes.
14. Cattle grazing may enhance the spread of undesirable exotic vegetation such as Brome or attract Brown-headed Cowbirds that parasitize the nests of songbirds.

Conservation Actions:

- Use studies of historic fire regimes and the historic distributions of woodlands and forests to help develop site-specific recommendations for the use of prescribed burning. These recommendations should evaluate the timing (i.e., season), sizes and frequencies of prescribed burns to balance the needs of fire dependent and fire sensitive species (e.g., amphibians).
- Evaluate ways to reduce the impediments and constraints that reduce the use of prescribed fire as a management tool. These may include:
    - provide funding to agencies to assist with conducting controlled burns on private property,

  - develop technical assistance materials for landowners (e.g., publications, burning guidelines, workshops, equipment rentals, and demonstration areas),
  - provide financial assistance or incentives to landowners to encourage woodland restoration,
  - develop burn cooperatives to work with agencies and landowners to increase the use of burning, and
  - develop ways to reduce landowner liability while conducting burns (e.g., use of official burn protocols).
- Evaluate the use of mowing or brush-hogging as an alternative to conducting burns.
- Develop monitoring programs to evaluate the effects of management techniques such as prescribed fire and tree harvest on populations of species of greatest conservation need and vegetation structure.
- Develop informational materials to inform landowners and the general public about the benefits of woodland restoration, the importance of fire in maintaining oak and hickory habitats, and the wildlife diversity of oak-hickory habitats.
- Develop ways to help families pass down large tracts of land from one generation to the next.
- Evaluate means to make it economically feasible for private landowners to maintain their land in oak-hickory forest (e.g., encourage markets for oak and hickory timber, or encourage groups of landowners to work together as a block to manage habitat for hardwood timber production or hunting leases).
- Develop programs to maintain large tracts of oak-hickory woodlands and forests such as conservation easements, conservation leases, purchase of development rights, or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest "bang for the buck" or efficiency.
- Evaluate methods to restore oak-hickory woodlands from pastures or crop fields, and develop cost-share programs, grants, or financial incentives to encourage landowners to restore/replant these areas to oak-hickory woodlands.
- Coordinate with other agencies and research institutions to develop Best Management Practices and management recommendations to minimize the ecological footprint left by road, pipeline, utility line construction, and right-of-way maintenance.
- Develop and distribute informational materials with Best Management Practices and recommendations to landowners, agencies, and utility companies for their consideration and use.
- Purchase grazing rights to remove cattle or establish rotational grazing programs to defer grazing on some areas during the growing season.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

15. Several exotic plant species such as *Sericea lespedeza*, Tall Fescue, Chinese privet and Japanese honeysuckle have become established outside of cultivation and appear to displace native plants and plant communities and to alter the habitat conditions for wildlife species of conservation need.
16. Several exotic animal species appear to be causing substantial ecological damage, including feral hogs that damage seeps and vernal pools which are important to amphibians, or compete with native wildlife for food, and feral cats that exert additional predation pressure upon local populations of small reptiles, birds and mammals.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species (i.e., displacement of native vegetation/plant communities, predation on native animal populations, or hybridization with native species).
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., controlled burning programs, herbicide treatment, and mechanical removal).
- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Work with U.S. Army Corps of Engineers to develop an invasive/nuisance species management plan.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Changes in acreage/coverage of exotic vegetation.
- Easements secured and acreage protected.
- Acres of native plant communities (species composition) restored.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Species declining outside Oklahoma but still common in this habitat.

Conservation Landscape: Tallgrass Prairie

The relative condition of Tallgrass Prairie habitat is currently poor with a declining trend. Tallgrass Prairies occur locally within the Springfield Plateau section of the Ozark Region over sites with deep, well-drained soils on level portions of the plateau. These prairies are herbaceous plant communities dominated by Big Bluestem (*Andropogon gerardi*), Indian Grass (*Sorghastrum nutans*), Switchgrass (*Panicum virgatum*) and Little Bluestem (*Schizachyrium scoparium*) and are maintained by relatively frequent fires that suppress woody vegetation. Other widespread or common plants include Eastern Gamagrass (*Tripsacum dactyloides*), Rosinweed (*Silphium integrifolium*), Lead Plant (*Amorpha canescens*), Illinois Bundleflower (*Desmanthus illinoensis*), Blazing Star (*Liatris sp.*), Goldenrod (*Solidago sp.*), and Maximillian Sunflower (*Helianthus maximilliani*). Tallgrass Prairies were among the first sites settled in the Ozark Region and historically occurred in the vicinity of the larger communities such as Tahlequah, Stillwell, Jay, and Grove. Much of the habitat has been converted to residential developments, cropland, or introduced pastures planted to Tall Fescue.

Recognized plant associations within this habitat include:

Big Bluestem – Little Bluestem – Indian Grass Grassland
Big Bluestem – Switchgrass Grassland
Little Bluestem – Big Bluestem Grassland
Little Bluestem – Indian Grass Grassland
Switchgrass – Eastern Gamagrass Grassland

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X
Bird	American Golden Plover		X						X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Harris's Sparrow		X						X
Bird	Henslow's Sparrow	X							X
Bird	LeConte's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Red-headed Woodpecker		X			X			
Bird	Short-eared Owl				X				X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Upland Sandpiper				X		X		
Inve	Byssus Skipper	X							X
Inve	Prairie Mole Cricket	X				X			
Inve	Rattlesnake Master Borer	X							X
Mamm	Eastern Harvest Mouse				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Much of the Tallgrass Prairie habitat type has been settled and converted to other uses. Better data are needed regarding the current and historic extent and location of Tallgrass Prairie.
3. More information is needed regarding the factors that determine vegetation structure and maintained prairies historically.

Conservation Actions:

- Conduct surveys of existing literature, reports, and museum records to evaluate historic distributions, abundances and habitat affinities of species of greatest conservation need, and examine possible causes of suspected population declines.
- Conduct field surveys to:
  - establish a baseline conditions for the current distributions, abundances and habitat affinities of species of greatest conservation need,
  - verify the accuracy of existing data, and
  - assess changes over time.
- Develop databases to store and analyze distributional and ecological data for species of greatest conservation need.
- Conduct ecological studies on priority species of greatest conservation need to:
  - identify factors that limit population sizes,
  - evaluate factors that may be responsible for population declines, and
  - develop recommendations to enhance populations (i.e., through enhancement of habitat conditions).
- Develop a method to accurately identify and map the distribution and condition of Tallgrass Prairie habitat to establish a current baseline.
- Assess historic literature and conduct field studies to evaluate the probable historic distribution and condition of this habitat type. Soil survey maps may be helpful tools in this process.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss and fragmentation from land management practices:

4. Conversion of prairie to other land uses:
    - Tallgrass Prairies have been converted to and fragmented by residential developments, conversion to crop fields, and introduced pastures planted to Tall Fescue. Prairies are often level and possess deep or rich soils making them desirable areas for residential and agricultural uses.
    - When prairies are converted to Fescue pasture or crop fields, seasonal wetlands that are important to amphibians and birds are lost.
    - Fragmentation and loss of prairie habitat due to expanding infrastructure including roads, utility lines, and pipelines.
    - Fragmentation of land ownership for which the trend is for more individuals owning smaller tracts of land.
    - Herbicide use in right-of-way management may affect native forbs and woody plants that are food and habitat for wildlife.
5. Loss of historic fire regime:
    - Periodic fires have not been allowed on most prairies because of active fire suppression near most developed areas.
    - Decades of fire suppression and the loss of historic fire regimes have changed the structure of some prairies and has allowed for increases in some woody plant species including sumacs, Winged Elm, and Eastern Redcedar, and allowed the spread of invasive non-native grasses and forbs (i.e., pasture weeds).
    - There are several limitations/constraints that discourage landowners and agencies for using prescribed burning as a land management tool to maintain prairies. These constraints include limited personnel and financial capacity to conduct burns, landowner liability issues, air quality concerns, and logistical difficulties conducting burns in developed areas, and lack of technical assistance in conducting burns.
    - There is a scarcity of data from which to evaluate the effects of controlled burning on many species of greatest conservation need. Because periodic fire is required to maintain prairie habitats, it is almost certain that most prairie-dwelling species would benefit from prescribed burning but the populations of individual species are likely to respond differently to the timing, frequency, and spatial scale of prescribed burns.
6. Continuous grazing locally alters the condition of native Tallgrass Prairie:
    - Tallgrass Prairie is a habitat type that is largely maintained by periodic fire, which plays a greater role than grazing in maintaining the structure and species diversity of this habitat type.
    - Continuous grazing by livestock often results in a decline in abundance of some grasses and forbs (e.g., Eastern Gama Grass and Compass Plant) and increases in other less desirable species such as winter annuals and exotic pasture weeds (e.g., Japanese Brome).
    - Some landowners use herbicides on pastures that reduce the abundance of native forbs and shrubs that are naturally found in Ozark prairies, which can reduce food supplies for some wildlife species.
    - Cattle grazing may enhance local populations of Brown-headed Cowbirds, which parasitize the nests of songbirds.

Conservation Actions:

- Develop ways to help families stay on the land and pass down large tracts of land from one generation to the next.
- Evaluate means to make it economically attractive for private landowners to maintain prairie habitat on their land or to restore introduced pastures to native grasses and forbs (e.g., conduct studies on the cost/benefit ratio of raising livestock on native prairie versus introduced pasture, encourage markets for native prairie hay,

and encourage groups of landowners to work together as a block to manage habitat for hunting leases).

- Develop programs to maintain biologically meaningful tracts of native prairie habitat such as conservation easements, conservation leases, and purchase of development rights or willing-seller land acquisitions, preceded by a landscape-level assessment of habitat conditions to identify focus areas of greatest conservation value in order to get the greatest "bang for the buck" or conservation efficiency.
- Evaluate alternative methods for restoring Fescue pastures and crop fields to native prairie grasses and forbs, and develop cost-share programs, grants, or financial incentives to encourage landowners to restore these areas to native prairie.
- Coordinate with other agencies and research institutions to develop Best Management Practices and management recommendations to minimize the disturbance caused by and the ecological footprint left by road, pipeline, utility line construction, and right-of-way maintenance activities such as herbicide use and mowing.
- Develop and distribute informational materials with these Best Management Practices and recommendations to landowners, agencies, and utility companies for their consideration and use.
- Use studies of historic fire regimes and the historic distribution of this woodland habitat to develop site-specific recommendations for the use of prescribed burning. These studies and recommendations should evaluate the timing (i.e., season), sizes and frequencies of prescribed burns to balance the needs of the range of fire dependent species (e.g., prairie grasses and birds).
- Evaluate ways to reduce the impediments and constraints that reduce the use of prescribed fire as a management tool. These may include:
    - providing funding to agencies to assist with conducting controlled burns on private property,
    - developing technical assistance materials for landowners (e.g., publications, burning guidelines, workshops, equipment rentals, and demonstration areas),
    - providing financial assistance or incentives to landowners to encourage woodland restoration,
    - developing burn cooperatives to work with agencies and landowners to increase the use of burning, and
    - looking for ways to reduce landowner liability while conducting burns (e.g., use of official burn protocols).
- Evaluate the use of mowing or brush-hogging as alternatives to conducting burns in developed areas.
- Develop monitoring programs to evaluate the effects of prescribed fire on populations of species of greatest conservation need, prairie diversity, and vegetation structure.
- Develop informational materials to inform landowners and the general public about the importance of fire in maintaining prairie communities and the biological diversity of this habitat type.
- Purchase grazing rights to reduce the number of cattle or relocate cattle to other locations while still providing income for landowners.
- Establish rotational grazing programs to defer grazing on some areas during the growing season or for periods of one or more years.

Conservation Issue: Invasive and exotic plants and animals that are detrimental to species of greatest conservation need:

7. Several exotic plant species such as *Sericea lespedeza*, Tall Fescue, have become established in prairie habitats and are displacing native plants and altering prairie habitat conditions for wildlife species of conservation need.

8. Tall Fescue that has been planted for introduced pastures has spread beyond pastures and into native habitats.
9. Some agencies and organizations promote the use of exotic plants for erosion control, livestock forage, beautification programs, and wildlife habitat that are actually invasive.

Conservation Actions:

- Evaluate the severity and magnitude of the ecological damage done by exotic plant and animal species, including displacement of native vegetation/plant communities, predation on native animal populations, or hybridization with native species.
- Identify those exotic species causing the greatest impact to this habitat and species of greatest conservation need.
- Provide the results of studies of exotic species impacts to landowners and conservation agencies/ organizations.
- Improve coordination between wildlife biologists, conservation agencies, and agricultural organizations so that these groups can share information about the negative effects of using exotic plant materials.
- Reduce the number of invasive and exotic species being recommended for erosion control (e.g., *Sericea lespedeza*) and other uses.
- Develop control or management plans for the exotic species that cause the greatest ecological damage (e.g., controlled burning programs, herbicide treatment, and mechanical removal).
- Develop monitoring programs to measure and evaluate the effectiveness of these control measures.
- Work with U.S. Army Corps of Engineers to develop an invasive/nuisance species management plan.
- Develop cost-share or incentives programs for private landowners to encourage them to control invasive and exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned/treated.
- Changes in acreage/coverage of exotic vegetation.
- Easements secured and acreage protected.
- Acres of native plant communities (species composition) restored.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Species declining outside Oklahoma but still common in this habitat.

Conservation Landscape: Large River (Grand-Neosho River)

The relative condition of Large River habitat is currently poor with a declining trend. The only large river within the Ozark Region is the Grand-Neosho River that forms its western boundary. Historically, the Grand-Neosho was a deep, swift moving river but has been modified by the construction of three reservoirs that have inundated most of the river's length. For the purposes of this Strategy, we consider the large river habitat to be the three impoundments, the remaining river channel that connects these and the seasonally flooded areas along the river and reservoirs.

The species of greatest conservation need found in this habitat are listed in the following table. The population abundance (status and trend) of each species is described in relative terms. The best professional judgment of the advisory group and technical experts was used to identify each species status and trend. Species are sorted alphabetically within groups of amphibians (Amph), birds, fish, invertebrates (Inve), mammals (Mamm), and reptiles (Rept) for easy reference.

Species status definitions:
Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.
Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.
Abundant – species is common and widespread within the Region in appropriate habitat.
Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Bald Eagle	X						X	
Bird	Canvasback	X							X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Fish	Alligator Gar	X				X			
Fish	Blue Sucker	X							X
Fish	Paddlefish		X				X		
Fish	Pallid Shiner (Chub)	X							X
Fish	River Darter	X					X		
Fish	Shorthead Redhorse	X							X
Fish	Shovelnose Sturgeon	X							X
Inve	Black Sandshell	X				X			
Inve	Bleufer			X			X		
Inve	Monkeyface Mussel			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Ozark Pigtoe	X							X

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	Plain Pocketbook		X			X			
Inve	Threeridge Mussel			X			X		
Inve	Washboard			X			X		
Mamm	Gray Myotis		X					X	
Mamm	Indiana Myotis	X				X			
Mamm	Northern Long-eared Myotis				X				X
Mamm	River Otter		X					X	
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

The following conservation issues and actions are listed in general priority order.

Conservation Issue: Incomplete data concerning species of greatest conservation need (refer to the matrix above) and habitat, an impediment for effective conservation planning and implementation:

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

Conservation Issue: Habitat loss from geomorphic alteration and instability of river channels:

2. Altered Geomorphology through sediment transport blocked by impoundments, channelization, dredging of sand and gravel in channel, urban shoreline development, and lack of sandbars.

Conservation Actions:

- Research the presettlement river status of rivers.
- Support the transfer of knowledge between the U.S. Army Corps of Engineers and biologists about priorities and operations.
- Promote a better working relationship with the U.S. Army Corps of Engineers regarding economic, social and political arenas.

- Research the applicability and use of e-SWIM model (Ecologically Sustainable Water Impoundment Management).
- Research the use of mitigation to fund and support fish and wildlife protection and management from hydropower projects and U.S. Army Corps of Engineers impoundment project agreements.
- Determine the cumulative effects of development and runoff.
- Research alternative methods of flood control such as levee removal and floodplain mitigation as wetland banks.
- Identify spawning areas potentially impacted by dredging.
- Standardize the water requirements below dams.
- Improve water quality requirements around dams.
- Implement mitigation and reimbursement for fish losses to entrainment and stranding.
- Create and maintain riparian buffer zones.

Additional Conservation Issues:

3. Illegal shooting of birds, turtles, and other wildlife.
4. Invasive species (e.g., fish, aquatic plants, and Zebra mussels).
5. No provisions to establish minimum in-stream flows.
6. Urban uses (e.g., recreation, water diversions, lack of knowledge, water impoundment, and off-road vehicles).
7. Water quality issues (e.g., herbicides, nitrates, metals, oil field, and all pollution).

Additional Conservation Actions:

- Analyze dam breaching for at risk species (e.g., paddlefish and terns).
- Cost share with U.S. Army Corps of Engineers for important priorities.
- Encourage establishment of more natural alternative flow patterns.
- In-stream flow legislation.
- Pollution abatement efforts.
- Raise the importance of recreation and alternative flow patterns.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- U.S. Geological Survey gauging station for flow.
- Water quality standards – Oklahoma Water Resources Board.

Potential partnerships to deliver conservation for Ozark Region:

State Government

- Arkansas Game and Fish Commission
- Arkansas Natural Heritage Commission
- Arkansas/Oklahoma Compact Commission
- Grand River Dam Authority
- Kansas State University, Monarch Monitoring Program
- Missouri Department of Conservation
- Oklahoma Biological Survey
- Oklahoma Corporation Commission
- Oklahoma Department of Agriculture, Food and Forestry
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Wildlife Conservation
- Oklahoma Natural Heritage Inventory
- Oklahoma Scenic Rivers Commission
- Oklahoma State University, Cooperative Extension Service
- Oklahoma State University, Department of Forestry
- Oklahoma Tourism and Recreation Department
- Oklahoma Water Resources Board
- Other state universities and departments
- Other state-funded museums
- States of Arkansas and Missouri

Federal Government

- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Department of Agriculture, Forest Service
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Agriculture, Resource Conservation and Development Councils
- U.S. Department of the Interior, National Park Service
- U.S. Fish and Wildlife Service Ozark Ecosystem Team
- U.S. Fish and Wildlife Service Ozark Plateau National Wildlife Refuge
- U.S. Fish and Wildlife Service Partner for Fish and Wildlife Program
- U.S. Geological Survey

Local Government

- Municipalities in Oklahoma, Arkansas, Missouri
- Municipalities wanting to buy water
- Tribal governments

Businesses, Citizens and Citizen Groups

- Local Audubon Chapters
- Bat Conservation International
- Canoe Operators Association
- Central Hardwoods Joint Venture
- Chambers of Commerce
- Ducks Unlimited and local Oklahoma chapters
- Farm Bureau
- Hunting cooperatives
- Karst Initiative
- Kerr Center for Sustainable Agriculture
- Land Legacy

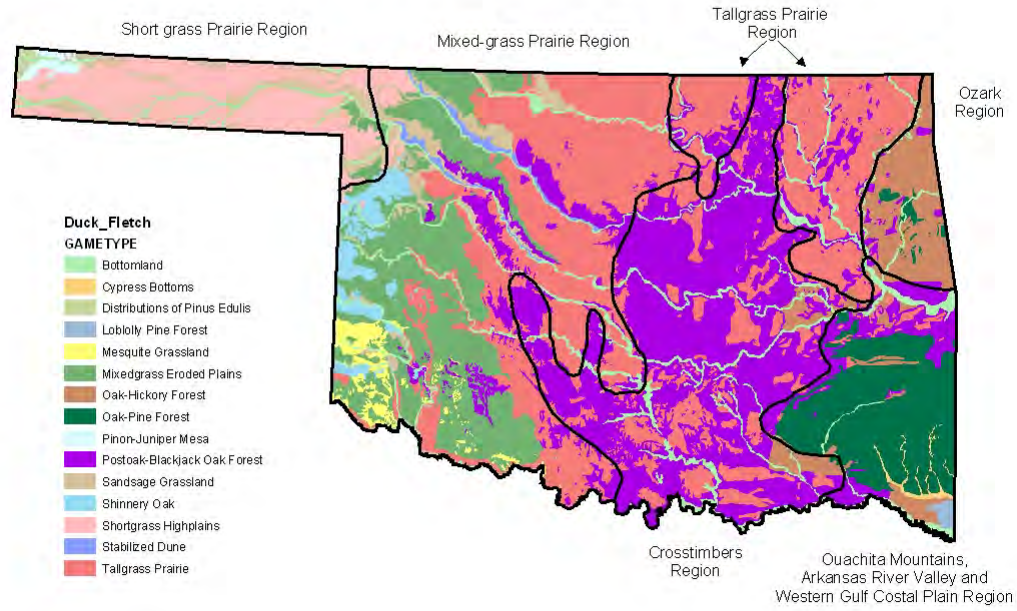
- National Rivers Society
- National Wild Turkey Federation and local Oklahoma chapters
- Oklahoma Anglers United
- Oklahoma Cattlemen's Association
- Oklahoma Forestry Association
- Oklahoma Native Plant Society
- Oklahoma Ornithological Society
- Oklahoma Section of the Society for Range Management
- Other sportsmen's groups
- Ozark Regional Land Trust
- Ozark Society
- Private landowners
- Sierra Club
- Small Woodland Owner's Association
- Speleological Societies
- Spring Creek Coalition
- The Nature Conservancy
- The Wildlife Society
- Timber Companies
- Urban development groups
- Vernal Pool Society

Appendix A: Glossary

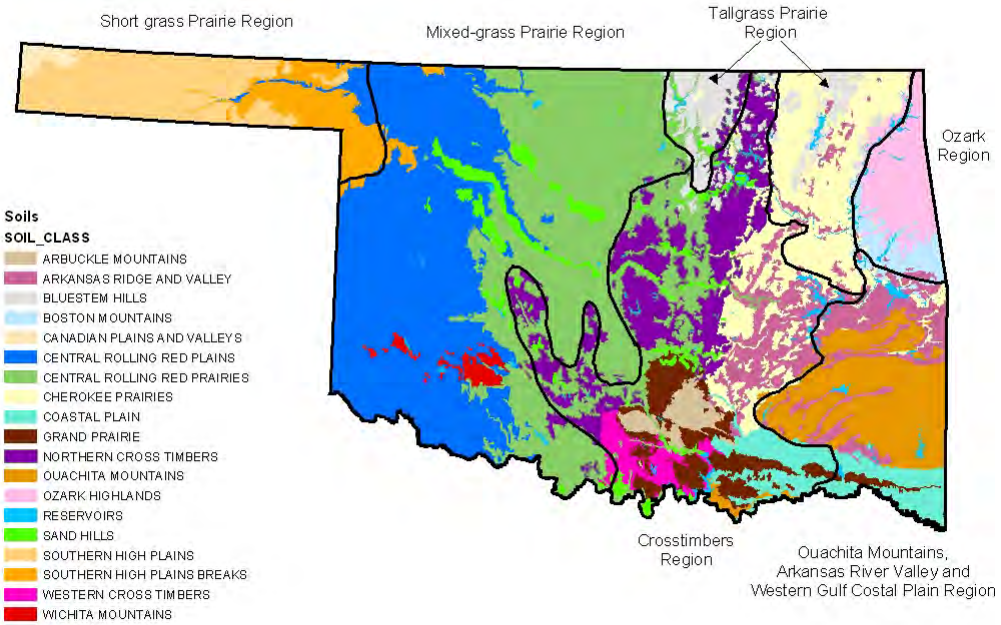
Term	Definition
Comprehensive	Broad in scope and content as related to the conservation, protection, restoration of species of greatest conservation need and their habitats. This is also taken in context that all identified wildlife species in Oklahoma were considered when selecting species of greatest conservation need.
Conservation Landscape	"Conservation Landscape" in this Strategy is the term used to convey the concepts of "key habitats and community types" identified by Congress. The term Conservation Landscape as used in the document is considered to be synonymous with "habitat types," "vegetation communities" and "aquatic communities."
Issues	"Conservation issues" in this Strategy is the term used for the "conservation problems" identified by Congress. Issues are a source of debate, discussion or difference of opinion. Issues may or may not be a problem; sometimes they are opportunities and challenges. Issues frame threats, weaknesses, challenges and opportunities differently than as problems. The Oklahoma Department of Wildlife Conservation wants the best and most opportunistic way of framing resource challenges so that the best conservations actions can be ranked and a widest array of partners can be brought to the table to resolve conservation challenges and realize opportunities in the future.
Strategy	Strategies are termed "conservation actions" in this document.
Wildlife	Animals as a broad, all-inclusive group that live in the water or on land. They include: insects, snakes, freshwater mussels, butterflies, salamanders, birds and mammals.

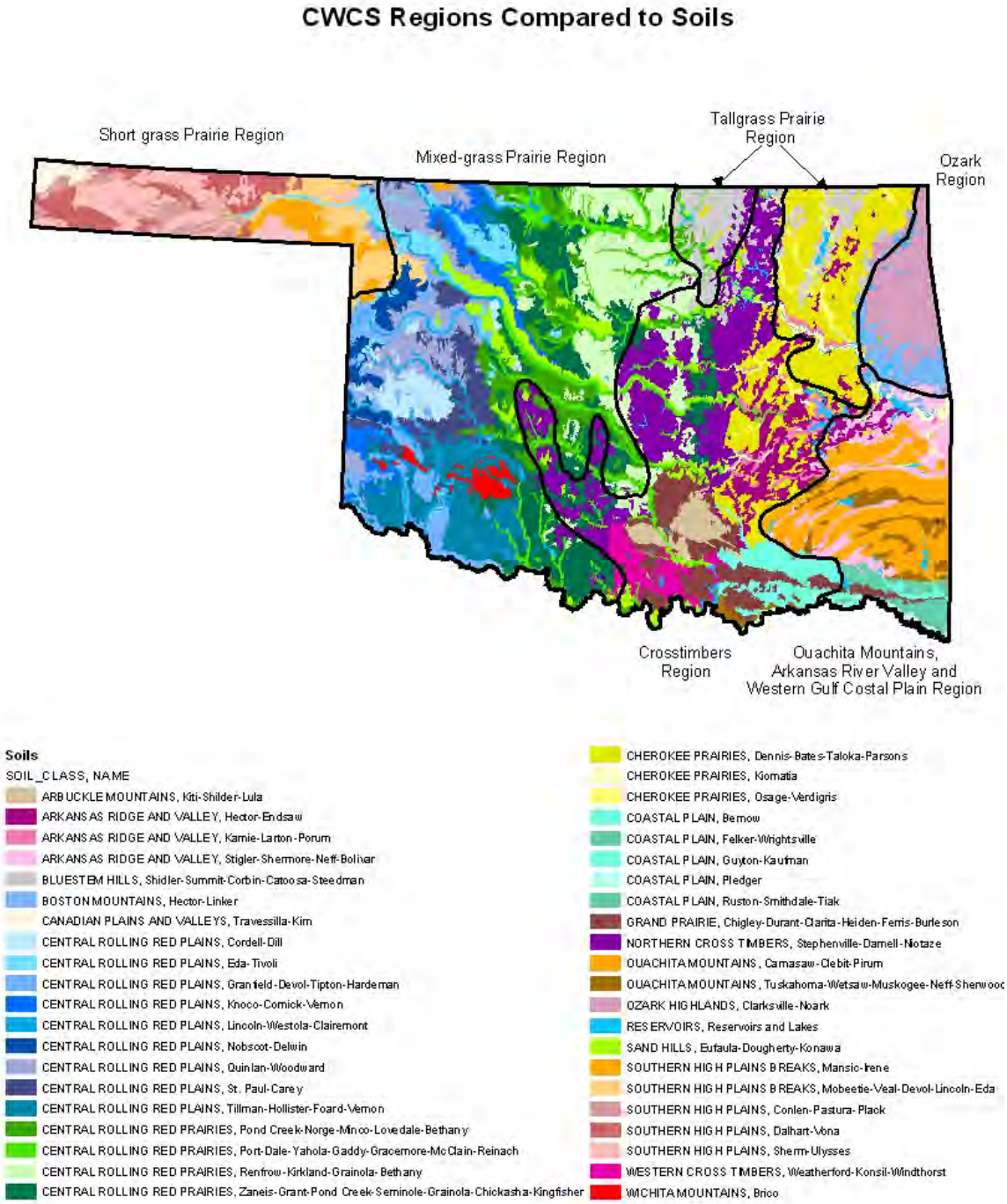
Appendix B: Maps used in the Development of the Oklahoma Comprehensive Wildlife Conservation Strategy

CWCS Regions Compared to Duck and Fletcher Game Types



CWCS Regions Compared to Soil Class





Appendix B: Maps used in the Development of the Oklahoma Comprehensive Wildlife Conservation Strategy

Conserving the Biodiversity of the Central Mixed-grass Prairie: A Portfolio Designed for Conservation Action

Summary for Oklahoma's Comprehensive Wildlife Conservation Strategy

- The Central Mixed-grass Prairie ecoregion encompasses 15,500 square miles of western and north-central Oklahoma. It is the second largest ecoregion in the state, and includes a diversity of habitat types.

- This ecoregion is characterized as a transitional zone between the mesic Tallgrass Prairies to the east and the more xeric Shortgrass Prairies to the west. The biodiversity of this area exhibits this transitional nature, and encompasses many species characteristic of other prairie types. The Oklahoma portion of the ecoregion includes large areas of Little Bluestem and Sideoats dominated Mixed-grass Prairie, with areas of Tallgrass Prairie, Post Oak-Blackjack Oak forest, Shinnery Oak shrubland, Mesquite shrubland, and Sand Sage shrubland.

- Climate, grazing, and fire are the key ecological processes that shape the habitats of the Mixed-grass Prairie

- The majority of this Region has been cultivated; only 20 percent of the native vegetation remains in large, untilled parcels. Much of this remaining area is infested with invasive Eastern Redcedar timber, and its wildlife habitat values have been markedly reduced. Habitat fragmentation and altered fire regime are the most serious threats to the biodiversity of the Region. Other threats include altered grazing regime, exotic/invasive plant species, and hydrologic modification.

- The plan identifies 13 areas in the Oklahoma portion of the ecoregion as priorities for conservation (see attached map):

    - **Red Hills** – northern Woods, Woodward, and Harper Counties. Portion of a larger site that extends into south-central Kansas. Characterized by rolling topography, Permian shale and gypsum soils, various Mixed-grass Prairie types. Conservation targets include Lesser Prairie Chicken, Arkansas Darter, bat caves, Townsend's Big-eared Bat, Hall's Bulrush, and Oklahoma Phlox (endemic to Oklahoma).

    - **Great Salt Plains –** Federal wildlife refuge and surrounding private lands in Alfalfa County. Salt flats and marshes, some Mixed-grass Sand Prairie. Conservation targets include Least Tern, Snowy Plover, Whooping Crane, and other migratory waterfowl.

    - **Cimarron River terrestrial site –** high-quality riparian areas and salt flats adjacent to the river.

    - **Woodward Co. Phlox** – isolated population of endemic Oklahoma Phlox located in northern Woodward County.

    - **Glass Mountains** – series of untilled prairie fragments in western Major County. Rough, broken topography, Permian shale and gypsum soils w/Mixed-grass Prairie, several large gypsum dissolution caves housing maternity colonies of Mexican Free-tailed Bats. Site designated primarily for conservation of bat caves.

    - **Salt Creek Canyon –** isolated population of federally endangered Black-capped Vireo in the Salt Creek Canyon area of Blaine County. Rough, eroded topography, substantial infestation of Eastern Redcedar. Cooperative habitat restoration project underway with U.S. Fish and Wildlife Service, Oklahoma Department of Wildlife Conservation, and The Nature Conservancy to restore habitat.

- **Canadian River Terrestrial site** – high quality riparian areas associated with the Canadian River.

- **Black Kettle** – Series of untilled prairie fragments near the Black Kettle Nat'l Grassland in the Washita River drainage of Roger Mills County. Characterized by Mixed-grass Prairie with some Shinnery Oak shrubland to the west. Species targets include Texas Gartersnake and Texas Horned Lizard.

- **Washita Nat'l Wildlife Refuge** – Federal wildlife refuge near Foss Reservoir in Custer County. Important area for migratory waterfowl.

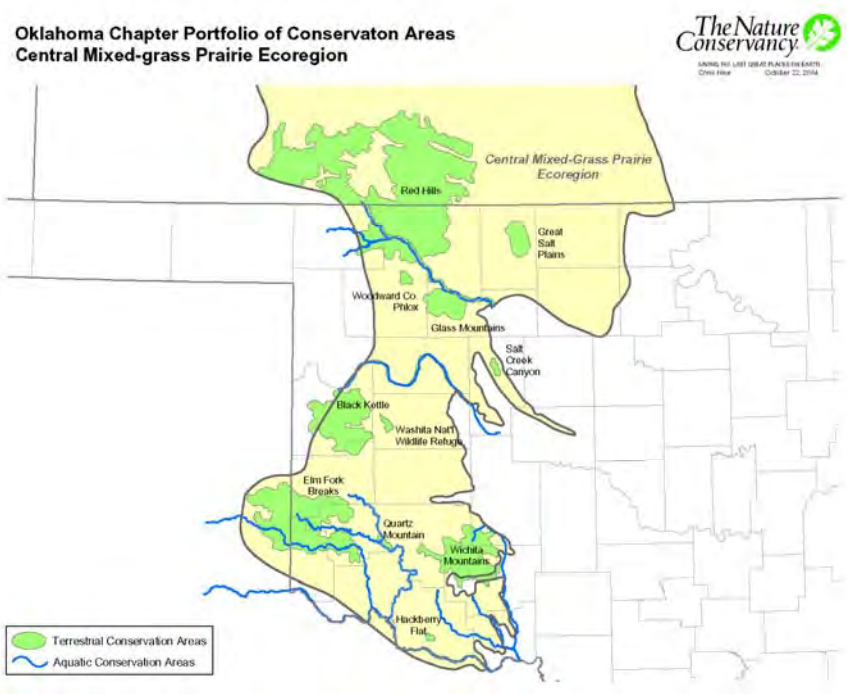
- **Elm Fork Breaks** – large tract of intact rough, broken land in the "breaks" of the upper Red River in Beckham, Greer, and Harmon Counties. Vegetation dominated by Mesquite and Redberry Juniper shrublands. Several gypsum dissolution caves in the area house maternity colonies of Mexican Free-tail and other bats.

- **Quartz Mountain State Park** – isolated granite peaks at the western terminus of the Wichita Mountains in Greer and Kiowa Counties. These hills support the only known extant occurrences of Long-hair Phlox, a state endemic plant.

- **Wichita Mountains** – these ancient mountains form a unique ecological system in Comanche, Kiowa, and Caddo Counties of southwestern Oklahoma. Characterized by a mosaic of vegetation types including Post Oak-Blackjack Oak forest and Mixed-grass Prairie. Species targets include Hall's Bulrush, Oklahoma Beardtongue (state endemic), Black-capped Vireo, and Whooping Crane.

- **Hackberry Flat** – restored wetland complex in Tillman County, supports large numbers of migratory waterfowl.

- Many aquatic sites designated for various fishes, insects, etc. Main species targets include Red River Pupfish, Arkansas Darter, Arkansas River Shiner, Plains Killifish, Plains Minnow, Flathead Chub, and Red River Shiner



Appendix B: Maps used in the Development of the Oklahoma Comprehensive Wildlife Conservation Strategy

Ouachita Mountains and Upper West Gulf Coastal Plain ecoregion assessments

Summary for Oklahoma's Comprehensive Wildlife Conservation Strategy

- The Ouachita Mountains and Upper West Gulf Coastal Plain ecoregions encompass 5,900 and 1,400 square miles of southeast Oklahoma, respectively.

- The Oklahoma portions of these ecoregions are characterized by rugged, Pine-Oak forested mountains, rolling hills, narrow mountain river valleys, and broad floodplains associated with the Red River and other major river systems. Marshes, oxbow lakes, and cypress swamps are found along the Little River and other drainages to the south.

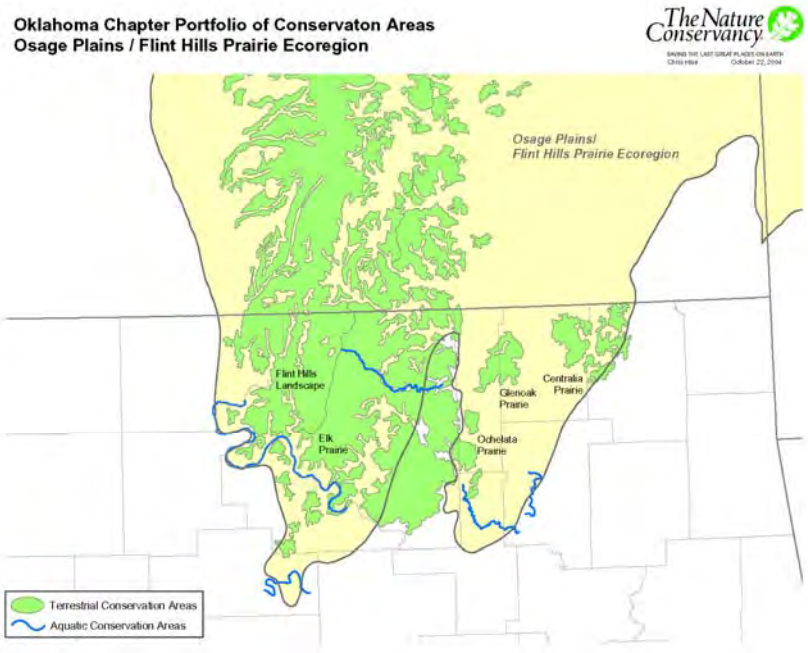
- Fires, both natural and those set by Native Americans are believed to have been a profound influence on the natural vegetation of this area.

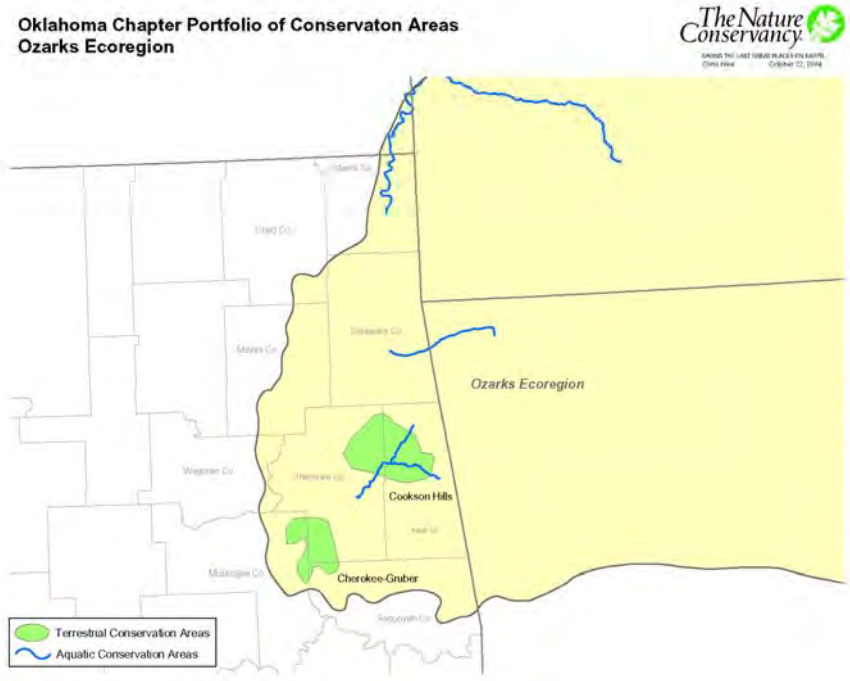
- While fairly substantial areas of native vegetation remain in the Ouachita Mountains, the vast majority of the Upper West Gulf Coastal Plain ecoregion in Oklahoma have been cultivated.

- Major threats to biodiversity include habitat fragmentation by development and agricultural conversion, incompatible timber harvest, altered fire regime, and hydrologic modification.

- The plans for the Ouachita Mountains and Upper West Gulf Coastal Plain ecoregions identify several areas of conservation significance in Oklahoma.

    - **Weyerhauser Tiak, Little River, and McCurtain Co.** (Upper West Gulf Coastal Plain) – areas in southern McCurtain County. Species of importance include Bluejack Oak, Central Newt, American Alligator, and additional plants, amphibians, and birds.
    - The terrestrial portfolio for the Ouachita Mountains ecoregion is currently under revision. Several aquatic sites in Oklahoma protect habitat for numerous species of conservation concern, including Ouachita Shiner, Ouachita Rock Pocketbook, Arkansas Fatmucket, Winged Mapleleaf, and other mussels and fish. Surrounding high-quality terrestrial areas provide habitat for Black Bear, Cerulean Warbler, Ouachita Dusky Salamander, and other species.





Appendix B: Maps used in the Development of the Oklahoma Comprehensive Wildlife Conservation Strategy

A Biodiversity and Conservation Assessment for the Southern Shortgrass Prairie

Summary for Oklahoma's Comprehensive Wildlife Conservation Strategy

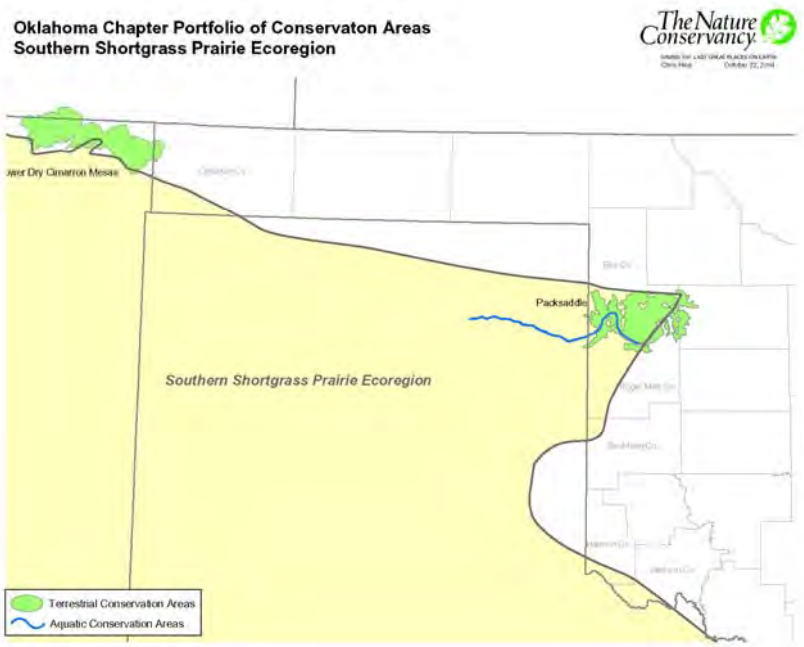
- The Southern Shortgrass Prairie ecoregion encompasses 1,500 square miles of Cimarron, Ellis, Roger Mills, Beckham, Harmon, and Jackson Counties in far western Oklahoma. This represents the "edge" of a much larger region of xeric Shortgrass Prairie that lies to the west in Texas and eastern New Mexico.

- The Region is characterized by the plateaus, escarpments, and rolling prairies of the High Plains.

- While completion of the plan document is pending; two areas of conservation significance have been designated for the Oklahoma portion of the ecoregion:

    - **Packsaddle** – southern Ellis, northern Roger Mills, and western Dewey Counties. Characterized by rolling Sand Sage shrubland, Shinnery Oak shrubland, and Mixed-grass Prairie along and north of the Canadian River. Species targets include Bell's Vireo, Lesser Prairie Chicken, Snowy Plover, Least Tern, and Arkansas River Shiner.

    - **Lower Dry Cimarron Mesas** – far western Cimarron County, south of the Black Mesa area. The majority of this site lies in New Mexico. Primary conservation targets are various plant communities that comprise an eastern extension of Rocky Mountain foothills vegetation.



Ecoregion Based Conservation in the Central Shortgrass Prairie

Summary for Oklahoma's Comprehensive Wildlife Conservation Strategy

- The Central Shortgrass Prairie ecoregion encompasses 1,850 square miles of northwest Oklahoma and the Panhandle, a Region commonly known as the "High Plains."

- The Oklahoma portion of the ecoregion is characterized by rolling plains, stabilized dunes, and tablelands, and is dominated by Shortgrass Prairie, Sand Sage grassland, and Pinyon/Juniper mesa type vegetation.

- Climate, grazing, and fire are the key ecological processes that shape the habitats of the Shortgrass Prairie

- The majority of this Region has been cultivated, with approximately 40 percent of the area remaining in large, untilled landscapes. Many species of native wildlife, most notably grassland-obligate birds, have been greatly reduced or extirpated since European settlement.

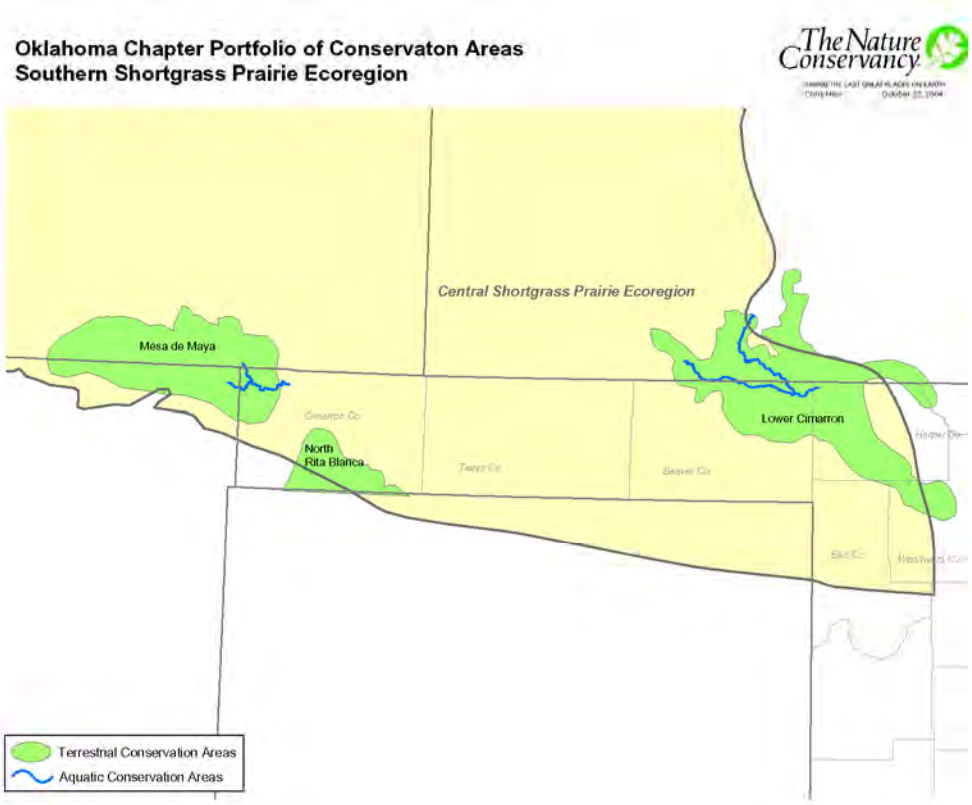
- Major threats to biodiversity include habitat fragmentation by development and agricultural conversion, altered grazing regime, altered fire regime, and hydrologic modification (groundwater withdrawal).

- The plan identifies three areas in the Oklahoma portion of the ecoregion as priorities for conservation (see attached map):

    - **Mesa de Maya** – northwest Cimarron County. Characterized by mesa and butte topography, Pinyon/Juniper woodlands (Rocky Mountain foothills vegetation). Conservation targets include various Shortgrass Prairie plant communities, and the following species: Black-throated Sparrow, Swainson's Hawk, Canyon Wren, Lark Sparrow, Prairie Falcon, Curve-billed Thrasher, Hoary Skimmer, Texas Horned Lizard, Plains Leopard Frog, Green Toad, and Trinidad Milkvetch. Includes reaches of Cimarron River and North Carrizo Creek.

    - **Lower Cimarron –** parts of Beaver, Harper, Woods, and Woodward counties. Characterized by Sand Sage Grassland and Shortgrass Prairie. Conservation targets include various plant communities, and the following species: Lesser Prairie Chicken, Grasshopper Sparrow, Snowy Plover, and Least Tern. Includes reaches of Cimarron River and Crooked Creek for conservation of Arkansas Darter.

    - **North Rita Blanca** – southern Cimarron County. Characterized by Sand Sage Grassland, with playa lakes on flatter sites. Designated primarily for playa lakes on and near federally-owned Rita Blanca National Grassland.



Appendix B: Maps used in the Development of the Oklahoma Comprehensive Wildlife Conservation Strategy

Appendix C: Management Plans and Habitat Plans Relevant to Oklahoma's Comprehensive Wildlife Conservation Strategy

Management Plans

Title **Contact Information**

Fisheries Future 2000 Strategic Plan

1. Purpose — This document is a blueprint that will direct the course of aquatic resource management within the Fisheries Division of the Oklahoma Department of Wildlife Conservation into the 21st century.
2. Publisher — Oklahoma Department of Wildlife Conservation
3. Date — 1998
4. Website
5. Hard copy
6. Name
7. Address
8. Phone no.
9. Email — acrews@odwc.state.ok.us
10. Submitter — Andrea Crews

Fisheries Program Vision for the Future (USFWS)

1. Purpose — to identify the most critical needs for aquatic resources and to reach consensus on the most appropriate role for the Fisheries Program
2. Publisher — U.S. Fish and Wildlife Service
3. Date — December 2002
4. Website — http://fisheries.fws.gov/CAF/Vision.htm#tfp
5. Hard copy — See below
6. Name — Harold Namminga
7. Address — OK Dept. of Wildlife Conservation
8. Phone no.
9. Email — hnamminga@odwc.state.ok.us
10. Submitter — Kim Erickson, OK Dept. of Wildlife Conservation

Guiding Conservation into the New Millennium – A Strategic Plan for 1998-2002

1. Purpose — The purpose of this plan is to communicate overall Department direction for fiscal years 1998-2002. The basic plan consists of a mission statement, a conservation vision, four major goals, and multiple objectives and strategies. Collectively, these elements give structure and order to the difficult task of planning for the future of Oklahoma's fish and wildlife resources.
2. Publisher — Oklahoma Department of Wildlife Conservation
3. Date — 1998
4. Website
5. Hard copy
6. Name
7. Address
8. Phone no.
9. Email — acrews@odwc.state.ok.us
10. Submitter — Andrea Crews

Oklahoma Department of Wildlife Conservation Fisheries Division Southeast Region Management Plan

1. Purpose
2. Publisher — Oklahoma Department of Wildlife Conservation
3. Date
4. Website
5. Hard copy
6. Name

Title	Contact Information
7. Address	
8. Phone no.	
9. Email	
10. Submitter	Keith Thomas

Oklahoma's Biodiversity Plan: A Shared Vision for Conserving Our Natural Heritage

1. Purpose	To provide information about Oklahoma's biodiversity and make recommendations on how biodiversity conservation can be included in a variety of economic and other activities
2. Publisher	Oklahoma Department of Wildlife Conservation
3. Date	1996
4. Website	
5. Hard copy	See below
6. Name	Ron Shuttles
7. Address	Oklahoma Department of Wildlife Conservation
8. Phone no.	
9. Email	rsuttles@odwc.state.ok.us
10. Submitter	Ron Shuttles

Wildlife and Wildlife Compensation Commission Policy No. J11 and J11.1

1. Purpose	Policy on compensation for actual or potential habitat losses resulting from land and water projects.
2. Publisher	Arizona Game and Fish Department
3. Date	June 26, 1987
4. Website	
5. Hard copy	
6. Name	
7. Address	
8. Phone no.	
9. Email	
10. Submitter	Jerry Brabander

North American Waterfowl Management Plan

1. Purpose	North American waterfowl management 2004 strategic guidance
2. Publisher	U.S. Fish and Wildlife Service
3. Date	November 2004
4. Website	http://birdhabitat.fws.gov/NAWMP/images/update04.PDF
5. Hard copy	
6. Name	Seth Mott, Chief, Branch of Science and Planning Division of Bird Habitat Conservation U.S. Fish and Wildlife Service
7. Address	4401 N. Fairfax Dr., Stop 4075, Arlington, VA 22203
8. Phone no.	(703)- 358-1969
9. Email	seth_mott@fws.gov
10. Submitter	Andrea Crews

Monitoring Avian Conservation: Rational, Design and Coordination

1. Purpose	
2. Publisher	International Association of Game and Fish Agencies
3. Date	September 2004
4. Website	http://www.iafwa.org/publications.htm
5. Hard copy	
6. Name	
7. Address	
8. Phone no.	
9. Email	
10. Submitter	CWCS discussion group

Habitat Plans

Title	Contact Information

Arkansas/Red Rivers Ecosystem

1. Purpose	This Ecosystem Plan and its subsequent updates will help guide the U.S. Fish and Wildlife Service as it sets priorities, allocates resources, and conducts its activities and programs in the Arkansas/Red River Basins to meet the mandates established for it by the American public.
2. Publisher	U.S. Fish and Wildlife Service and Partners
3. Date	October 2000
4. Website	
5. Hard copy	
6. Name	
7. Address	
8. Phone no.	
9. Email	
10. Submitter	Jerry Brabander

Boehler Seeps and Sandhills Site Conservation Plan

1. Purpose	The plan gives details of target species and natural community occurrences within this portfolio site and analyzes threats to their survival. Strategies to combat these threats are also given.
2. Publisher	The Nature Conservancy
3. Date	April, 1995
4. Website	
5. Hard copy	
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett

Bottomland Hardwoods of Eastern Oklahoma, A Special Study of Their Status, Trends, and Values

1. Purpose	This report discusses: (1) the values/importance, (2) past trends, present status, and future trends, (3) identification of significant remaining tracts, and (4) alternatives for maintaining/enhancing the identified values of bottomland hardwood (BLH) forest habitat within a 28-county study area in eastern Oklahoma.
2. Publisher	U.S. Fish and Wildlife Service and Oklahoma Department of Wildlife Conservation
3. Date	December 1985
4. Website	
5. Hard copy	
6. Name	
7. Address	
8. Phone no.	
9. Email	
10. Submitter	Jerry Brabander

Conserving the Biological Diversity of the Central Mixed-Grass Prairie, A Portfolio Designed for Conservation Action

1. Purpose	The assessment describes conservation targets, and goals for each, at multiple scales in the ecoregion.
2. Publisher	The Nature Conservancy
3. Date	2003
4. Website	

Title	Contact Information
5. Hard copy	Bound paper
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Crosstimbers/Southern Tallgrass Prairie Ecoregional Assessment	
1. Purpose	The assessment will identify a portfolio of sites and a set of strategies needed to protect representative species and natural communities in the ecoregion.
2. Publisher	The Nature Conservancy
3. Date	In process. Will be available later in 2004
4. Website	
5. Hard copy	
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Cucumber Creek Conservation Area Site Conservation Plan	
1. Purpose	The plan gives details of target species and natural community occurrences within this portfolio site and analyzes threats to their survival. Strategies to combat these threats are also given
2. Publisher	The Nature Conservancy
3. Date	August, 2002
4. Website	
5. Hard copy	
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Ecoregional Based Conservation in the Central Shortgrass Prairie	
1. Purpose	The document identifies a portfolio of sites and a set of strategies needed to protect all the species and natural communities representative of the ecoregion.
2. Publisher	The Nature Conservancy
3. Date	April, 1998
4. Website	
5. Hard copy	Bound paper or CD
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Ecoregional Conservation in the Osage Plains/Flint Hills Prairie and Appendices	
1. Purpose	The document presents conservation targets (species and natural communities) in the ecoregion along with conservation goals (the number and distribution of populations/occurrences required to sustain targets over time) for the targets, followed by an assembly into an ecoregional portfolio. Conservation strategies

Title	Contact Information
	were also given.
2. Publisher	The Nature Conservancy
3. Date	October, 2000
4. Website	
5. Hard copy	Bound paper or CD
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Ecoregional Portfolio Site Abstract, Kiamichi River Watershed	
1. Purpose	The abstract describes the ecological significance of the watershed and analyzes the stresses on each of the conservation targets. Conservation strategies are presented to combat those threats
2. Publisher	The Nature Conservancy
3. Date	2000?
4. Website	
5. Hard copy	
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Habitat fragmentation, rapid evolution, and population persistence	
1. Purpose	
2. Publisher	Patten, M. A., D. H. Wolfe, E. Shochat, and S. K. Sherrod
3. Date	
4. Website	
5. Hard copy	Not yet available
6. Name	
7. Address	
8. Phone no.	
9. Email	
10. Submitter	Dan Reinking
Ouachita Mountains Ecoregional Assessment	
1. Purpose	The assessment identified a portfolio of sites that, if protected, collectively conserve the biodiversity of the ecoregion. It also presented an implementation strategy to protect the sites, including strategies and conservation partners. It also identified data gaps to improve the quality of future conservation decision-making
2. Publisher	The Nature Conservancy
3. Date	December, 2003
4. Website	
5. Hard copy	Bound paper
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Ozark Ecoregional Conservation Assessment	
1. Purpose	The assessment was to determine the spatial configuration that would most

Title	Contact Information
	efficiently conserve viable examples of all significant biodiversity features. The assessment identified the significant species, natural communities and ecological systems in the ecoregion, established viability criteria for occurrences of these features and developed representation and selection criteria for sustainable conservation of these features.
2. Publisher	The Nature Conservancy
3. Date	November, 2003
4. Website	
5. Hard copy	Bound paper or CD
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Pontotoc Ridge Conservation Area Site Conservation Plan	
1. Purpose	The plan gives details of target species and natural community occurrences within this portfolio site and analyzes threats to their survival. Strategies to combat these threats are also given.
2. Publisher	The Nature Conservancy
3. Date	May, 1999
4. Website	
5. Hard copy	
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett
Riparian Areas of Western Oklahoma, A Special Study of Their Status, Trends, and Values	
1. Purpose	Information presented in the report should be useful for management and protection of streamside areas by both private and public groups.
2. Publisher	U.S. Fish and Wildlife Service and Oklahoma Department of Wildlife Conservation
3. Date	1987
4. Website	
5. Hard copy	
6. Name	
7. Address	
8. Phone no.	
9. Email	
10. Submitter	Jerry Brabander
Southern Shortgrass Prairie Ecoregional Assessment	
1. Purpose	The assessment will identify a portfolio of sites and a set of strategies needed to protect representative species and natural communities in the ecoregion
2. Publisher	The Nature Conservancy
3. Date	In process. Will be available later in 2004
4. Website	
5. Hard copy	
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917

Title	Contact Information
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett

Standard Operating Procedures for Stream Assessments and Biological Collections Related to Biological Criteria in Oklahoma

1. Purpose	standardizing the methods for making biological collections and physical stream assessments when assessing the streams beneficial use support status
2. Publisher	Oklahoma Water Resources Board
3. Date	1999
4. Website	http://www.owrb.state.ok.us/studies/reports/reports_pdf/TR1999_3_SOP_Assess_Collect.pdf
5. Hard copy	See below
6. Name	Chuck Potts
7. Address	3800 N Classen , Oklahoma City, OK 73118
8. Phone no.	405.530.8800
9. Email	cpotts@owrb.state.ok.us
10. Submitter	Same

Upper West Gulf Coastal Plain Ecoregional Plan

1. Purpose	The assessment identified a portfolio of sites that, if protected, collectively conserve the biodiversity of the ecoregion. It also presented an implementation strategy to protect the sites, including strategies and conservation partners. It also identified data gaps to improve the quality of future conservation decision-making.
2. Publisher	The Nature Conservancy
3. Date	June, 2002
4. Website	
5. Hard copy	Bound paper or CD
6. Name	Jay Pruett
7. Address	2727 E. 21st Street, Suite 102 Tulsa, OK 74114
8. Phone no.	918/293-2917
9. Email	jpruett@tnc.org
10. Submitter	Jay Pruett

Appendix D: Oklahoma's Species of Greatest Conservation Need Selection and Scoring Criteria

Criteria for Identifying and Ranking Species of Greatest Conservation Need:

Step 1 was to identify Oklahoma's species of greatest conservation need by applying the following criteria:

Criterion 1 – Species which are listed as federal candidate, threatened or endangered species under the ESA

Criterion 2 – Species which are classified as state species of special concern, threatened or endangered species (OAC Title 800)

Criterion 3 – Species which have been assigned global ranking scores of G1, G2 or G3 by the network of state Natural Heritage Inventory programs

Criterion 4 – Species which have been identified as conservation priorities through a rangewide status assessment, or assessment of large taxonomic divisions. Examples of these include: assessments of freshwater fish, freshwater mussels and crayfish by the American Fisheries Society, or bird conservation plans such as the national Partners In Flight Conservation Plan, the North American Waterfowl Conservation Plan and the U.S. Shorebird Conservation Plan.

Criterion 5 – Reptile, amphibian, fish and mussel species which are subject to commercial harvest in Oklahoma but are not eligible for funding under existing Federal Assistance Programs in order to monitor or periodically assess their status

Criterion 6 – Species thich are regionally endemic regardless of their conservation status.

Step 2 was to score/rank (prioritize) the species of greatest conservation need by applying the following criteria:

Criterion 1 – Natural Heritage Global Rank:

The network of State Natural Heritage Inventory Programs ranks all species on a scale of G1 through G5 with G1 species being the most imperiled and G5 species being the most secure. Each species' Natural Heritage Global Rank is identical across its range in the United States and can be obtained from the Nature Serve Website - http://www.natureserve.org.

3 points - Species has a Global Heritage Rank of G1 or G2

2 points - Species has a Global Heritage Rank of G3 or G4

1 point - Species has a Global Heritage Rank of G5

Criterion 2 – Availability of Other Federal Assistance Funding Sources:

One of the selling points used to develop support for the State Wildlife Grants program in Congress has been that it meets unfunded wildlife conservation needs. As such, state wildlife agencies have been cautioned against using these funds to supplement traditional management program such as - endangered and threatened species recovery, sport fish management or game management. Incorporating this criterion does not eliminate endangered, threatened, game and sport fish species from the list of species of greatest conservation need, but it does lower their ranking relative to other species.

3 points - Species is not eligible for management funding under ESA, P-R or D-J Programs (Federal Aid in Sport Fish and Wildlife Restoration Programs)

2 points - Species is listed as federally endangered or threatened and is eligible for management funding under the endangered species act

1 point - Species is eligible for management funding as a sport fish, game bird or game mammal

Criterion 3 – Percent of population size or geographic range within Oklahoma:

A species receives a higher score if it is found only in Oklahoma and/or a few surrounding states and a lower score if Oklahoma is on the periphery of its range.

3 points - Oklahoma encompasses >25% of the species' range or population
2 points - Oklahoma encompasses 5-25% of the species range or population
1 point - Oklahoma encompasses < 5% of the species range or population

Criterion 4 – Trend in population size or geographic range over the past 40 Years:

Forty years is our recommended window of measurement, because 1) the best population estimates and records only go back only 20 to 60 years depending upon the species, 2) the narrow time frame better reflects current trends and habitat conditions.

3 points - Species has had a documented population or range decline during the past 40 Years
2 points - Species appears to have been stable or the population trend is unknown (this applies to most species)
1 point - Species has had a documented population or range increase during the past 40 years

Criterion 5 – Availability of existing data to support inclusion of the species as a species of greatest conservation need:

A species receives one point for each of the three items listed below (maximum of 3 total points). One of the arguments in favor of new Federal Assistance funding for wildlife conservation has been the need to support proactive conservation measures that could head-off population declines and prevent the need for additional Endangered Species Act listings. Federal Candidate species have been identified as those species at greatest risk of endangerment, therefore they receive an additional point above all other species within this criterion. Points are added to the species' score if it has been previously identified as conservation concern through a public process such as a state or federal listing or has been identified as conservation concern in a peer-reviewed publication that evaluates the conservation status of a large taxonomic group or a species throughout its range. Part of the rationale is to separate those species which have been previously identified as conservation concern through other processes from those species which are Regionally endemic but appear to have stable or secure populations. It also gives added weight to the species where the data are most robust regarding its conservation status.

1 point - species has been listed as federally or state endangered, threatened, candidate or species of special concern
1 point - species has been identified as a conservation priority in a status assessment or similar peer-reviewed publication
1 point - species has been identified as a federal candidate or proposed listed species

The scores for all ranking criteria are listed below in the species evaluation matrix.. Based upon their total evaluation score, species are assigned to one of three tiers as follows:

Tier I - species receiving 11 to 15 points
Tier II - species receiving 9 or 10 points
Tier III - species receiving 6 to 8 points

Species of Greatest Conservation Need:

Group	Species	Score Criterion 1	Score Criterion 2	Score Criterion 3	Score Criterion 4	Score Criterion 5	Total 15 max	Tier	SGCN Selection Criteria
Amph	Crawfish Frog	2	3	2	2	0	9	II	4
Amph	Four-toed Salamander	1	3	1	2	1	8	III	2
Amph	Grotto Salamander	2	3	3	2	2	12	I	2, 3, 6

Group	Species	Score Criterion 1	Score Criterion 2	Score Criterion 3	Score Criterion 4	Score Criterion 5	Total 15 max	Tier	SGCN Selection Criteria
Amph	Kiamichi Slimy Salamander	3	3	3	2	0	11	I	3, 6
Amph	Many-ribbed Salamander	1	3	3	2	0	9	II	6
Amph	Mole Salamander	1	3	1	2	1	8	III	2
Amph	Oklahoma Salamander	2	3	3	2	1	11	I	2, 3, 6
Amph	Ouachita Dusky Salamander	2	3	3	2	0	10	II	2, 3, 6
Amph	Ozark Salamander	2	3	3	2	0	10	II	3, 6
Amph	Rich Mountain Salamander	3	3	3	2	1	12	I	2, 3, 6
Amph	Ringed Salamander	2	3	3	2	1	11	I	2, 3, 6
Amph	Sequoyah Slimy Salamander	3	3	3	2	0	11	I	3, 6
Amph	Southern Red-backed Salamander	1	3	3	2	0	9	II	6
Amph	Three-toed Amphiuma	1	3	2	2	1	9	II	2
Amph	Western Bird-voiced Treefrog	1	3	1	2	1	8	III	2
Amph	Western Lesser Siren	1	3	2	2	1	9	II	2
Bird	American Golden Plover	1	3	1	3	1	9	II	4
Bird	American Woodcock	1	1	2	3	1	8	III	4
Bird	Bachman's Sparrow	2	3	2	3	2	12	I	2, 3, 4
Bird	Baird's Sparrow	2	3	1	3	1	10	II	3, 4
Bird	Bald Eagle	2	2	1	1	2	8	III	1
Bird	Barn Owl	1	3	1	2	1	8	III	2
Bird	Bell's Vireo	1	3	2	3	2	11	I	2, 4
Bird	Black Rail	2	3	1	2	1	9	II	3, 4
Bird	Black-capped Vireo	3	2	3	3	2	13	I	1, 3, 4
Bird	Blue-winged Warbler	1	3	2	3	1	10	II	4
Bird	Brown-headed Nuthatch	1	3	2	3	1	10	II	4
Bird	Buff-breasted Sandpiper	2	3	2	3	1	11	I	4
Bird	Bullock's Oriole	1	3	1	3	1	9	II	4
Bird	Burrowing Owl	2	3	1	3	2	11	I	2, 3, 4
Bird	Canvasback	1	1	2	2	1	7	III	4
Bird	Cassin's Sparrow	1	3	2	2	1	9	II	4
Bird	Cerulean Warbler	2	3	1	3	2	11	I	3, 4
Bird	Chestnut-collared Longspur	1	3	2	2	1	9	II	4
Bird	Ferruginous Hawk	2	3	1	1	2	9	II	2, 3
Bird	Golden-fronted Woodpecker	1	3	2	3	1	10	II	4
Bird	Greater Prairie Chicken	1	1	2	3	1	8	III	4
Bird	Harris's Sparrow	1	3	2	3	1	10	II	4
Bird	Henslow's Sparrow	2	3	2	3	1	11	I	3, 4
Bird	Hooded Warbler	1	3	2	3	1	10	II	4
Bird	Hudsonian Godwit	1	3	1	2	1	8	III	4
Bird	Interior Least Tern	2	2	2	3	2	11	I	1, 3, 4
Bird	Juniper Titmouse	1	3	1	2	1	8	III	4
Bird	Kentucky Warbler	1	3	2	3	1	10	II	4
Bird	King Rail	2	1	2	2	1	8	III	3, 4
Bird	LeConte's Sparrow	1	3	2	2	1	9	II	4
Bird	Lesser Prairie Chicken	2	1	3	3	3	12	I	1, 3, 4
Bird	Lesser Scaup	1	1	2	3	1	8	III	4
Bird	Lewis's Woodpecker	2	3	1	2	1	9	II	3, 4
Bird	Little Blue Heron	1	3	2	2	1	9	II	4
Bird	Loggerhead Shrike	2	3	2	3	2	12	I	2, 3
Bird	Long-billed Curlew	1	3	2	3	2	11	I	4

Group	Species	Score Criterion 1	Score Criterion 2	Score Criterion 3	Score Criterion 4	Score Criterion 5	Total 15 max	Tier	SGCN Selection Criteria
Bird	Louisiana Waterthrush	1	3	2	2	1	9	II	4
Bird	McCown's Longspur	1	3	2	2	1	9	II	4
Bird	Mountain Plover	3	2	2	3	3	13	I	1, 3, 4
Bird	Nelson's Sharp-tailed Sparrow	2	3	1	1	1	8	III	4
Bird	Northern Bobwhite	1	1	2	3	1	8	III	4
Bird	Northern Pintail	1	1	2	3	1	8	III	4
Bird	Painted Bunting	1	3	2	3	1	10	II	4
Bird	Peregrine Falcon	2	2	1	1	1	7	III	1, 3
Bird	Pinyon Jay	1	3	1	3	1	9	II	4
Bird	Piping Plover	2	2	1	3	2	10	II	1, 3, 4
Bird	Prairie Falcon	1	3	1	1	1	7	III	2
Bird	Prairie Warbler	1	3	2	3	1	10	II	4
Bird	Prothonotary Warbler	1	3	2	3	1	10	II	4
Bird	Red-cockaded Woodpecker	3	2	1	3	2	11	I	1, 3, 4
Bird	Red-headed Woodpecker	1	3	2	3	1	10	II	4
Bird	Rusty Blackbird	1	3	1	3	1	9	II	4
Bird	Sandhill Crane	1	1	2	2	0	6	III	4
Bird	Scaled Quail	1	1	2	3	1	8	III	4
Bird	Short-eared Owl	1	3	1	3	1	9	II	4
Bird	Smith's Longspur	1	3	3	2	1	10	II	4
Bird	Snowy Egret	1	3	2	2	1	9	II	4
Bird	Snowy Plover	2	3	2	3	2	12	I	2, 4
Bird	Solitary Sandpiper	1	3	1	2	1	8	III	4
Bird	Sprague's Pipit	1	3	1	3	1	9	II	4
Bird	Swainson's Hawk	1	3	2	3	2	11	I	4
Bird	Swainson's Warbler	2	3	2	1	1	9	II	3, 4
Bird	Swallow-tailed Kite	1	3	1	3	1	9	II	4
Bird	Trumpeter Swan	2	1	1	1	1	6	III	4
Bird	Upland Sandpiper	1	3	1	3	1	9	II	4
Bird	Western Sandpiper	1	3	1	3	1	9	II	4
Bird	Whip-poor-will	1	3	2	3	1	10	II	4
Bird	Whooping Crane	3	2	2	2	2	11	I	1, 3
Bird	Willow Flycatcher	1	3	1	3	1	9	II	4
Bird	Wilson's Phalarope	1	3	1	3	1	9	II	4
Bird	Wood Stork	2	2	1	3	2	10	II	1
Bird	Wood Thrush	1	3	1	3	1	9	II	4
Bird	Worm-eating Warbler	1	3	2	2	1	9	II	4
Bird	Yellow Rail	2	3	1	2	1	9	II	3, 4
Fish	Alabama Shad	2	3	1	3	2	11	I	2, 3, 4
Fish	Alligator Gar	2	1	2	3	2	10	II	2, 3, 4
Fish	Arkansas Darter	2	3	3	2	3	13	I	1, 2, 3
Fish	Arkansas River Shiner	3	2	3	3	2	13	I	1, 3, 4
Fish	Arkansas River Speckled Chub	3	3	1	3	2	12	I	2, 3
Fish	Black Buffalo	1	3	1	2	1	8	III	2
Fish	Blackside Darter	1	3	1	2	1	8	III	2
Fish	Blackspot Shiner	2	3	3	2	1	11	I	3, 4, 6
Fish	Blue River pop of Least Darter	3	3	3	2	0	11	I	6
Fish	Blue Sucker	2	3	1	2	2	10	II	2, 3
Fish	Bluehead Shiner	2	3	3	2	2	12	I	2, 3, 4, 6

Group	Species	Score Criterion 1	Score Criterion 2	Score Criterion 3	Score Criterion 4	Score Criterion 5	Total 15 max	Tier	SGCN Selection Criteria
Fish	Bluntface Shiner	1	3	2	2	1	9	II	2
Fish	Brown Bullhead	1	3	1	1	1	7	III	2
Fish	Cardinal Shiner	2	3	3	2	0	10	II	6
Fish	Chain Pickerel	1	1	1	2	1	6	III	2
Fish	Chub Shiner	1	3	3	2	0	9	II	6
Fish	Creole Darter	2	3	2	2	0	9	II	6
Fish	Crystal Darter	2	3	2	3	2	12	I	2, 3, 4
Fish	Cypress Minnow	1	3	1	2	1	8	III	2
Fish	Flathead Chub	1	3	1	3	2	10	II	2, 4
Fish	Goldstripe Darter	2	3	2	2	1	10	II	2
Fish	Harlequin Darter	1	3	1	2	1	8	III	2
Fish	Ironcolor Shiner	2	3	1	2	2	10	II	2, 4
Fish	Kiamichi Shiner	2	3	3	2	2	12	I	2, 3, 4, 6
Fish	Leopard Darter	3	2	3	3	2	13	I	1, 3, 4, 6
Fish	Longnose Darter	2	3	3	3	2	13	I	2, 3, 4, 6
Fish	Mooneye	1	3	1	2	1	8	III	2
Fish	Mountain Madtom	2	3	1	2	1	9	II	2
Fish	Neosho Madtom	3	2	3	3	2	13	I	1, 3, 4, 6
Fish	Orangebelly Darter	1	3	3	2	0	9	II	6
Fish	Ouachita Mountain Shiner	2	3	3	2	2	12	I	2, 3, 4, 6
Fish	Ozark Cavefish	3	2	3	2	2	12	I	1, 3, 4, 6
Fish	Ozark Minnow	1	3	3	2	0	9	II	6
Fish	Paddlefish	2	1	2	2	1	8	III	3, 4
Fish	Pallid Shiner (Chub)	2	3	2	2	2	11	I	2, 3, 4
Fish	Peppered (Colorless) Shiner	3	3	3	2	2	13	I	2, 3, 4, 6
Fish	Plains Minnow	1	3	2	2	0	8	III	5
Fish	Plains Topminnow	2	3	1	2	1	9	II	2, 3
Fish	Prairie Speckled Chub	3	3	3	2	0	11	I	2, 3
Fish	Red River Pupfish	1	3	3	1	0	8	III	6
Fish	Red River Shiner	1	3	3	1	0	8	III	6
Fish	Redspot Chub	2	3	3	1	0	9	II	3, 6
Fish	River Darter	1	3	1	2	1	8	III	2
Fish	Rocky Shiner	2	3	3	2	1	11	I	3, 4, 6
Fish	Shorthead Redhorse	1	3	1	2	1	8	III	2
Fish	Shovelnose Sturgeon	2	3	2	3	1	11	I	2, 3
Fish	Southern Brook Lamprey	1	3	2	2	1	9	II	2
Fish	Spotfin Shiner	1	3	1	2	1	8	III	2
Fish	Sunburst (Stippled) Darter	2	3	3	2	0	10	II	6
Fish	Taillight Shiner	1	3	1	2	1	8	III	2
Fish	Wedgespot Shiner	1	3	3	2	0	9	II	6
Fish	Western Sand Darter	2	3	2	2	2	11	I	3, 4
Inver	American Burying Beetle	2	2	2	2	2	10	II	1, 3
Inver	Big Cedar Grasshopper	3	3	2	2	0	10	II	3, 6
Inver	Black Sandshell	1	3	1	3	1	9	II	4
Inver	Bleufer	1	3	2	2	0	8	III	5
Inver	Bowman's Cave Amphipod	3	3	3	2	1	12	I	3, 6
Inver	Butterfly Mussel	2	3	2	3	1	11	I	3, 4
Inver	Byssus Skipper	2	3	2	2	0	9	II	3
Inver	Caecidotea acuticarpa	3	3	3	2	0	11	I	3, 6
Inver	Caecidotea ancyla	2	3	3	2	0	10	II	3

Group	Species	Score Criterion 1	Score Criterion 2	Score Criterion 3	Score Criterion 4	Score Criterion 5	Total 15 max	Tier	SGCN Selection Criteria
Inver	Caecidotea antricola	1	3	3	2	0	9	II	3
Inver	Caecidotea macropoda	3	3	3	2	0	11	I	3, 6
Inver	Caecidotea simulator	3	3	3	2	0	11	I	3, 6
Inver	Caecidotea stiladactyla	2	3	3	2	0	10	II	3, 6
Inver	Cave Crayfish	3	3	3	2	1	12	I	3, 4, 6
Inver	Diana Fritillary	2	3	2	2	0	9	II	3
Inver	Dotted Skipper	2	3	1	2	0	8	III	3
Inver	Elktoe	2	3	1	3	1	10	II	4
Inver	Faxonella blairi	3	3	3	2	0	11	II	3, 6
Inver	Iowa Skipper	2	3	1	2	0	8	III	3
Inver	Kansas Well Amphipod	2	3	3	2	0	10	II	3, 6
Inver	Kiamichi Crayfish	3	3	3	2	1	12	I	3, 4, 6
Inver	Linda's Roadside Skipper	3	3	2	2	0	10	II	3
Inver	Little Dubiraphian Riffle Beetle	3	3	3	2	0	11	I	3
Inver	Little Spectaclecase	1	3	2	2	0	8	III	5
Inver	Louisiana Fatmucket	2	3	2	2	0	9	II	3, 6
Inver	Monkeyface Mussel	2	3	1	2	0	8	III	5
Inver	Neosho Mucket	3	3	3	3	3	15	I	1, 2, 3, 4
Inver	Ohio River Pigtoe	2	3	1	2	1	9	II	3, 4
Inver	Oklahoma Cave Amphipod	3	3	3	2	1	12	I	2, 3, 6
Inver	Oklahoma Cave Crayfish	3	3	3	2	2	13	I	2, 3, 4, 6
Inver	Oklahoma Clubtail	1	3	3	2	0	9	II	6
Inver	Orconectes menae	2	3	3	2	1	11	I	3, 4, 6
Inver	Orconectes nana	2	3	3	2	1	11	I	3, 4, 6
Inver	Ouachita Creekshell	3	3	3	2	1	12	I	3, 4, 6
Inver	Ouachita Kidneyshell	2	3	3	2	2	12	I	3, 4, 6
Inver	Ouachita Rock Pocketbook	3	2	3	3	2	13	I	1, 3, 4
Inver	Outis Skipper	2	3	2	2	0	9	II	3
Inver	Ozark Cave Amphipod	2	3	3	2	0	10	II	3, 6
Inver	Ozark Clubtail	1	3	3	2	0	9	II	6
Inver	Ozark Emerald	2	3	3	2	0	10	II	3, 6
Inver	Ozark Pigtoe	2	3	3	2	1	11	I	3, 4, 6
Inver	Plain Pocketbook	1	3	2	2	1	9	II	5
Inver	Prairie Mole Cricket	2	3	2	2	1	10	II	3
Inver	Procambarus tenuis	2	3	3	2	1	11	I	3, 4, 6
Inver	Purple Lilliput	3	3	1	3	1	11	I	3, 4
Inver	Rabbitsfoot	2	3	2	3	2	12	I	2, 3, 4
Inver	Rattlesnake Master Borer	3	3	2	2	0	10	II	3
Inver	Regal Fritillary	2	3	1	2	1	9	II	3
Inver	Rich Mountain Slitmouth Snail	3	3	3	2	2	13	I	2, 3, 6
Inver	Scaleshell	3	2	2	3	2	12	I	1, 2, 3, 4
Inver	Shinnery Oak Buck Moth	2	3	3	2	0	10	II	3, 6
Inver	Southern Hickorynut	3	3	2	2	1	11	I	3, 4
Inver	Texas Lilliput	2	3	2	2	0	9	II	3, 6
Inver	Threeridge Mussel	1	3	2	2	0	8	III	5
Inver	Wartyback Mussel	2	3	2	2	0	9	II	5
Inver	Washboard	1	3	2	2	0	8	III	5
Inver	Western Fanshell	3	3	2	3	2	13	I	2, 3, 4, 6
Inver	Winged Mapleleaf	3	2	1	3	2	11	I	1, 3, 4

Group	Species	Score Criterion 1	Score Criterion 2	Score Criterion 3	Score Criterion 4	Score Criterion 5	Total 15 max	Tier	SGCN Selection Criteria
Mamm	Black-tailed Prairie Dog	1	3	2	2	3	11	I	1, 2, 3
Mamm	Brazilian (Mexican) Free-tailed Bat	1	3	2	2	2	10	II	2
Mamm	Colorado Chipmunk	1	3	1	2	0	7	III	6
Mamm	Desert Shrew	1	3	2	2	1	9	II	2
Mamm	Eastern Harvest Mouse	1	3	1	2	1	8	III	2
Mamm	Eastern Small-footed Myotis	2	3	1	2	2	10	II	2, 3
Mamm	Eastern Spotted Skunk	1	1	2	3	1	8	III	2, 3
Mamm	Golden Mouse	1	3	1	2	1	8	III	2
Mamm	Gray Myotis	2	2	2	1	2	9	II	1, 3
Mamm	Hog-nosed Skunk	2	1	1	2	1	7	III	2
Mamm	Indiana Myotis	3	2	1	3	2	11	I	1, 3
Mamm	Long-tailed Weasel	1	1	1	2	1	6	III	2
Mamm	Marsh Rice Rat	1	3	1	2	1	8	III	2
Mamm	Meadow Jumping Mouse	1	3	1	2	1	8	III	2
Mamm	Mountain Lion	1	1	1	1	2	6	III	2
Mamm	Northern Long-eared Myotis	2	3	1	2	2	10	II	2, 3
Mamm	Ozark Big-eared Bat	2	2	3	3	2	12	I	1, 3
Mamm	Rafinesque's Big-eared Bat	2	3	1	2	2	10	II	2, 3
Mamm	Ringtail	1	1	2	2	1	7	III	2
Mamm	River Otter	1	1	1	1	2	6	III	2
Mamm	Seminole Bat	1	3	1	2	1	8	III	2
Mamm	Southeastern Myotis	2	3	2	2	2	11	I	2, 3
Mamm	Swamp Rabbit	1	1	2	2	0	6	III	4
Mamm	Swift Fox	2	2	2	2	2	10	II	2, 3
Mamm	Texas Kangaroo Rat	3	3	1	2	1	10	II	2, 3
Mamm	Western Big-eared Bat	2	3	1	3	2	11	I	2, 3
Rept	Alligator Snapping Turtle	2	3	2	3	2	12	I	2, 3
Rept	American Alligator	1	3	1	1	1	7	III	2
Rept	Common Checkered Whiptail	1	3	1	2	0	7	III	2
Rept	Com.on Lesser Earless Lizard	1	3	2	2	1	9	II	2
Rept	Eastern River Cooter	1	3	2	2	0	8	III	5
Rept	Gulf Crayfish Snake	1	3	2	2	1	9	II	2
Rept	Louisiana Milksnake	2	3	2	2	1	10	II	2
Rept	Midland Smooth Softshell	1	3	2	2	0	8	III	5
Rept	Mississippi Map Turtle	1	3	2	2	0	8	III	5
Rept	Northern Map Turtle	1	3	1	2	1	8	III	2
Rept	Northern Scarletsnake	1	3	2	2	1	9	II	2
Rept	Ouachita Map Turtle	1	3	2	2	0	8	III	5
Rept	Razor-backed Musk Turtle	1	3	2	2	0	8	III	6
Rept	Round-tailed Horned Lizard	1	3	1	2	1	8	III	2
Rept	Spiny Softshell Turtle	1	3	2	2	0	8	III	5
Rept	Texas Gartersnake	1	3	2	2	1	9	II	2, 3
Rept	Texas Horned Lizard	2	3	2	3	2	12	I	2
Rept	Texas Long-nosed Snake	1	3	2	2	1	9	II	2
Rept	Western Chicken Turtle	1	3	2	2	1	9	II	2
Rept	Western Diamond-backed Rattlesnake	1	3	2	2	0	8	III	5
Rept	Western Massasauga	2	3	2	2	1	10	II	2, 3
Rept	Western Mudsnake	1	3	2	2	1	9	II	2

Appendix E: Oklahoma's Species of Greatest Conservation Need Grouped by Priority Sets

Tier I species of greatest conservation need is top priority.

Tier designation is based on scores for meeting the criteria outlined in step 2 of Appendix D: Oklahoma's Species of Greatest Conservation Need Selection and Scoring Criteria.

Group	Species	Tier
Amph	Grotto Salamander	I
Amph	Kiamichi Slimy Salamander	I
Amph	Oklahoma Salamander	I
Amph	Rich Mountain Salamander	I
Amph	Ringed Salamander	I
Amph	Sequoyah Slimy Salamander	I
Bird	Bachman's Sparrow	I
Bird	Bell's Vireo	I
Bird	Black-capped Vireo	I
Bird	Buff-breasted Sandpiper	I
Bird	Burrowing Owl	I
Bird	Cerulean Warbler	I
Bird	Henslow's Sparrow	I
Bird	Interior Least Tern	I
Bird	Lesser Prairie Chicken	I
Bird	Loggerhead Shrike	I
Bird	Long-billed Curlew	I
Bird	Mountain Plover	I
Bird	Red-cockaded Woodpecker	I
Bird	Snowy Plover	I
Bird	Swainson's Hawk	I
Bird	Whooping Crane	I
Fish	Alabama Shad	I
Fish	Arkansas Darter	I
Fish	Arkansas River Shiner	I
Fish	Arkansas River Speckled Chub	I
Fish	Blackspot Shiner	I
Fish	Blue River pop of Least Darter	I
Fish	Bluehead Shiner	I
Fish	Crystal Darter	I
Fish	Kiamichi Shiner	I
Fish	Leopard Darter	I
Fish	Longnose Darter	I
Fish	Neosho Madtom	I
Fish	Ouachita Mountain Shiner	I
Fish	Ozark Cavefish	I
Fish	Pallid Shiner (Chub)	I
Fish	Peppered (Colorless) Shiner	I
Fish	Prairie Speckled Chub	I
Fish	Rocky Shiner	I
Fish	Shovelnose Sturgeon	I

Group	Species	Tier
Fish	Western Sand Darter	I
Inver	Bowman's Cave Amphipod	I
Inver	Butterfly Mussel	I
Inver	Caecidotea acuticarpa	I
Inver	Caecidotea macropoda	I
Inver	Caecidotea simulator	I
Inver	Cave Crayfish	I
Inver	Kiamichi Crayfish	I
Inver	Little Dubiraphian Riffle Beetle	I
Inver	Neosho Mucket	I
Inver	Oklahoma Cave Amphipod	I
Inver	Oklahoma Cave Crayfish	I
Inver	Orconectes menae	I
Inver	Orconectes nana	I
Inver	Ouachita Creekshell	I
Inver	Ouachita Kidneyshell	I
Inver	Ouachita Rock Pocketbook	I
Inver	Ozark Pigtoe	I
Inver	Procambarus tenuis	I
Inver	Purple Lilliput	I
Inver	Rabbitsfoot	I
Inver	Rich Mountain Slitmouth Snail	I
Inver	Scaleshell	I
Inver	Southern Hickorynut	I
Inver	Western Fanshell	I
Inver	Winged Mapleleaf	I
Mamm	Black-tailed Prairie Dog	I
Mamm	Indiana Myotis	I
Mamm	Ozark Big-eared Bat	I
Mamm	Southeastern Myotis	I
Mamm	Western Big-eared Bat	I
Rept	Alligator Snapping Turtle	I
Rept	Texas Horned Lizard	I
Amph	Crawfish Frog	II
Amph	Many-ribbed Salamander	II
Amph	Ouachita Dusky Salamander	II
Amph	Ozark Salamander	II
Amph	Southern Red-backed Salamander	II
Amph	Three-toed Amphiuma	II
Amph	Western Lesser Siren	II
Bird	American Golden Plover	II
Bird	Baird's Sparrow	II
Bird	Black Rail	II
Bird	Blue-winged Warbler	II
Bird	Brown-headed Nuthatch	II
Bird	Bullock's Oriole	II
Bird	Cassin's Sparrow	II
Bird	Chestnut-collared Longspur	II
Bird	Ferruginous Hawk	II
Bird	Golden-fronted Woodpecker	II

Group	Species	Tier
Bird	Harris's Sparrow	II
Bird	Hooded Warbler	II
Bird	Kentucky Warbler	II
Bird	LeConte's Sparrow	II
Bird	Lewis's Woodpecker	II
Bird	Little Blue Heron	II
Bird	Louisiana Waterthrush	II
Bird	McCown's Longspur	II
Bird	Painted Bunting	II
Bird	Pinyon Jay	II
Bird	Piping Plover	II
Bird	Prairie Warbler	II
Bird	Prothonotary Warbler	II
Bird	Red-headed Woodpecker	II
Bird	Rusty Blackbird	II
Bird	Short-eared Owl	II
Bird	Smith's Longspur	II
Bird	Snowy Egret	II
Bird	Sprague's Pipit	II
Bird	Swainson's Warbler	II
Bird	Swallow-tailed Kite	II
Bird	Upland Sandpiper	II
Bird	Western Sandpiper	II
Bird	Whip-poor-will	II
Bird	Willow Flycatcher	II
Bird	Wilson's Phalarope	II
Bird	Wood Stork	II
Bird	Wood Thrush	II
Bird	Worm-eating Warbler	II
Bird	Yellow Rail	II
Fish	Alligator Gar	II
Fish	Blue Sucker	II
Fish	Bluntface Shiner	II
Fish	Cardinal Shiner	II
Fish	Chub Shiner	II
Fish	Creole Darter	II
Fish	Flathead Chub	II
Fish	Goldstripe Darter	II
Fish	Ironcolor Shiner	II
Fish	Mountain Madtom	II
Fish	Orangebelly Darter	II
Fish	Ozark Minnow	II
Fish	Plains Topminnow	II
Fish	Redspot Chub	II
Fish	Southern Brook Lamprey	II
Fish	Sunburst (Stippled) Darter	II
Fish	Wedgespot Shiner	II
Inver	American Burying Beetle	II
Inver	Big Cedar Grasshopper	II
Inver	Black Sandshell	II

Group	Species	Tier
Inver	Byssus Skipper	II
Inver	Caecidotea ancyla	II
Inver	Caecidotea antricola	II
Inver	Caecidotea stiladactyla	II
Inver	Diana Fritillary	II
Inver	Elktoe	II
Inver	Faxonella blairi	II
Inver	Kansas Well Amphipod	II
Inver	Linda's Roadside Skipper	II
Inver	Louisiana Fatmucket	II
Inver	Ohio River Pigtoe	II
Inver	Oklahoma Clubtail	II
Inver	Outis Skipper	II
Inver	Ozark Cave Amphipod	II
Inver	Ozark Clubtail	II
Inver	Ozark Emerald	II
Inver	Plain Pocketbook	II
Inver	Prairie Mole Cricket	II
Inver	Rattlesnake Master Borer	II
Inver	Regal Fritillary	II
Inver	Shinnery Oak Buck Moth	II
Inver	Texas Lilliput	II
Inver	Wartyback Mussel	II
Mamm	Brazilian (Mexican) Free-tailed Bat	II
Mamm	Desert Shrew	II
Mamm	Eastern Small-footed Myotis	II
Mamm	Gray Myotis	II
Mamm	Northern Long-eared Myotis	II
Mamm	Rafinesque's Big-eared Bat	II
Mamm	Swift Fox	II
Mamm	Texas Kangaroo Rat	II
Rept	Common Lesser Earless Lizard	II
Rept	Gulf Crayfish Snake	II
Rept	Louisiana Milksnake	II
Rept	Northern Scarletsnake	II
Rept	Texas Gartersnake	II
Rept	Texas Long-nosed Snake	II
Rept	Western Chicken Turtle	II
Rept	Western Massasauga	II
Rept	Western Mudsnake	II
Amph	Four-toed Salamander	III
Amph	Mole Salamander	III
Amph	Western Bird-voiced Treefrog	III
Bird	American Woodcock	III
Bird	Bald Eagle	III
Bird	Barn Owl	III
Bird	Canvasback	III
Bird	Greater Prairie Chicken	III
Bird	Hudsonian Godwit	III
Bird	Juniper Titmouse	III

Group	Species	Tier
Bird	King Rail	III
Bird	Lesser Scaup	III
Bird	Nelson's Sharp-tailed Sparrow	III
Bird	Northern Bobwhite	III
Bird	Northern Pintail	III
Bird	Peregrine Falcon	III
Bird	Prairie Falcon	III
Bird	Sandhill Crane	III
Bird	Scaled Quail	III
Bird	Solitary Sandpiper	III
Bird	Trumpeter Swan	III
Fish	Black Buffalo	III
Fish	Blackside Darter	III
Fish	Brown Bullhead	III
Fish	Chain Pickerel	III
Fish	Cypress Minnow	III
Fish	Harlequin Darter	III
Fish	Mooneye	III
Fish	Paddlefish	III
Fish	Plains Minnow	III
Fish	Red River Pupfish	III
Fish	Red River Shiner	III
Fish	River Darter	III
Fish	Shorthead Redhorse	III
Fish	Spotfin Shiner	III
Fish	Taillight Shiner	III
Inver	Bleufer	III
Inver	Dotted Skipper	III
Inver	Iowa Skipper	III
Inver	Little Spectaclecase	III
Inver	Monkeyface Mussel	III
Inver	Threeridge Mussel	III
Inver	Washboard	III
Mamm	Colorado Chipmunk	III
Mamm	Eastern Harvest Mouse	III
Mamm	Eastern Spotted Skunk	III
Mamm	Golden Mouse	III
Mamm	Hog-nosed Skunk	III
Mamm	Long-tailed Weasel	III
Mamm	Marsh Rice Rat	III
Mamm	Meadow Jumping Mouse	III
Mamm	Mountain Lion	III
Mamm	Ringtail	III
Mamm	River Otter	III
Mamm	Seminole Bat	III
Mamm	Swamp Rabbit	III
Rept	American Alligator	III
Rept	Common Checkered Whiptail	III
Rept	Eastern River Cooter	III
Rept	Midland Smooth Softshell	III

Group	Species	Tier
Rept	Mississippi Map Turtle	III
Rept	Northern Map Turtle	III
Rept	Ouachita Map Turtle	III
Rept	Razor-backed Musk Turtle	III
Rept	Round-tailed Horned Lizard	III
Rept	Spiny Softshell Turtle	III
Rept	Western Diamond-backed Rattlesnake	III

Appendix F: Oklahoma Species Which Did Not Meet Greatest Conservation Need Criteria

Amphibians:

Blanchard's Cricket Frog
Bullfrog
Cave Salamander
Central Newt
Cope's Gray Treefrog
Couch's Spadefoot
Dark-sided Salamander
Dwarf American Toad
Eastern Narrowmouth Toad
Gray Treefrog
Great Plains Narrowmouth Toad
Great Plains Toad
Green Frog
Green Toad
Green Treefrog
Hurter's Spadefoot
Marbled Salamander
New Mexico Spadefoot
Northern Spring Peeper
Pickerel Frog
Plains Leopard Frog
Plains Spadefoot
Red River Mudpuppy
Red-spotted Toad
Smallmouth Salamander
Southern Leopard Frog
Spotted Salamander
Strecker's Chorus Frog
Texas Toad
Tiger Salamander
Upland Chorus Frog
Western Chorus Frog
Western Slimy Salamander
Wood Frog
Woodhouse's Toad

Birds:

Acadian Flycatcher
Alder Flycatcher
American Avocet
American Bittern
American Coot
American Crow
American Goldfinch
American Kestrel
American Pipit
American Redstart
American Robin
American Tree Sparrow
American White Pelican
American Wigeon
Anhinga
Ash-throated Flycatcher
Baird's Sandpiper
Baltimore Oriole
Bank Swallow
Barn Swallow
Barred Owl
Bay-breasted Warbler
Belted Kingfisher
Bewick's Wren
Black Tern
Black Vulture
Black-and-White Warbler
Black-bellied Plover
Black-billed Cuckoo
Black-billed Magpie
Blackburnian Warbler
Black-chinned Hummingbird
Black-crowned Night-Heron
Black-headed Grosbeak
Black-necked Stilt
Blackpoll Warbler
Black-throated Green Warbler
Black-throated Sparrow
Blue Grosbeak
Blue Jay
Blue-gray Gnatcatcher
Blue-headed Vireo
Blue-winged Teal
Bobolink
Bonaparte's Gull
Brewer's Blackbird
Brewer's Sparrow
Broad-winged Hawk
Brown Creeper
Brown Thrasher
Brown-headed Cowbird
Bufflehead
Canada Goose
Canada Warbler
Canyon Towhee
Canyon Wren
Carolina Chickadee
Carolina Wren
Caspian Tern
Cassin's Finch
Cassin's Kingbird
Cattle Egret
Cedar Waxwing
Chestnut-sided Warbler
Chihuahuan Raven
Chimney Swift
Chipping Sparrow
Chuck-will's-widow
Cinnamon Teal
Clay-colored Sparrow
Cliff Swallow
Common Bushtit
Common Goldeneye
Common Grackle
Common Loon
Common Merganser
Common Moorhen
Common Nighthawk
Common Poorwill
Common Raven
Common Tern
Common Yellowthroat
Cooper's Hawk
Cordilleran Flycatcher
Curve-billed Thrasher
Dark-eyed Junco
Dickcissel
Double-crested Cormorant
Downy Woodpecker
Dunlin
Dusky Flycatcher
Eared Grebe
Eastern Bluebird
Eastern Kingbird
Eastern Meadowlark
Eastern Phoebe
Eastern Screech Owl
Eastern Towhee
Eastern Wood-Pewee
Eurasian Collared Dove
European Starling
Evening Grosbeak
Field Sparrow
Fish Crow
Forster's Tern
Fox Sparrow
Franklin's Gull

Gadwall
Glaucous Gull
Golden Eagle
Golden-crowned Kinglet
Golden-winged Warbler
Grasshopper Sparrow
Gray Catbird
Gray-cheeked Thrush
Great Blue Heron
Great Crested Flycatcher
Great Egret
Great Horned Owl
Greater Roadrunner
Greater Scaup
Greater White-fronted Goose
Greater Yellowlegs
Great-tailed Grackle
Green Heron
Green-tailed Towhee
Green-winged Teal
Hairy Woodpecker
Hammond's Flycatcher
Hermit Thrush
Herring Gull
Hooded Merganser
Horned Grebe
Horned Lark
House Finch
House Sparrow
House Wren
Inca Dove
Indigo Bunting
Killdeer
Ladder-backed Woodpecker
Lapland Longspur
Lark Bunting
Lark Sparrow
Lazuli Bunting
Least Bittern
Least Flycatcher
Least Sandpiper
Lesser Goldfinch
Lesser Yellowlegs
Lincoln's Sparrow
Long-billed Dowitcher
Long-eared Owl
MacGillivray's Warbler
Magnolia Warbler
Mallard
Marbled Godwit
Marsh Wren
Merlin
Mississippi Kite
Mountain Bluebird
Mourning Dove
Mourning Warbler
Nashville Warbler
Neotropic Cormorant
Northern Cardinal
Northern Flicker
Northern Goshawk
Northern Harrier
Northern Mockingbird
Northern Parula
Northern Rough-winged Swallow
Northern Shoveler
Northern Shrike
Northern Waterthrush
Olive-sided Flycatcher
Orange-crowned Warbler
Orchard Oriole
Osprey
Ovenbird
Palm Warbler
Pectoral Sandpiper
Philadelphia Vireo
Pied-billed Grebe
Pileated Woodpecker
Pine Siskin
Pine Warbler
Plumbeous Vireo
Purple Finch
Purple Gallinule
Purple Martin
Pygmy Nuthatch
Red Crossbill
Red Knot
Red-bellied Woodpecker
Red-breasted Merganser
Red-breasted Nuthatch
Red-eyed Vireo
Redhead
Red-shouldered Hawk
Red-tailed Hawk
Red-winged Blackbird
Ring-billed Gull
Ring-necked Duck
Ring-necked Pheasant
Rock Pigeon
Rock Wren
Rose-breasted Grosbeak
Ross's Goose
Rough-legged Hawk
Ruby-crowned Kinglet
Ruby-throated Hummingbird
Ruddy Duck
Ruddy Turnstone
Rufous Hummingbird
Rufous-crowned Sparrow
Sage Thrasher
Sanderling
Savannah Sparrow
Say's Phoebe
Scarlet Tanager
Scissor-tailed Flycatcher
Sedge Wren
Semipalmated Plover
Semipalmated Sandpiper
Sharp-shinned Hawk
Short-billed Dowitcher
Snow Goose
Snowy Owl
Song Sparrow
Sora
Spotted Sandpiper
Spotted Towhee
Stilt Sandpiper
Summer Tanager
Swainson's Thrush
Swamp Sparrow
Tennessee Warbler
Townsend's Solitare
Townsend's Warbler
Tree Swallow
Tufted Titmouse
Tundra Swan
Turkey Vulture
Veery
Verdin
Vesper Sparrow
Virginia Rail
Virginia's Warbler
Warbling Vireo
Western Grebe
Western Kingbird
Western Meadowlark
Western Screech Owl
Western Scrub Jay
Western Tanager
Western Wood-Pewee
Whimbrel
White Ibis
White-breasted Nuthatch
White-crowned Sparrow
White-eyed Vireo
White-faced Ibis
White-rumped Sandpiper

White-tailed Kite
White-throated Sparrow
Wild Turkey
Willet
Wilson's (Common) Snipe
Wilson's Warbler
Winter Wren
Wood Duck
Yellow Warbler
Yellow-bellied Flycatcher
Yellow-bellied Sapsucker
Yellow-billed Cuckoo
Yellow-breasted Chat
Yellow-crowned Night-Heron
Yellow-headed Blackbird
Yellow-rumped Warbler
Yellow-throated Vireo
Yellow-throated Warbler

Fish:

American Eel
Banded Darter
Banded Pygmy Sunfish
Bantam Sunfish
Bigeye Chub
Bigeye Shiner
Bigmouth Buffalo
Bigscale Logperch
Black Bullhead
Black Crappie
Black Redhorse
Blackspotted Topminnow
Blackstripe Topminnow
Blacktail Shiner
Blue Catfish
Bluegill Sunfish
Bluntnose Darter
Bluntnose Minnow
Bowfin
Brindled Madtom
Brook Silverside
Brown Trout
Bullhead Minnow
Central Stoneroller
Channel Catfish
Channel Darter
Chestnut Lamprey
Common Shiner
Creek Chub
Creek Chubsucker
Cypress Darter
Dollar Sunfish
Dusky Darter
Emerald Shiner
Fantail Darter
Fathead Minnow
Flathead Catfish
Flier
Freckled Madtom
Freshwater Drum
Ghost Shiner
Gizzard Shad
Golden Redhorse
Golden Shiner
Golden Topminnow
Goldeneye
Gravel Chub
Green Sunfish
Greenside Darter
Highfin Carpsucker
Hogsucker
Hybrid Striped Bass
Inland Silverside
Johnny Darter
Lake Chubsucker
Largemouth Bass
Largescale Stoneroller
Least Darter
Logperch
Longear Sunfish
Longnose Gar
Mimic Shiner
Mosquito Fish
Mottled Sculpin
Mud Darter
Northern Studfish
Orange-spotted Sunfish
Orangethroat Darter
Pirate Perch
Plains Killifish
Pugnose Shiner (Minnow)
Quillback
Rainbow Trout
Red Shiner
Redbreasted Sunfish
Redear Sunfish
Redfin Darter
Redfin Pickerel
Redfin Shiner
Ribbon Shiner
River Carpsucker
River Redhorse
River Shiner
Rock Bass
Rosyface Shiner
Sand Shiner
Sauger
Saugeye
Scaly Sand Darter
Shoal Speckled Chub
Shortnose Gar
Silverband Shiner
Silvery Chub
Silvery Minnow
Skipjack
Slender Madtom
Slenderhead Darter
Slim Minnow
Slough Darter
Smallmouth Bass
Smallmouth Buffalo
Southern Red-bellied Dace
Speckled Darter
Spotted Bass
Spotted Gar
Spotted Sucker
Spotted Sunfish
Starhead Minnow
Steelcolor Shiner
Stonecat
Striped Bass
Striped Mullet
Suckermouth Minnow
Swamp Darter
Tadpole Madtom
Threadfin Shad
Walleye
Warmouth
White (Sand) Bass
White Crappie
White Sucker
Yellow Bass
Yellow Bullhead

Mammals:

American Badger
American Beaver
American Elk
Baird's Pocket Gopher

Big Brown Bat
Big Free-tailed Bat
Black Bear
Black Rat
Black-tailed Jackrabbit
Bobcat
Brush Mouse
Cave Myotis
Common Muskrat
Common Porcupine
Common Raccoon
Cotton Mouse
Coyote
Deer Mouse
Desert Cottontail
Eastern Chipmunk
Eastern Cottontail
Eastern Mole
Eastern Pipistrel
Eastern Woodrat
Elliot's Short-tailed Shrew
Evening Bat
Fox Squirrel
Fulvous Harvest Mouse
Gray Fox
Gray Squirrel
Hispid Cotton Rat
Hispid Pocket Mouse
Hoary Bat
House Mouse
Least Shrew
Least Weasel
Little Brown Myotis
Mexican Woodrat
Mink
Mule Deer
Nine-banded Armadillo
Northern Grasshopper Mouse
Northern Pygmy Mouse
Norway Rat
Nutria
Ord's Kangaroo Rat
Pallid Bat
Pinyon Mouse
Plains Harvest Mouse
Plains Pocket Gopher
Plains Pocket Mouse
Prairie Vole
Pronghorn
Red Bat
Red Fox
Rock Mouse
Rock Squirrel
Silky Pocket Mouse
Silver-haired Bat
Southern Flying Squirrel
Southern Plains Woodrat
Southern Short-tailed Shrew
Southern Short-tailed Shrew
Spotted Ground Squirrel
Striped Skunk
Texas Mouse
Thirteen-lined Ground Squirrel
Virginia Opossum
Western Harvest Mouse
Western Pipistrel
Western Small-footed Myotis
Western Spotted Skunk
White-ankled Mouse
White-footed Mouse
White-tailed Deer
White-throated Woodrat
Woodchuck
Woodland Vole
Yellow-faced Pocket Gopher
Yuma Myotis

Reptiles:

Black Ratsnake
Black-necked Gartersnake
Broadhead Skink
Brown Skink
Bullsnake
Central Plains Milksnake
Checkered Gartersnake
Coachwhip
Collared Lizard
Common Musk Turtle
Common Snapping Turtle
Copperhead
DeKay's Brownsnake
Desert Side-blotched Lizard
Diamond-backed Watersnake
Eastern Gartersnake
Eastern Hognose Snake
Eastern Racer
Fence (Prairie) Lizard
Five-lined Skink
Flat-headed Snake
Glossy Snake
Graham's Crayfish Snake
Great Plains Ratsnake
Great Plains Skink
Green Anole
Ground Snake
Lined Snake
Mississippi Mud Turtle
New Mexico Blind Snake
Northern Watersnake
Ornate Box Turtle
Painted Turtle
Plain-bellied Watersnake
Plains Black-headed Snake
Prairie Kingsnake
Prairie Rattlesnake
Pygmy Rattlesnake
Red Milksnake
Red-bellied Snake
Red-eared Slider
Red-sided Gartersnake
Ring-necked Snake
Rough Greensnake
Six-lined Racerunner
Slender Glass Lizard
Southern (Broad-banded) Watersnake
Southern Coal Skink
Southern Prairie Skink
Speckled Kingsnake
Texas Nightsnake
Texas Spotted Whiptail
Three-toed Box Turtle
Timber Rattlesnake
Wandering Gartersnake
Western Cottonmouth
Western Hognose Snake
Western Plains Gartersnake
Western Ribbonsnake
Western Worm Snake
Yellow Mud Turtle

Appendix G: Oklahoma Species List with Scientific Names

Group	Common Name	Scientific Name
Amphibian	Blanchard's Cricket Frog	*Acris crepitans blanchardi*
Amphibian	Bullfrog	*Rana catesbeiana*
Amphibian	Cave Salamander	*Eurycea lucifuga*
Amphibian	Central Newt	*Notophthalmus viridescens louisianensis*
Amphibian	Cope's Gray Treefrog	*Hyla chrysoscelis*
Amphibian	Couch's Spadefoot	*Scaphiopus couchii*
Amphibian	Crawfish Frog	*Rana areolata*
Amphibian	Dark-sided Salamander	*Eurycea longicauda melanopleura*
Amphibian	Dwarf American Toad	*Bufo americanus charlesmithi*
Amphibian	Eastern Narrowmouth Toad	*Gastrophryne carolinensis*
Amphibian	Four-toed Salamander	*Hemidactylium scutatum*
Amphibian	Gray Treefrog	*Hyla versicolor*
Amphibian	Great Plains Narrowmouth Toad	*Gastrophryne olivacea*
Amphibian	Great Plains Toad	*Bufo cognatus*
Amphibian	Green Frog	*Rana clamitans*
Amphibian	Green Toad	*Bufo debilis*
Amphibian	Green Treefrog	*Hyla cinerea*
Amphibian	Grotto Salamander	*Typhlotriton spelaeus*
Amphibian	Hurter's Spadefoot	*Scaphiopus hurteri*
Amphibian	Kiamichi Slimy Salamander	*Plethodon kiamichi*
Amphibian	Many-ribbed Salamander	*Eurycea multiplicata*
Amphibian	Marbled Salamander	*Ambystoma opacum*
Amphibian	Mole Salamander	*Ambystoma talpoideum*
Amphibian	New Mexico Spadefoot	*Spea multiplicatus*
Amphibian	Northern Spring Peeper	*Pseudacris crucifer crucifer*
Amphibian	Oklahoma Salamander	*Eurycea tynerensis*
Amphibian	Ouachita Dusky Salamander	*Desmognathus brimleyorum*
Amphibian	Ozark Salamander	*Plethodon angusticlavius*
Amphibian	Pickerel Frog	*Rana palustris*
Amphibian	Plains Leopard Frog	*Rana blairi*
Amphibian	Plains Spadefoot	*Spea bombifrons*
Amphibian	Red River Mudpuppy	*Necturus maculosis louisianensis*
Amphibian	Red-spotted Toad	*Bufo punctatus*
Amphibian	Rich Mountain Salamander	*Plethodon ouachitae*
Amphibian	Ringed Salamander	*Ambystoma annulatum*
Amphibian	Sequoyah Slimy Salamander	*Plethodon sequoyah*
Amphibian	Smallmouth Salamander	*Ambystoma texanum*
Amphibian	Southern Leopard Frog	*Rana sphenocephala*
Amphibian	Southern Red-backed Salamander	*Plethodon serratus*
Amphibian	Spotted Salamander	*Ambystoma maculatum*
Amphibian	Strecker's Chorus Frog	*Pseudacris streckeri*
Amphibian	Texas Toad	*Bufo speciosus*
Amphibian	Three-toed Amphiuma	*Amphiuma tridactylum*
Amphibian	Tiger Salamander	*Ambystoma tigrinum*
Amphibian	Upland Chorus Frog	*Pseudacris feriarum feriarum*
Amphibian	Western Bird-voiced Treefrog	*Hyla avivoca avivoca*
Amphibian	Western Chorus Frog	*Pseudacris triseriata*
Amphibian	Western Lesser Siren	*Siren intermedia nettingi*

Group	Common Name	Scientific Name
Amphibian	Western Slimy Salamander	*Plethodon albagula*
Amphibian	Wood Frog	*Rana sylvatica*
Amphibian	Woodhouse's Toad	*Bufo woodhousii*
Bird	Acadian Flycatcher	*Empidonax virescens*
Bird	Alder Flycatcher	*Empidonax alnorum*
Bird	American Avocet	*Recurvirostra americana*
Bird	American Bittern	*Botaurus lentiginosus*
Bird	American Coot	*Fulica americana*
Bird	American Crow	*Corvus brachyrhynchos*
Bird	American Golden Plover	*Pluvialis dominica*
Bird	American Goldfinch	*Carduelis tristis*
Bird	American Kestrel	*Falco sparverius paulus*
Bird	American Pipit	*Anthus rubescens*
Bird	American Redstart	*Setophaga ruticilla*
Bird	American Robin	*Turdus migratorius*
Bird	American Tree Sparrow	*Spizella arborea*
Bird	American White Pelican	*Pelecanus erythrorhynchos*
Bird	American Wigeon	*Anas americana*
Bird	American Woodcock	*Scolopax minor*
Bird	Anhinga	*Anhinga anhinga*
Bird	Ash-throated Flycatcher	*Myiarchus cinerascens*
Bird	Bachman's Sparrow	*Aimophila aestivalis*
Bird	Baird's Sandpiper	*Calidris bairdii*
Bird	Baird's Sparrow	*Ammodramus bairdii*
Bird	Bald Eagle	*Haliaeetus leucocephalus*
Bird	Baltimore Oriole	*Icterus galbula*
Bird	Bank Swallow	*Riparia riparia*
Bird	Barn Owl	*Tyto alba*
Bird	Barn Swallow	*Hirundo rustica*
Bird	Barred Owl	*Strix varia*
Bird	Bay-breasted Warbler	*Dendroica castanea*
Bird	Bell's Vireo	*Vireo bellii*
Bird	Belted Kingfisher	*Ceryle alcyon*
Bird	Bewick's Wren	*Thryomanes bewickii*
Bird	Black Rail	*Laterallus jamaicensis*
Bird	Black Tern	*Chlidonias niger*
Bird	Black Vulture	*Coragyps atratus*
Bird	Black-and-White Warbler	*Mniotilta varia*
Bird	Black-bellied Plover	*Pluvialis squatarola*
Bird	Black-billed Cuckoo	*Coccyzus erythropthalmus*
Bird	Black-billed Magpie	*Pica hudsonia*
Bird	Blackburnian Warbler	*Dendroica fusca*
Bird	Black-capped Vireo	*Vireo atricapillus*
Bird	Black-chinned Hummingbird	*Archilochus alexandri*
Bird	Black-crowned Night-Heron	*Nycticorax nycticorax*
Bird	Black-headed Grosbeak	*Pheucticus melanocephalus*
Bird	Black-necked Stilt	*Himantopus mexicanus*
Bird	Blackpoll Warbler	*Dendroica striata*
Bird	Black-throated Green Warbler	*Dendroica virens*
Bird	Black-throated Sparrow	*Amphispiza bilineata*

Group	Common Name	Scientific Name
Bird	Blue Grosbeak	*Guiraca caerulea*
Bird	Blue Jay	*Cyanocitta cristata*
Bird	Blue-gray Gnatcatcher	*Polioptila caerulea*
Bird	Blue-headed Vireo	*Vireo solitarius*
Bird	Blue-winged Teal	*Anas discors*
Bird	Blue-winged Warbler	*Vermivora pinus*
Bird	Bobolink	*Dolichonyx oryzivorus*
Bird	Bonaparte's Gull	*Larus philadelphia*
Bird	Brewer's Blackbird	*Euphagus cyanocephalus*
Bird	Brewer's Sparrow	*Spizella breweri*
Bird	Broad-winged Hawk	*Buteo platypterus*
Bird	Brown Creeper	*Certhia americana*
Bird	Brown Thrasher	*Toxostoma rufum*
Bird	Brown-headed Cowbird	*Molothrus ater*
Bird	Brown-headed Nuthatch	*Sitta pusilla*
Bird	Buff-breasted Sandpiper	*Tryngites subruficollis*
Bird	Bufflehead	*Bucephala albeola*
Bird	Bullock's Oriole	*Icterus bullockii*
Bird	Burrowing Owl	*Athene cunicularia*
Bird	Canada Goose	*Branta canadensis*
Bird	Canada Warbler	*Wilsonia canadensis*
Bird	Canvasback	*Aythya valisineria*
Bird	Canyon Towhee	*Pipilo fuscus*
Bird	Canyon Wren	*Catherpes mexicanus*
Bird	Carolina Chickadee	*Poecile carolinensis*
Bird	Carolina Wren	*Thryothorus ludovicianus*
Bird	Caspian Tern	*Sterna caspia*
Bird	Cassin's Finch	*Carpodacus cassinii*
Bird	Cassin's Kingbird	*Tyrannus vociferans*
Bird	Cassin's Sparrow	*Aimophila cassinii*
Bird	Cattle Egret	*Bubulcus ibis*
Bird	Cedar Waxwing	*Bombycilla cedrorum*
Bird	Cerulean Warbler	*Dendroica cerulea*
Bird	Chestnut-collared Longspur	*Calcarius ornatus*
Bird	Chestnut-sided Warbler	*Dendroica pensylvanica*
Bird	Chihuahuan Raven	*Corvus cryptoleucus*
Bird	Chimney Swift	*Chaetura pelagica*
Bird	Chipping Sparrow	*Spizella passerina*
Bird	Chuck-will's-widow	*Caprimulgus carolinensis*
Bird	Cinnamon Teal	*Anas cyanoptera*
Bird	Clay-colored Sparrow	*Spizella pallida*
Bird	Cliff Swallow	*Petrochelidon pyrrhonota*
Bird	Common Bushtit	*Psaltriparus minimus*
Bird	Common Goldeneye	*Bucephala clangula*
Bird	Common Grackle	*Quiscalus quiscula*
Bird	Common Loon	*Gavia immer*
Bird	Common Merganser	*Mergus merganser*
Bird	Common Moorhen	*Gallinula chloropus*
Bird	Common Nighthawk	*Chordeiles minor*
Bird	Common Poorwill	*Phalaenoptilus nuttallii*

Group	Common Name	Scientific Name
Bird	Common Raven	*Corvus corax*
Bird	Common Tern	*Sterna hirundo*
Bird	Common Yellowthroat	*Geothlypis trichas*
Bird	Cooper's Hawk	*Accipiter cooperii*
Bird	Cordilleran Flycatcher	*Empidonax occidentalis*
Bird	Curve-billed Thrasher	*Toxostoma curvirostre*
Bird	Dark-eyed Junco	*Junco hyemalis*
Bird	Dickcissel	*Spiza americana*
Bird	Double-crested Cormorant	*Phalacrocorax auritus*
Bird	Downy Woodpecker	*Picoides pubescens*
Bird	Dunlin	*Calidris alpina*
Bird	Dusky Flycatcher	*Empidonax oberholseri*
Bird	Eared Grebe	*Podiceps nigricollis*
Bird	Eastern Bluebird	*Sialia sialis*
Bird	Eastern Kingbird	*Tyrannus tyrannus*
Bird	Eastern Meadowlark	*Sturnella magna*
Bird	Eastern Phoebe	*Sayornis phoebe*
Bird	Eastern Screech Owl	*Otus asio*
Bird	Eastern Towhee	*Pipilo erythrophthalmus*
Bird	Eastern Wood-Pewee	*Contopus virens*
Bird	Eurasian Collared Dove	*Streptopelia decaocto*
Bird	European Starling	*Sturnus vulgarisms*
Bird	Evening Grosbeak	*Coccothraustes vespertinus*
Bird	Ferruginous Hawk	*Buteo regalis*
Bird	Field Sparrow	*Spizella pusilla*
Bird	Fish Crow	*Corvus ossifragus*
Bird	Forster's Tern	*Sterna forsteri*
Bird	Fox Sparrow	*Passerella iliaca*
Bird	Franklin's Gull	*Larus pipixcan*
Bird	Gadwall	*Anas strepera*
Bird	Glaucous Gull	*Larus hyperboreus*
Bird	Golden Eagle	*Aquila chrysaetos*
Bird	Golden-crowned Kinglet	*Regulus satrapa*
Bird	Golden-fronted Woodpecker	*Melanerpes aurifrons*
Bird	Golden-winged Warbler	*Vermivora chrysoptera*
Bird	Grasshopper Sparrow	*Ammodramus savannarum*
Bird	Gray Catbird	*Dumetella carolinensis*
Bird	Gray-cheeked Thrush	*Catharus minimus*
Bird	Great Blue Heron	*Ardea herodias*
Bird	Great Crested Flycatcher	*Myiarchus crinitus*
Bird	Great Egret	*Ardea alba*
Bird	Great Horned Owl	*Bubo virginianus*
Bird	Greater Prairie Chicken	*Tympanuchus cupido*
Bird	Greater Roadrunner	*Geococcyx californianus*
Bird	Greater Scaup	*Aythya marila*
Bird	Greater White-fronted Goose	*Anser albifrons*
Bird	Greater Yellowlegs	*Tringa melanoleuca*
Bird	Great-tailed Grackle	*Quiscalus mexicanus*
Bird	Green Heron	*Butorides virescens*
Bird	Green-tailed Towhee	*Pipilo chlorurus*

Group	Common Name	Scientific Name
Bird	Green-winged Teal	*Anas crecca*
Bird	Hairy Woodpecker	*Picoides villosus*
Bird	Hammond's Flycatcher	*Empidonax hammondii*
Bird	Harris's Sparrow	*Zonotrichia querula*
Bird	Henslow's Sparrow	*Ammodramus henslowii*
Bird	Hermit Thrush	*Catharus guttatus*
Bird	Herring Gull	*Larus argentatus*
Bird	Hooded Merganser	*Lophodytes cucullatus*
Bird	Hooded Warbler	*Wilsonia citrina*
Bird	Horned Grebe	*Podiceps auritus*
Bird	Horned Lark	*Eremophila alpestris*
Bird	House Finch	*Carpodacus mexicanus*
Bird	House Sparrow	*Passer domesticus*
Bird	House Wren	*Troglodytes aedon*
Bird	Hudsonian Godwit	*Limosa haemastica*
Bird	Inca Dove	*Columbina inca*
Bird	Indigo Bunting	*Passerina cyanea*
Bird	Interior Least Tern	*Sterna antillarum athalassos*
Bird	Juniper Titmouse	*Baeolophus ridgwayi*
Bird	Kentucky Warbler	*Oporornis formosus*
Bird	Killdeer	*Charadrius vociferus*
Bird	King Rail	*Rallus elegans*
Bird	Ladder-backed Woodpecker	*Picoides scalaris*
Bird	Lapland Longspur	*Calcarius lapponicus*
Bird	Lark Bunting	*Calamospiza melanocorys*
Bird	Lark Sparrow	*Chondestes grammacus*
Bird	Lazuli Bunting	*Passerina amoena*
Bird	Least Bittern	*Ixobrychus exilis*
Bird	Least Flycatcher	*Empidonax minimus*
Bird	Least Sandpiper	*Calidris minutilla*
Bird	LeConte's Sparrow	*Ammodramus leconteii*
Bird	Lesser Goldfinch	*Carduelis psaltria*
Bird	Lesser Prairie Chicken	*Tympanuchus pallidicinctus*
Bird	Lesser Scaup	*Aythya affinis*
Bird	Lesser Yellowlegs	*Tringa flavipes*
Bird	Lewis's Woodpecker	*Melanerpes lewis*
Bird	Lincoln's Sparrow	*Melospiza lincolnii*
Bird	Little Blue Heron	*Egretta caerulea*
Bird	Loggerhead Shrike	*Lanius ludovicianus*
Bird	Long-billed Curlew	*Numenius americanus*
Bird	Long-billed Dowitcher	*Limnodromus scolopaceus*
Bird	Long-eared Owl	*Asio otus*
Bird	Louisiana Waterthrush	*Seiurus motacilla*
Bird	MacGillivray's Warbler	*Oporornis tolmiei*
Bird	Magnolia Warbler	*Dendroica magnolia*
Bird	Mallard	*Anas platyrhynchos*
Bird	Marbled Godwit	*Limosa fedoa*
Bird	Marsh Wren	*Cistothorus palustris*
Bird	McCown's Longspur	*Calcarius mccownii*
Bird	Merlin	*Falco columbarius*

Group	Common Name	Scientific Name
Bird	Mississippi Kite	*Ictinia mississippiensis*
Bird	Mountain Bluebird	*Sialia currucoides*
Bird	Mountain Plover	*Charadrius montanus*
Bird	Mourning Dove	*Zenaida macroura*
Bird	Mourning Warbler	*Oporornis philadelphia*
Bird	Nashville Warbler	*Vermivora ruficapilla*
Bird	Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*
Bird	Neotropic Cormorant	*Phalacrocorax brasilianus*
Bird	Northern Bobwhite	*Colinus virginianus*
Bird	Northern Cardinal	*Cardinalis cardinalis*
Bird	Northern Flicker	*Colaptes auratus*
Bird	Northern Goshawk	*Accipiter gentilis*
Bird	Northern Harrier	*Circus cyaneus*
Bird	Northern Mockingbird	*Mimus polyglottos*
Bird	Northern Parula	*Parula americana*
Bird	Northern Pintail	*Anas acuta*
Bird	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bird	Northern Shoveler	*Anas clypeata*
Bird	Northern Shrike	*Lanius excubitor*
Bird	Northern Waterthrush	*Seiurus noveboracensis*
Bird	Olive-sided Flycatcher	*Contopus cooperi*
Bird	Orange-crowned Warbler	*Vermivora celata*
Bird	Orchard Oriole	*Icterus spurius*
Bird	Osprey	*Pandion haliaetus*
Bird	Ovenbird	*Seiurus aurocapillus*
Bird	Painted Bunting	*Passerina ciris*
Bird	Palm Warbler	*Dendroica palmarum*
Bird	Pectoral Sandpiper	*Calidris melanotos*
Bird	Peregrine Falcon	*Falco peregrinus*
Bird	Philadelphia Vireo	*Vireo philadelphicus*
Bird	Pied-billed Grebe	*Podilymbus podiceps*
Bird	Pileated Woodpecker	*Dryocopus pileatus*
Bird	Pine Siskin	*Carduelis pinus*
Bird	Pine Warbler	*Dendroica pinus*
Bird	Pinyon Jay	*Gymnorhinus cyanocephalus*
Bird	Piping Plover	*Charadrius melodus*
Bird	Plumbeous Vireo	*Vireo plumbeus*
Bird	Prairie Falcon	*Falco mexicanus*
Bird	Prairie Warbler	*Dendroica discolor*
Bird	Prothonotary Warbler	*Protonotaria citrea*
Bird	Purple Finch	*Carpodacus purpureus*
Bird	Purple Gallinule	*Porphyrio martinicus*
Bird	Purple Martin	*Progne subis*
Bird	Pygmy Nuthatch	*Sitta pygmaea*
Bird	Red Crossbill	*Loxia curvirostra*
Bird	Red Knot	*Calidris canutus*
Bird	Red-bellied Woodpecker	*Melanerpes carolinus*
Bird	Red-breasted Merganser	*Mergus serrator*
Bird	Red-breasted Nuthatch	*Sitta canadensis*
Bird	Red-cockaded Woodpecker	*Picoides borealis*

Group	Common Name	Scientific Name
Bird	Red-eyed Vireo	*Vireo olivaceus*
Bird	Redhead	*Aythya americana*
Bird	Red-headed Woodpecker	*Melanerpes erythrocephalus*
Bird	Red-shouldered Hawk	*Buteo lineatus*
Bird	Red-tailed Hawk	*Buteo jamaicensis*
Bird	Red-winged Blackbird	*Agelaius phoeniceus*
Bird	Ring-billed Gull	*Larus delawarensis*
Bird	Ring-necked Duck	*Aythya collaris*
Bird	Ring-necked Pheasant	*Phasianus colchicus*
Bird	Rock Pigeon	*Columba livia*
Bird	Rock Wren	*Salpinctes obsoletus*
Bird	Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Bird	Ross's Goose	*Chen rossii*
Bird	Rough-legged Hawk	*Buteo lagopus*
Bird	Ruby-crowned Kinglet	*Regulus calendula*
Bird	Ruby-throated Hummingbird	*Archilochus colubris*
Bird	Ruddy Duck	*Oxyura jamaicensis*
Bird	Ruddy Turnstone	*Arenaria interpres*
Bird	Rufous Hummingbird	*Selasphorus rufus*
Bird	Rufous-crowned Sparrow	*Aimophila ruficeps*
Bird	Rusty Blackbird	*Euphagus carolinus*
Bird	Sage Thrasher	*Oreoscoptes montanus*
Bird	Sanderling	*Calidris alba*
Bird	Sandhill Crane	*Grus canadensis*
Bird	Savannah Sparrow	*Passerculus sandwichensis*
Bird	Say's Phoebe	*Sayornis saya*
Bird	Scaled Quail	*Callipepla squamata*
Bird	Scarlet Tanager	*Piranga olivacea*
Bird	Scissor-tailed Flycatcher	*Tyrannus forficatus*
Bird	Sedge Wren	*Cistothorus platensis*
Bird	Semipalmated Plover	*Charadrius semipalmatus*
Bird	Semipalmated Sandpiper	*Calidris pusilla*
Bird	Sharp-shinned Hawk	*Accipiter striatus*
Bird	Short-billed Dowitcher	*Limnodromus griseus*
Bird	Short-eared Owl	*Asio flammeus*
Bird	Smith's Longspur	*Calcarius pictus*
Bird	Snow Goose	*Chen caerulescens*
Bird	Snowy Egret	*Egretta thula*
Bird	Snowy Owl	*Nyctea scandiaca*
Bird	Snowy Plover	*Charadrius alexandrinus*
Bird	Solitary Sandpiper	*Tringa solitaria*
Bird	Song Sparrow	*Melospiza melodia*
Bird	Sora	*Porzana carolina*
Bird	Spotted Sandpiper	*Actitis macularia*
Bird	Spotted Towhee	*Pipilo maculatus*
Bird	Sprague's Pipit	*Anthus spragueii*
Bird	Stilt Sandpiper	*Calidris himantopus*
Bird	Summer Tanager	*Piranga rubra*
Bird	Swainson's Hawk	*Buteo swainsoni*
Bird	Swainson's Thrush	*Catharus ustulatus*

Group	Common Name	Scientific Name
Bird	Swainson's Warbler	*Limnothlypis swainsonii*
Bird	Swallow-tailed Kite	*Elanoides forficatus*
Bird	Swamp Sparrow	*Melospiza georgiana*
Bird	Tennessee Warbler	*Vermivora peregrina*
Bird	Townsend's Solitare	*Myadestes townsendi*
Bird	Townsend's Warbler	*Dendroica townsendi*
Bird	Tree Swallow	*Tachycineta bicolor*
Bird	Trumpeter Swan	*Cygnus buccinator*
Bird	Tufted Titmouse	*Baeolophus bicolor*
Bird	Tundra Swan	*Cygnus columbianus*
Bird	Turkey Vulture	*Cathartes aura*
Bird	Upland Sandpiper	*Bartramia longicauda*
Bird	Veery	*Catharus fuscescens*
Bird	Verdin	*Auriparus flaviceps*
Bird	Vesper Sparrow	*Pooecetes gramineus*
Bird	Virginia Rail	*Rallus limicola*
Bird	Virginia's Warbler	*Vermivora virginiae*
Bird	Warbling Vireo	*Vireo gilvus*
Bird	Western Grebe	*Aechmophorus occidentalis*
Bird	Western Kingbird	*Tyrannus verticalis*
Bird	Western Meadowlark	*Sturnella neglecta*
Bird	Western Sandpiper	*Calidris mauri*
Bird	Western Screech Owl	*Megascops kennicottii*
Bird	Western Scrub Jay	*Aphelocoma californica*
Bird	Western Tanager	*Piranga ludoviciana*
Bird	Western Wood-Pewee	*Contopus sordidulus*
Bird	Whimbrel	*Numenius phaeopus*
Bird	Whip-poor-will	*Caprimulgus vociferus*
Bird	White Ibis	*Eudocimus albus*
Bird	White-breasted Nuthatch	*Sitta carolinensis*
Bird	White-crowned Sparrow	*Zonotrichia leucophrys*
Bird	White-eyed Vireo	*Vireo griseus*
Bird	White-faced Ibis	*Plegadis chihi*
Bird	White-rumped Sandpiper	*Calidris fuscicollis*
Bird	White-tailed Kite	*Elanus leucurus*
Bird	White-throated Sparrow	*Zonotrichia albicollis*
Bird	Whooping Crane	*Grus americana*
Bird	Wild Turkey	*Meleagris gallopavo*
Bird	Willet	*Catoptrophorus semipalmatus*
Bird	Willow Flycatcher	*Empidonax traillii*
Bird	Wilson's (Common) Snipe	*Gallinago delicata*
Bird	Wilson's Phalarope	*Phalaropus tricolor*
Bird	Wilson's Warbler	*Wilsonia pusilla*
Bird	Winter Wren	*Troglodytes troglodytes*
Bird	Wood Duck	*Aix sponsa*
Bird	Wood Stork	*Mycteria americana*
Bird	Wood Thrush	*Hylocichla mustelina*
Bird	Worm-eating Warbler	*Helmitheros vermivorus*
Bird	Yellow Rail	*Coturnicops noveboracensis*
Bird	Yellow Warbler	*Dendroica petechia*

Group	Common Name	Scientific Name
Bird	Yellow-bellied Flycatcher	*Empidonax flaviventris*
Bird	Yellow-bellied Sapsucker	*Sphyrapicus varius*
Bird	Yellow-billed Cuckoo	*Coccyzus americanus*
Bird	Yellow-breasted Chat	*Icteria virens*
Bird	Yellow-crowned Night-Heron	*Nyctanassa violacea*
Bird	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Bird	Yellow-rumped Warbler	*Dendroica coronata*
Bird	Yellow-throated Vireo	*Vireo flavifrons*
Bird	Yellow-throated Warbler	*Dendroica dominica*
Fish	Alabama Shad	*Alosa alabamae*
Fish	Alligator Gar	*Atractosteus spatula*
Fish	American Eel	*Anguilla rostrata*
Fish	Arkansas Darter	*Etheostoma cragini*
Fish	Arkansas River Shiner	*Notropis girardi*
Fish	Arkansas River Speckled Chub	*Macrhybopsis tetranema*
Fish	Banded Darter	*Etheostoma zonale*
Fish	Banded Pygmy Sunfish	*Elassoma zonatum*
Fish	Bantam Sunfish	*Lepomis symmetricus*
Fish	Bigeye Chub	*Hybopsis amblops*
Fish	Bigeye Shiner	*Notropis boops*
Fish	Bigmouth Buffalo	*Ictiobus cyprinellus*
Fish	Bigscale Logperch	*Percina macrolepida*
Fish	Black Buffalo	*Ictiobus niger*
Fish	Black Bullhead	*Ameiurus melas*
Fish	Black Crappie	*Pomoxis nigromaculatus*
Fish	Black Redhorse	*Moxostoma duquesnei*
Fish	Blackside Darter	*Percina maculata*
Fish	Blackspot Shiner	*Notropis atrocaudalis*
Fish	Blackspotted Topminnow	*Fundulus olivaceus*
Fish	Blackstripe Topminnow	*Fundulus notatus*
Fish	Blacktail Shiner	*Cyprinella venusta*
Fish	Blue Catfish	*Ictalurus furcatus*
Fish	Blue River pop of Least Darter	*Etheostoma sp*
Fish	Blue Sucker	*Cycleptus elongatus*
Fish	Bluegill Sunfish	*Lepomis macrochirus*
Fish	Bluehead Shiner	*Pteronotropis hubbsi*
Fish	Bluntface Shiner	*Cyprinella camurus*
Fish	Bluntnose Darter	*Etheostoma chlorosomum*
Fish	Bluntnose Minnow	*Pimaphales notatus*
Fish	Bowfin	*Amia calva*
Fish	Brindled Madtom	*Noturus miurus*
Fish	Brook Silverside	*Labidesthes sicculus*
Fish	Brown Bullhead	*Ameiurus nebulosus*
Fish	Brown Trout	*Salmo trutta*
Fish	Bullhead Minnow	*Pimaphales vigilax*
Fish	Cardinal Shiner	*Luxilus cardinalis*
Fish	Central Stoneroller	*Campostoma anomalum*
Fish	Chain Pickerel	*Esox niger*
Fish	Channel Catfish	*Ictalurus punctatus*
Fish	Channel Darter	*Percina copelandi*

Group	Common Name	Scientific Name
Fish	Chestnut Lamprey	*Ichthyomyzon castaneus*
Fish	Chub Shiner	*Notropis potteri*
Fish	Creek Chub	*Semotilus atromaculatus*
Fish	Creek Chubsucker	*Erimyzon oblongus*
Fish	Creole Darter	*Etheostoma collettei*
Fish	Crystal Darter	*Crystallaria asprella*
Fish	Cypress Darter	*Etheostoma proeliare*
Fish	Cypress Minnow	*Hybognathus hayi*
Fish	Dollar Sunfish	*Lepomis marginatus*
Fish	Dusky Darter	*Percina sciera*
Fish	Emerald Shiner	*Notropis atherinoides*
Fish	Fantail Darter	*Etheostoma flabellare*
Fish	Fathead Minnow	*Pimephales promelas*
Fish	Flathead Catfish	*Pylodictis olivaris*
Fish	Flathead Chub	*Platygobio gracilis*
Fish	Flier	*Centrarchus macropterus*
Fish	Freckled Madtom	*Noturus nocturnus*
Fish	Freshwater Drum	*Aplodinotus grunniens*
Fish	Ghost Shiner	*Notropis buchanani*
Fish	Gizzard Shad	*Dorosoma cepedianum*
Fish	Golden Redhorse	*Moxostoma erythrurum*
Fish	Golden Shiner	*Notemigonus crysoleucas*
Fish	Golden Topminnow	*Fundulus chrysotus*
Fish	Goldeneye	*Hiodon alosoides*
Fish	Goldstripe Darter	*Etheostoma parvipinne*
Fish	Gravel Chub	*Erimystax x-punctata*
Fish	Green Sunfish	*Lepomis cyanellus*
Fish	Greenside Darter	*Etheostoma blennioides*
Fish	Harlequin Darter	*Etheostoma histrio*
Fish	Highfin Carpsucker	*Carpiodes velifer*
Fish	Hogsucker	*Hypentelium nigricans*
Fish	Hybrid Striped Bass	*Morone saxatilis x chrysops*
Fish	Inland Silverside	*Menidia beryllina*
Fish	Ironcolor Shiner	*Notropis chalybaeus*
Fish	Johnny Darter	*Etheostoma nigrum*
Fish	Kiamichi Shiner	*Notropis ortenburgeri*
Fish	Lake Chubsucker	*Erimyzon sucetta*
Fish	Largemouth Bass	*Micropterus salmoides*
Fish	Largescale Stoneroller	*Campostoma oligolepis*
Fish	Least Darter	*Etheostoma microperca*
Fish	Leopard Darter	*Percina pantherina*
Fish	Logperch	*Percina caprodes*
Fish	Longear Sunfish	*Lepomis megalotis*
Fish	Longnose Darter	*Percina nasuta*
Fish	Longnose Gar	*Lepisosteus osseus*
Fish	Mimic Shiner	*Notropis volucellus*
Fish	Mooneye	*Hiodon tergisus*
Fish	Mosquito Fish	*Gambusia affinis*
Fish	Mottled Sculpin	*Cottus carolinae*
Fish	Mountain Madtom	*Noturus eleutherus*

Group	Common Name	Scientific Name
Fish	Mud Darter	*Etheostoma asprigene*
Fish	Neosho Madtom	*Noturus placidus*
Fish	Northern Studfish	*Fundulus catenatus*
Fish	Orangebelly Darter	*Etheostoma radiosum*
Fish	Orange-spotted Sunfish	*Lepomis humilis*
Fish	Orangethroat Darter	*Etheostoma spectabile*
Fish	Ouachita Mountain Shiner	*Lythurus snelsoni*
Fish	Ozark Cavefish	*Amblyopsis rosae*
Fish	Ozark Minnow	*Notropis nubilus*
Fish	Paddlefish	*Polyodon spathula*
Fish	Pallid Shiner (Chub)	*Chub (Hybopsis amnis*
Fish	Peppered (Colorless) Shiner	*Notropis perpallidus*
Fish	Pirate Perch	*Aphredoderus sayanus*
Fish	Plains Killifish	*Fundulus zebrinus*
Fish	Plains Minnow	*Hybognathus placitus*
Fish	Plains Topminnow	*Fundulus sciadicus*
Fish	Prairie Speckled Chub	*Macrhybopsis australis*
Fish	Pugnose Shiner (Minnow)	*Notropis emiliae*
Fish	Quillback	*Carpiodes cyprinus*
Fish	Rainbow Trout	*Oncorhynchus mykiss*
Fish	Red River Pupfish	*Cyprinodon rubrofluviatilis*
Fish	Red River Shiner	*Notropis bairdi*
Fish	Red Shiner	*Cyprinella lutrensis*
Fish	Redbreasted Sunfish	*Lepomis auritus*
Fish	Redear Sunfish	*Lepomis microlophis*
Fish	Redfin Darter	*Etheostoma whipplei*
Fish	Redfin Pickerel	*Esox americanus*
Fish	Redfin Shiner	*Lythurus umbratilis*
Fish	Redspot Chub	*Nocomis asper*
Fish	Ribbon Shiner	*Lythurus fumeus*
Fish	River Carpsucker	*Carpiodes carpio*
Fish	River Darter	*Percina shumardi*
Fish	River Redhorse	*Moxostoma carinatum*
Fish	River Shiner	*Notropis blennius*
Fish	Rock Bass	*Ambloplites rupestris*
Fish	Rocky Shiner	*Notropis suttkusi*
Fish	Rosyface Shiner	*Notropis rubellus*
Fish	Sand Shiner	*Notropis stramineus*
Fish	Sauger	*Sander canadensis*
Fish	Saugeye	*Sander canadense x vitreus*
Fish	Scaly Sand Darter	*Ammocrypta vivax*
Fish	Shoal Speckled Chub	*Macrhybopsis hystoma*
Fish	Shorthead Redhorse	*Moxostoma macrolepidotum*
Fish	Shortnose Gar	*Lepisosteus platostomus*
Fish	Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Fish	Silverband Shiner	*Notropis shumardi*
Fish	Silvery Chub	*Macrhybopsis storeriana*
Fish	Silvery Minnow	*Hybognathus nuchalis*
Fish	Skipjack	*Alosa chrysochloris*
Fish	Slender Madtom	*Noturus exilis*

Group	Common Name	Scientific Name
Fish	Slenderhead Darter	*Percina phoxocephala*
Fish	Slim Minnow	*Pimephales tenellus*
Fish	Slough Darter	*Etheostoma gracile*
Fish	Smallmouth Bass	*Micropterus dolomieui*
Fish	Smallmouth Buffalo	*Ictiobus bubalus*
Fish	Southern Brook Lamprey	*Ichthyomyzon gagei*
Fish	Southern Red-bellied Dace	*Phoxinus erythrogaster*
Fish	Speckled Darter	*Etheostoma stigmaeum*
Fish	Spotfin Shiner	*Cyprinella spilopterus*
Fish	Spotted Bass	*Micropterus punctulatus*
Fish	Spotted Gar	*Lepisosteus oculatus*
Fish	Spotted Sucker	*Minytrema melanops*
Fish	Spotted Sunfish	*Lepomis punctatus*
Fish	Starhead Minnow	*Fundulus blairae*
Fish	Steelcolor Shiner	*Cyprinella whipplei*
Fish	Stonecat	*Noturus flavus*
Fish	Striped Bass	*Morone saxatilis*
Fish	Striped Mullet	*Mugil cephalus*
Fish	Striped Shiner	*Luxilus chrysocephalus*
Fish	Suckermouth Minnow	*Phenacobius mirabilis*
Fish	Sunburst (Stippled) Darter	*Etheostoma punctulatum*
Fish	Swamp Darter	*Etheostoma fusiforme*
Fish	Tadpole Madtom	*Noturus gyrinus*
Fish	Taillight Shiner	*Notropis maculatus*
Fish	Threadfin Shad	*Dorosoma petenense*
Fish	Walleye	*Sander vitreus*
Fish	Warmouth	*Lepomis gulosus*
Fish	Wedgespot Shiner	*Notropis greenei*
Fish	Western Sand Darter	*Ammocrypta clara*
Fish	White (Sand) Bass	*Morone chrysops*
Fish	White Crappie	*Pomoxis annularis*
Fish	White Sucker	*Catostomus commersoni*
Fish	Yellow Bass	*Morone mississippiensis*
Fish	Yellow Bullhead	*Ameiurus natalis*
Invertebrate	American Burying Beetle	*Nicrophorus americanus*
Invertebrate	Big Cedar Grasshopper	*Eximacris phenax*
Invertebrate	Black Sandshell	*Ligumia recta*
Invertebrate	Bleufer	*Potamilus purpuratus*
Invertebrate	Bowman's Cave Amphipod	*Stygobromus bowmani*
Invertebrate	Butterfly Mussel	*Ellipsaria lineolata*
Invertebrate	Byssus Skipper	*Problema byssus*
Invertebrate	Caecidotea acuticarpa	*Caecidotea acuticarpa*
Invertebrate	Caecidotea ancyla	*Caecidotea ancyla*
Invertebrate	Caecidotea antricola	*Caecidotea antricola*
Invertebrate	Caecidotea macropoda	*Caecidotea macropoda*
Invertebrate	Caecidotea simulator	*Caecidotea simulator*
Invertebrate	Caecidotea stiladactyla	*Caecidotea stiladactyla*
Invertebrate	Cave Crayfish	*Cambarus subterraneus*
Invertebrate	Diana Fritillary	*Speyeria diana*
Invertebrate	Dotted Skipper	*Hesperia attalus*

Group	Common Name	Scientific Name
Invertebrate	Elktoe	*Alasmidonta marginata*
Invertebrate	Faxonella blairi	*Faxonella blairi*
Invertebrate	Iowa Skipper	*Atrytone arogos iowa*
Invertebrate	Kansas Well Amphipod	*Bactrurus hubrichti*
Invertebrate	Kiamichi Crayfish	*Orconectes saxatilis*
Invertebrate	Linda's Roadside Skipper	*Amblyscirtes linda*
Invertebrate	Little Dubiraphian Riffle Beetle	*Dubiraphia parva*
Invertebrate	Little Spectaclecase	*Villosa lienosa*
Invertebrate	Louisiana Fatmucket	*Lampsilis hydiana*
Invertebrate	Monkeyface Mussel	*Quadrula metanevra*
Invertebrate	Neosho Mucket	*Lampsilis rafinesqueana*
Invertebrate	Ohio River Pigtoe	*Pleurobema cordatum*
Invertebrate	Oklahoma Cave Amphipod	*Allocragonyx pellucidus*
Invertebrate	Oklahoma Cave Crayfish	*Cambarus tartarus*
Invertebrate	Oklahoma Clubtail	*Gomphus oklahomensis*
Invertebrate	Orconectes menae	*Orconectes menae*
Invertebrate	Orconectes nana	*Orconectes nana*
Invertebrate	Ouachita Creekshell	*Villosa arkansasensis*
Invertebrate	Ouachita Kidneyshell	*Ptychobranchus occidentalis*
Invertebrate	Ouachita Rock Pocketbook	*Arkansia wheeleri*
Invertebrate	Outis Skipper	*Cogia outis*
Invertebrate	Ozark Cave Amphipod	*Stygobromus ozarkensis*
Invertebrate	Ozark Clubtail	*Gomphus ozarkensis*
Invertebrate	Ozark Emerald	*Somatochlora ozarkensis*
Invertebrate	Ozark Pigtoe	*Fusconia ozarkensis*
Invertebrate	Plain Pocketbook	*Lampsilis cardium*
Invertebrate	Prairie Mole Cricket	*Gryllotalpa major*
Invertebrate	Procambarus tenuis	*Procambarus tenuis*
Invertebrate	Purple Lilliput	*Toxolasma lividum*
Invertebrate	Rabbitsfoot	*Quadrula cylindrica*
Invertebrate	Rattlesnake Master Borer	*Papaipema eryngii*
Invertebrate	Regal Fritillary	*Speyeria idalia*
Invertebrate	Rich Mountain Slitmouth Snail	*Stenotrema pilsbryi*
Invertebrate	Scaleshell	*Leptodea leptodon*
Invertebrate	Shinnery Oak Buck Moth	*Hemileuca slosseri*
Invertebrate	Southern Hickorynut	*Obovaria jacksoniana*
Invertebrate	Texas Lilliput	*Toxolasma texasiensis*
Invertebrate	Threeridge Mussel	*Amblema plicata*
Invertebrate	Wartyback Mussel	*Quadrula nodulata*
Invertebrate	Washboard	*Megalonaias nervosa*
Invertebrate	Western Fanshell	*Cyprogenia aberti*
Invertebrate	Winged Mapleleaf	*Quadrula fragosa*
Mammal	American Badger	*Taxidea taxus*
Mammal	American Beaver	*Castor canadensis*
Mammal	American Elk	*Cervus elaphus*
Mammal	Baird's Pocket Gopher	*Geomys breviceps*
Mammal	Big Brown Bat	*Eptesicus fuscus*
Mammal	Big Free-tailed Bat	*Nyctinomops macrotis*
Mammal	Black Bear	*Ursus americanus*
Mammal	Black Rat	*Rattus rattus*

Group	Common Name	Scientific Name
Mammal	Black-tailed Jackrabbit	*Lepus californicus*
Mammal	Black-tailed Prairie Dog	*Cynomys ludovicianus*
Mammal	Bobcat	*Lynx rufus*
Mammal	Brazilian (Mexican) Free-tailed Bat	*Tadarida brasiliensis*
Mammal	Brush Mouse	*Peromyscus boylii*
Mammal	Cave Myotis	*Myotis velifer*
Mammal	Colorado Chipmunk	*Tamias quadrivittatus*
Mammal	Common Muskrat	*Ondatra zibethicus*
Mammal	Common Porcupine	*Erethizon dorsatum*
Mammal	Common Raccoon	*Procyon lotor*
Mammal	Cotton Mouse	*Peromyscus gossypinus*
Mammal	Coyote	*Canis latrans*
Mammal	Deer Mouse	*Peromyscus maniculatus*
Mammal	Desert Cottontail	*Sylvilagus audubonii*
Mammal	Desert Shrew	*Notiosorex crawfordi*
Mammal	Eastern Chipmunk	*Tamias striatus*
Mammal	Eastern Cottontail	*Sylvilagus floridanus*
Mammal	Eastern Harvest Mouse	*Reithrodontomys humilis*
Mammal	Eastern Mole	*Scalopus aquaticus*
Mammal	Eastern Pipistrel	*Pipistrellus subflavus*
Mammal	Eastern Small-footed Myotis	*Myotis leibii*
Mammal	Eastern Spotted Skunk	*Spilogale putorius*
Mammal	Eastern Woodrat	*Neotoma floridana*
Mammal	Elliot's Short-tailed Shrew	*Blarina hylophaga*
Mammal	Evening Bat	*Nycticeius humeralis*
Mammal	Fox Squirrel	*Sciurus niger*
Mammal	Fulvous Harvest Mouse	*Reithrodontomys fulvescens*
Mammal	Golden Mouse	*Ochrotomys nuttalli*
Mammal	Gray Fox	*Urocyon cinereoargenteus*
Mammal	Gray Myotis	*Myotis grisescens*
Mammal	Gray Squirrel	*Sciurus carolinensis*
Mammal	Hispid Cotton Rat	*Sigmodon hispidus*
Mammal	Hispid Pocket Mouse	*Chaetodipus hispidus*
Mammal	Hoary Bat	*Lasiurus cinereus*
Mammal	Hog-nosed Skunk	*Conepatus mesoleucus*
Mammal	House Mouse	*Mus musculus*
Mammal	Indiana Myotis	*Myotis sodalis*
Mammal	Least Shrew	*Cryptotis parva*
Mammal	Least Weasel	*Mustela nivalis*
Mammal	Little Brown Myotis	*Myotis lucifugus*
Mammal	Long-tailed Weasel	*Mustela frenata*
Mammal	Marsh Rice Rat	*Oryzomys palustris*
Mammal	Meadow Jumping Mouse	*Zapus hudsonius*
Mammal	Mexican Woodrat	*Neotoma mexicana*
Mammal	Mink	*Mustela vison*
Mammal	Mountain Lion	*Puma concolor*
Mammal	Mule Deer	*Odocoileus hemionus*
Mammal	Nine-banded Armadillo	*Dasypus novemcinctus*
Mammal	Northern Grasshopper Mouse	*Onychomys leucogaster*
Mammal	Northern Long-eared Myotis	*Myotis septentrionalis*

Group	Common Name	Scientific Name
Mammal	Northern Pygmy Mouse	*Baiomys taylori*
Mammal	Norway Rat	*Rattus norvegicus*
Mammal	Nutria	*Myocastor coypus*
Mammal	Ord's Kangaroo Rat	*Dipodomys ordii*
Mammal	Ozark Big-eared Bat	*Corynorhinus townsendii ingens*
Mammal	Pallid Bat	*Antrozous pallidus*
Mammal	Pinyon Mouse	*Peromyscus truei*
Mammal	Plains Harvest Mouse	*Reithrodontomys montanus*
Mammal	Plains Pocket Gopher	*Geomys bursarius*
Mammal	Plains Pocket Mouse	*Perognathus flavescens*
Mammal	Prairie Vole	*Microtus ochrogaster*
Mammal	Pronghorn	*Antilocapra americana*
Mammal	Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Mammal	Red Bat	*Lasiurus borealis*
Mammal	Red Fox	*Vulpes vulpes*
Mammal	Ringtail	*Bassariscus astutus*
Mammal	River Otter	*Lontra canadensis*
Mammal	Rock Mouse	*Peromyscus difficilis*
Mammal	Rock Squirrel	*Spermophilus variegatus*
Mammal	Seminole Bat	*Lasiurus seminolus*
Mammal	Silky Pocket Mouse	*Perognathus flavus*
Mammal	Silver-haired Bat	*Lasionycteris noctivagans*
Mammal	Southeastern Myotis	*Myotis austroriparius*
Mammal	Southern Flying Squirrel	*Glaucomys volans*
Mammal	Southern Plains Woodrat	*Neotoma micropus*
Mammal	Southern Short-tailed Shrew	*Sorex longirostris*
Mammal	Southern Short-tailed Shrew	*Blarina carolinensis*
Mammal	Spotted Ground Squirrel	*Spermophilus spilosoma*
Mammal	Striped Skunk	*Mephitis mephitis*
Mammal	Swamp Rabbit	*Sylvilagus aquaticus*
Mammal	Swift Fox	*Vulpes velox*
Mammal	Texas Kangaroo Rat	*Dipodomys elator*
Mammal	Texas Mouse	*Peromyscus attwateri*
Mammal	Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*
Mammal	Virginia Opossum	*Didelphis virginiana*
Mammal	Western Big-eared Bat	*Corynorhinus townsendii pallescens*
Mammal	Western Harvest Mouse	*Reithrodontomys megalotis*
Mammal	Western Pipistrel	*Pipistrellus hesperus*
Mammal	Western Small-footed Myotis	*Myotis ciliolabrum*
Mammal	Western Spotted Skunk	*Spilogale gracilis*
Mammal	White-ankled Mouse	*Peromyscus pectoralis*
Mammal	White-footed Mouse	*Peromyscus leucopus*
Mammal	White-tailed Deer	*Odocoileus virginianus*
Mammal	White-throated Woodrat	*Neotoma albigula*
Mammal	Woodchuck	*Marmota monax*
Mammal	Woodland Vole	*Microtus pinetorum*
Mammal	Yellow-faced Pocket Gopher	*Cratogeomys castanops*
Mammal	Yuma Myotis	*Myotis yumanensis*
Reptile	Alligator Snapping Turtle	*Macrochelys temminckii*
Reptile	American Alligator	*Alligator mississippiensis*

Group	Common Name	Scientific Name
Reptile	Black Ratsnake	*Elaphe obsoleta*
Reptile	Black-necked Gartersnake	*Thamnophis cyrtopsis*
Reptile	Broadhead Skink	*Eumeces laticeps*
Reptile	Brown Skink	*Scincella lateralis*
Reptile	Bullsnake	*Pituophis catenifer sayi*
Reptile	Central Plains Milksnake	*Lampropeltis triangulum gentilis*
Reptile	Checkered Gartersnake	*Thamnophis marcianus*
Reptile	Coachwhip	*Masticophis flagellum*
Reptile	Collared Lizard	*Crotaphytus collaris*
Reptile	Common Checkered Whiptail	*Cnemidophorus tesselatus*
Reptile	Common Lesser Earless Lizard	*Holbrookia maculata*
Reptile	Common Musk Turtle	*Sternotherus odoratus*
Reptile	Common Snapping Turtle	*Chelydra serpentina*
Reptile	Copperhead	*Agkistrodon contortrix*
Reptile	DeKay's Brownsnake	*Storeria dekayi*
Reptile	Desert Side-blotched Lizard	*Uta stansburiana stejnegeri*
Reptile	Diamond-backed Watersnake	*Nerodia rhombifer*
Reptile	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
Reptile	Eastern Hognose Snake	*Heterodon platyrhinos*
Reptile	Eastern Racer	*Coluber constrictor*
Reptile	Eastern River Cooter	*Pseudemys concinna concinna*
Reptile	Fence (Prairie) Lizard	*Sceloporus undulatus*
Reptile	Five-lined Skink	*Eumeces fasciatus*
Reptile	Flat-headed Snake	*Tantilla gracilis*
Reptile	Glossy Snake	*Arizona elegans*
Reptile	Graham's Crayfish Snake	*Regina grahamii*
Reptile	Great Plains Ratsnake	*Elaphe guttata emoryi*
Reptile	Great Plains Skink	*Eumeces obsoletus*
Reptile	Green Anole	*Anolis carolinensis*
Reptile	Ground Snake	*Sonora semiannulata*
Reptile	Gulf Crayfish Snake	*Regina rigida sinicola*
Reptile	Lined Snake	*Tropidoclonion lineatum*
Reptile	Louisiana Milksnake	*Lampropeltis triangulum amaura*
Reptile	Midland Smooth Softshell	*Apalone mutica mutica*
Reptile	Mississippi Map Turtle	*Graptemys pseudogeographica kohnii*
Reptile	Mississippi Mud Turtle	*Kinosternon subrubrum hippocrepis*
Reptile	New Mexico Blind Snake	*Leptotyphlops dulcis*
Reptile	Northern Map Turtle	*Graptemys geographica*
Reptile	Northern Scarletsnake	*Cemophora coccinea copei*
Reptile	Northern Watersnake	*Nerodia sipedon*
Reptile	Ornate Box Turtle	*Terrepene ornata*
Reptile	Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*
Reptile	Painted Turtle	*Chrysemys picta*
Reptile	Plain-bellied Watersnake	*Nerodia erythrogaster*
Reptile	Plains Black-headed Snake	*Tantilla nigriceps*
Reptile	Prairie Kingsnake	*Lampropeltis calligaster*
Reptile	Prairie Rattlesnake	*Crotalus viridis viridis*
Reptile	Pygmy Rattlesnake	*Sistrurus miliarius*
Reptile	Razor-backed Musk Turtle	*Sternotherus carinatus*
Reptile	Red Milksnake	*Lampropeltis triangulum syspila*

Group	Common Name	Scientific Name
Reptile	Red-bellied Snake	*Storeria occipitomaculata*
Reptile	Red-eared Slider	*Trachemys scripta elegans*
Reptile	Red-sided Gartersnake	*Thamnopis sirtalis parietalis*
Reptile	Ring-necked Snake	*Diadophis punctatus*
Reptile	Rough Greensnake	*Opheodrys aestivus*
Reptile	Round-tailed Horned Lizard	*Phrynosoma modestum*
Reptile	Six-lined Racerunner	*Cnemidophorus sexlineatus*
Reptile	Slender Glass Lizard	*Ophisaurus attenuatus*
Reptile	Southern (Broad-banded) Watersnake	*Nerodia fasciata*
Reptile	Southern Coal Skink	*Eumeces anthracinus*
Reptile	Southern Prairie Skink	*Eumeces septentrionalis*
Reptile	Speckled Kingsnake	*Lampropeltis getula holbrooki*
Reptile	Spiny Softshell Turtle	*Apalone spiniferus*
Reptile	Texas Gartersnake	*Thamnopis sirtalis annectens*
Reptile	Texas Horned Lizard	*Phrynosoma cornutum*
Reptile	Texas Long-nosed Snake	*Rhinocheilus lecontei tessellatus*
Reptile	Texas Nightsnake	*Hypsiglena torquata janii*
Reptile	Texas Spotted Whiptail	*Cnemidophorus gularis*
Reptile	Three-toed Box Turtle	*Terrapene carolina*
Reptile	Timber Rattlesnake	*Crotalus horridus*
Reptile	Wandering Gartersnake	*Thamnophis elegans vagrans*
Reptile	Western Chicken Turtle	*Deirochelys reticularia miaria*
Reptile	Western Cottonmouth	*Agkistrodon piscivorus leucostoma*
Reptile	Western Diamond-backed Rattlesnake	*Crotalus atrox*
Reptile	Western Hognose Snake	*Heterodon nasicus*
Reptile	Western Massasauga	*Sistrurus catenatus tergeminus*
Reptile	Western Mudsnake	*Farancia abacura reinwardtii*
Reptile	Western Plains Gartersnake	*Thamnophis radix*
Reptile	Western Ribbonsnake	*Thamnophis proximus*
Reptile	Western Worm Snake	*Carphophis vermis*
Reptile	Yellow Mud Turtle	*Kinosternon flavescens*

Appendix H: Public Outreach, Oklahoma Department of Wildlife Conservation In-reach, and Coordination with Land Managers

What	When	Where	Who	Why
Comprehensive Wildlife Conservation Plan Workshop for the Mountain-Prairie Region and Southwest Region	May 13-14, 2003	Salt Lake City, UT Salt Lake Plaza Hotel	Andrea Crews (ODWC) Mark Howery (ODWC) Ron Suttles (ODWC) Other states in the Regions Multiple federal agencies and NGO's	To facilitate information sharing and collaboration for the CWCS.
Wildlife-O-Gram, ODWC Employee Newsletter: "State Wildlife Grants Program"	August 2003	Statewide	Andrea Crews to ODWC employees and Commissioners	Article introducing employees to SWG and CWCS.
Wildlife-O-Gram, ODWC Employee Newsletter: "Projects Now Have a Future!"	September 2003	Statewide	Andrea Crews to ODWC employees and Commissioners	Article reminding employees of the CWCS and demonstrating some of the projects tackled under SWG
ODWC and Ouachita National Forest Annual Coordination Meeting	September 17, 2003	Broken Bow, OK Oklahoma Forestry Heritage Museum	Mark Howery (ODWC) 9 USFS employees 6 ODWC employees	Briefly discussed the CWCS, to alert the Ouachita National Forest managers to the upcoming process.
ODWC Supervisors Meeting	October 28, 2003	Quartz Mountain State Park, OK	Harold Namminga (ODWC) ODWC Supervisors	Harold gave a Power Point presentation to ODWC supervisors, introducing them to the upcoming CWCS-development process.
Annual Meeting of the Science Team for the Lower Mississippi Valley Joint Venture	November 12, 2003	Caddo Lake State Park, TX	Mark Howery (ODWC) Mike Sams (ODWC) 24 biologists from Louisiana, Arkansas and Texas state and federal agencies and TNC	Mark gave a presentation on the approach ODWC was taking for the CWCS and outlined how the LMVJV could help.
Planning Team Meeting with ODWC Administration	November 17, 2003	Oklahoma City, OK ODWC Director's conference room	Andrea Crews (ODWC) Mark Howery (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Tommy Shropshire (DSG) Spencer Amend (DSG) Bruce Hawkinson (DSG)	Planning Team met with administration to give an overview of the CWCP project, address questions, issues, and concerns about the CWCS, identify potential participants, define comprehensive, and hear general thoughts about Oklahoma's CWCS.

What	When	Where	Who	Why
			Greg Duffy (ODWC) Richard Hatcher (ODWC) Alan Peoples (ODWC) Kim Erickson (ODWC) John Striech (ODWC) David Warren (ODWC) Bob Anderson (ODWC)	
Planning Team Meeting	November 17-19, 2003	Oklahoma City, OK ODWC auditorium	Andrea Crews (ODWC) Mark Howery (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Tommy Shropshire (DSG) Spencer Amend (DSG) Bruce Hawkinson (DSG) Bob Anderson (USFWS)	Initial meeting with contractor to develop the "plan for the Plan." Bob Anderson was present as an observer, to make sure that Oklahoma's approach fit with what the USFWS is expecting of the CWCS. Topics discussed included: definition of "comprehensive," review of new guidance from IAFWA, SEAFWA, etc, side benefits of CWCS, Advisory committee roles, potential advisory committee members, roles of people to get one-on-one interviews, candidates for one-on-one interviews, technical experts' roles, potential technical committee representatives, and options for making the adjusted CWCP work plan work within current DSG contract.
Planning Team Meeting with ODWC Administration	November 19, 2003	Oklahoma City, OK ODWC auditorium	Andrea Crews (ODWC) Mark Howery (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Tommy Shropshire (DSG) Spencer Amend (DSG) Bruce Hawkinson (DSG) Richard Hatcher (ODWC) Alan Peoples (ODWC) Bill Dinkines (ODWC) Barry Bolton (ODWC) Dennis Maxwell (ODWC) David Warren (ODWC)	Share with administration the work plan developed by the Planning Team, make sure we got it right.
Planning Team email	December 2,	Yahoo! Groups	Andrea Crews (ODWC)	To facilitate communications and file sharing

What	When	Where	Who	Why
communication system	2003 – present		Mark Howery (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Tommy Shropshire (DSG) Spencer Amend (DSG) Bruce Hawkinson (DSG) Greg Duffy (ODWC) Richard Hatcher (ODWC)	among Planning Team members. The director and assistant director were added to allow oversight of the CWCS process. Averaged 80 messages per month in the first eight months of use (December-July).
News Release: Wildlife Officials Looking to the Future	December 11, 2003	Statewide	Media outlets, individual subscribers	Overview of the CWCS, pre-announcement for public meetings.
ODWC Fisheries Division Meeting: Future Fisheries 200X Planning Meeting	December 12, 2003	Oklahoma City, OK ODWC Auditorium	Harold Namminga (ODWC) Andrea Crews (ODWC) Fisheries Division personnel interested in the Future Fisheries planning effort	Brief update to Fisheries personnel on the CWCS planning process.
The Wild Side – ODWC Newsletter to Non-game Mailing List: "New Strategy Gives Extra Breadth to Conservation Programs"	December 22, 2003 Winter Edition	Statewide	Jenny Thom (ODWC) to public constituents interested in non-game wildlife	Front page article to introduce the CWCS to public constituents interested in non-game wildlife.
Wildlife-O-Gram, ODWC Employee Newsletter: "Comprehensive Wildlife Conservation Strategy"	January 2004	Statewide	Andrea Crews to ODWC employees and Commissioners	Article to update ODWC employees on CWCS: hired a contractor, formed Planning Team (members listed), meeting with Advisory Group (members listed), upcoming employee meetings, upcoming public meetings, upcoming wildlife conference, etc.
Flier in monthly ODWC packet	January 2003	Statewide	To ODWC employees and Commissioners	Simple flier to announce ODWC employee meetings to discuss CWCS.
Initial meeting of Advisory Group	January 8, 2004	Oklahoma City, OK Oklahoma City Zoo	Alan Peoples (ODWC)	The AG was formed to assist ODWC with the development of the CWCS, in partial fulfillment of

What	When	Where	Who	Why
			Andrea Crews (ODWC)Bill Matthews (OU) Billie Brown, Sierra Club Bruce Hoagland (OU) Chip Leslie (OSU) Craig Davis (OK-TWS) Dan Reinking (Sutton Center) Dennis Maxwell (ODWC) Derek Smithee (OWRB) Don Black (QU) Erv Warren (ONG) Gary Gunter (B.A.S.S.) Greg Duffy (ODWC) Harold Namminga (ODWC) Jay Pruett (TNC) Jerry Brabander, USFWS	Required Element 7. Meeting topics included: a CWCS background briefing, Advisory Group Charter, USFWS Federal Aid requirements for the CWCS, CWCS project work plan, presentation of the geographic areas of Oklahoma, discussion of attendee's expectations, what questions, issues or problems the CWCS should address, what conservation actions (solutions) this strategy/plan/document should contain, additional criteria for selecting species of greatest conservation need, how to publicize the CWCS, how the AG will work together in the future, and organizations/people missing from Advisory Group.

What	When	Where	Who	Why
			Jerry Davis (USFS) Jimmy Wade Tucker (Weyerhaeuser) John Skeen (ODWC) John Steuber (USDA – Wildlife Services) Kim Erickson (ODWC) Kris Marek (OTRD) Larry Kramer (DU) Mark Howery (ODWC) Marla Peek (Farm Bureau) Michael Mathis (OWRB) Mike Porter (Noble Foundation) Nels Rodefeld (ODWC) Ralph McCalmont (OTRD) Richard Hatcher (ODWC)	

What	When	Where	Who	Why
			Richard Hoar (ODWC) Robert Cartlidge (Oklahoma Anglers Unlimited) Ron Suttles (ODWC) Spencer Amend (DSG) Steve Tully (USDA-NRCS) Tim Patton (SE-OSU) Tom Libby (Sierra Club) Tommy Shropshire (DSG)	
Wildlife Diversity Technical Committee Meeting	January 9, 2004	Oklahoma City, OK Oklahoma City Zoo	Mark Howery (ODWC) Ron Suttles (ODWC) 4 other ODWC employees WD Tech. Committee members from outside ODWC: Invertebrates (2) Habitat (2) Fish (2) Herptiles (2) Birds (1) Mammals (2) Education (1)	Discussion to introduce the Wildlife Diversity Technical Committee to the CWCS (background to SWG program, timeline, draft species list, public meetings, conference, etc.).
Email to Advisory Group	January 12, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group the 1/8/04 Meeting Report.
Outdoor Oklahoma	January 18 and	Statewide	Andrea Crews (ODWC)	To introduce the CWCS and promote the March

What	When	Where	Who	Why
Television Show	24, 2004		Todd Craighead (ODWC)	public meetings.
Letter to Tribal leaders from Director	January 26, 2004	Statewide	38 Tribal leaders	To introduce Tribes to the CWCS and invite them to the March meetings. Flier enclosed.
Website Feedback, linked from ODWC home page	January 27, 2004	Statewide and beyond	Public	To allow public feedback on the CWCS by those who can not attend a public meeting.
News Release: Meetings Will Collect Input from the Public	January 27, 2004	Statewide	Media outlets, individual subscribers	Brief overview of CWCS, announce public meetings, and announce the chance to provide input through the website.
Email to Advisory Group	January 28, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group ODWC news release about public meetings for use in their own promotions, request for AG to spread the word, and a feedback form for those who could not attend.
Wildlife-O-Gram, ODWC Employee Newsletter: "Your Input Wanted…"	February 2004	Statewide	Andrea Crews to ODWC employees and Commissioners	Article sharing results of Advisory Group meeting: priority issues and actions for Oklahoma. Reminder about employee and public meetings.
News Release: Horny Toads, Bobwhites and Long-Range Strategies	February 5, 2004	Statewide	Media outlets, individual subscribers	Another overview of CWCS, announce public meetings.
Email to Advisory Group	February 6, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group new ODWC news release about public meetings for use in their own promotions, request for AG to spread the word, agenda for public meetings, and a RSVP request for AG members planning to attend.
Email to Advisory Group	February 8, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group a request for email addresses for six new members.
Annual Scorecard Coordination Meeting of ODWC, USFWS, The Nature Conservancy and the Oklahoma Natural Heritage Inventory	February 11, 2004	Bartlesville, OK The Sutton Avian Research Center	Mark Howery (ODWC) Ron Suttles (ODWC) Jay Pruett (TNC) 3 USFWS employees 9 OHNI employees	Mark and Ron briefly discussed the CWCS, to alert attendees to the upcoming process (timeline, draft species list, ranking criteria, upcoming public meetings).

What	When	Where	Who	Why
Postcard	February 13, 2004	Stateside	Non-game newsletter mailing list	To announce the public meetings.
Email to Advisory Group	February 16, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group a reminder including the news release about the public meetings, another request for AG to spread the word, another agenda for public meetings, and another RSVP request for AG members planning to attend.
Email to Advisory Group	February 23, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group a request for reference materials that may help/support the development of the CWCS.
Outdoor Oklahoma – ODWC Magazine: Panorama (Editor's Column) and Outdoor Calendar	March/April 2004 Edition	Statewide	Nels Rodefeld to Magazine subscribers	Article describing the importance of the CWCS. Calendar lists public meeting dates.
ODWC Employee Meeting – Central Region	March 1, 2004	Oklahoma City, OK ODWC auditorium	Andrea Crews (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Mark Howery (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 25 ODWC Employees	Overview of CWCS for ODWC employees, gather input on most important wildlife conservation issues and actions for Oklahoma.
Public Meeting – Central Region	March 1, 2004	Oklahoma City, OK Metro Tech Spring Lake Campus	Harold Namminga (ODWC) Ron Suttles (ODWC) Mark Howery (ODWC)	Overview of CWCS for the public, gather input on most important wildlife conservation issues and actions for Oklahoma.

What	When	Where	Who	Why
			Spencer Amend (DSG) Tommy Shropshire (DSG) 18 public constituents	
ODWC Employee Meeting – Northwest Region	March 2, 2004	Woodward, OK Northwest Electric Company office	Ron Suttles (ODWC) Harold Namminga (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 15 ODWC Employees	Overview of CWCS for ODWC employees, gather input on most important wildlife conservation issues and actions for Oklahoma.
Public Meeting – Northwest Region	March 2, 2004	Woodward, OK City of Woodward Pioneer Room	Ron Suttles (ODWC) Harold Namminga (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 7 public constituents	Overview of CWCS for the public, gather input on most important wildlife conservation issues and actions for Oklahoma.
ODWC Employee Meeting – Southwest Region	March 3, 2004	Lawton, OK Public Library	Ron Suttles (ODWC) Mark Howery (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 19 ODWC Employees	Overview of CWCS for ODWC employees, gather input on most important wildlife conservation issues and actions for Oklahoma.

What	When	Where	Who	Why
Public Meeting – Southwest Region	March 3, 2004	Lawton, OK Cameron University Mezzanine	Ron Suttles (ODWC) Mark Howery (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 36 public constituents	Overview of CWCS for the public, gather input on most important wildlife conservation issues and actions for Oklahoma.
ODWC Employee Meeting – Southeast Region	March 4, 2004	Higgins, OK ODWC Regional Office	Mark Howery (ODWC) Andrea Crews (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 16 ODWC Employees	Overview of CWCS for ODWC employees, gather input on most important wildlife conservation issues and actions for Oklahoma.
Public Meeting – Southeast Region	March 4, 2004	McAlester, OK Ramada Inn	Mark Howery (ODWC) Andrea Crews (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 14 public constituents	Overview of CWCS for the public, gather input on most important wildlife conservation issues and actions for Oklahoma.
ODWC Employee Meeting – Northeast Region	March 5, 2004	Tulsa, OK Tulsa Aquarium Education Center	Harold Namminga (ODWC) Andrea Crews (ODWC)	Overview of CWCS for ODWC employees, gather input on most important wildlife conservation issues and actions for Oklahoma.

What	When	Where	Who	Why
			Spencer Amend (DSG) Tommy Shropshire (DSG) 27 ODWC Employees	
Public Meeting – Northeast Region	March 5, 2004	Tulsa, OK OU Tulsa Schusterman Center	Harold Namminga (ODWC) Andrea Crews (ODWC) Spencer Amend (DSG) Tommy Shropshire (DSG) 28 public constituents	Overview of CWCS for the public, gather input on most important wildlife conservation issues and actions for Oklahoma.
Email to Advisory Group	March 10, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group a report summarizing the results of the public and employee meetings held around the state.
Wildlife-O-Gram, ODWC Employee Newsletter: "Habitat, Funding and Constituents Voted Top Priority by ODWC Personnel"	April 2004	Statewide	Andrea Crews to ODWC employees and Commissioners	Article sharing results of March ODWC employee and public meetings.
Email to Advisory Group	April 3, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group the compiled list of plans that might be helpful in the CWCS, asked for input on additional plans.
Email to Technical Experts	April 7, 2004	Statewide	Tommy Shropshire (DSG) to list of Technical Experts	To alert technical experts that they have been nominated to help in the CWCS, brief introduction to the CWCS and link to IAFWA site for more information.
Email to Technical Experts	April 7, 2004	Statewide	Andrea Crews (ODWC) to list of Technical Experts	To reassure technical experts that Tommy's message was legitimate and encourage them to participate. Additional brief information about the

What	When	Where	Who	Why
				CWCS.
Email to Technical Experts	April 8, 2004	Statewide	Tommy Shropshire (DSG) to list of Technical Experts	To address some of the frequently asked questions of technical experts about the CWCS.
Email to Advisory Group	April 8, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group the list of technical experts that were asked to participate in the CWCS planning process, asked AG to review and nominate additional experts.
Email to Technical Experts	April 16, 2004	Statewide	Tommy Shropshire (DSG) to list of Technical Experts	To announce the wildlife conference to technical experts.
Email to Technical Experts	April 18, 2004	Statewide	Tommy Shropshire (DSG) to list of Technical Experts	To send the technical experts the Excel species and habitat "questionnaire."
Email to Advisory Group	April 20, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group the list of technical experts that were asked to review the Excel questionnaire, again asking for additional nominees.
Letter to ODWC Commissioners	April 20, 2004	Statewide – 8 commission districts	Greg Duffy to ODWC Commissioners	Update Commissioners on progress of CWCS (initial species list, contractor, Advisory Group, technical expert "committee," public meetings, conference, etc).
Email to Advisory Group	April 21, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group	Sent Advisory Group the Excel questionnaire for them to review if they so chose.
Email to Advisory Group and Technical Experts	April 21, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group and Technical Experts	Sent Advisory Group and Technical Experts a photograph of the state map marked with Regional boundaries.
News Release: "Conference Scheduled to Discuss the Future of Oklahoma's Wildlife"	April 22, 2004	Statewide	Media outlets, individual subscribers	Overview of CWCS, announce conference.
Email to Advisory Group and Technical Experts	April 22, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group and Technical Experts	Sent Advisory Group and Technical Experts a Quattro Pro version of the questionnaire and explained that hard copies were not available.
Mailing to Law Enforcement	April 23, 2004	Statewide	Tommy Shropshire (DSG) – email from 4/18 printed and sent to 112 Law Enforcement officers	Sent ODWC Law Enforcement officers the printed Excel questionnaire on species and habitats.

What	When	Where	Who	Why
Outdoor Oklahoma – ODWC Magazine: "Horny Toads, Bobwhites and Long-Range Strategies"	May-June 2004 Edition	Statewide	Micah Holmes to magazine subscribers	Article to describe the background for the CWCS planning process and inform about the Internet feedback site.
Email to Advisory Group and Technical Experts	May 2, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group and Technical Experts	Sent Advisory Group and Technical Experts a summary of the number of responses received to the questionnaire. Deadline extended. Reminder to register for the Wildlife Conference.
Email and Telephone Conservations	May 7, 2004	Oklahoma City, OK West Linn, OR	Andrea Crews (ODWC) Marcelo Bonta (Defenders of Wildlife	Coordination and sharing of information to get ODWC' CWCS information on Defenders of Wildlife website: www.biodiversitypartners.org.
Letter and telephone communications	May 11, 2004	Stillwater, OK	David Schmidly (OSU)	To request the president of OSU give a plenary speech at the July Wildlife Conference.
Conference Call	May 11, 2004	Nationwide	Andrea Crews (ODWC) 6 other state representatives 3 IAFWA employees	To discuss the national synopsis of state CWCS reports. Also, to discuss IAFWA's preliminary ideas for lobbying and campaigning for secure funding after the reports are submitted.
Federal Assistance Coordinator's Meeting	May 13, 2004	Albuquerque, NM	Harold Namminga (ODWC) Other Region 2 Federal Assistance Coordinators (state and USFWS)	To update Federal Assistance Coordinators of other states in the Region on the status of the CWCS in respective states.
Playa Lakes Joint Venture Meeting in Oklahoma	May 25, 2004	Oklahoma City (hotel conference room)	Andrea Crews (ODWC) Mark Howery (ODWC) 9 other ODWC employees 4 PLJV employees Jay Pruett (TNC) Trapper Heglin (OWPHA) Steve Tully (USDA-NRCS)	Mark gave a talk to update everyone on the CWCS process.
Email to Advisory Group and Technical Experts	May 27, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group and Technical Experts	Sent Advisory Group and Technical Experts the advanced agenda for the Wildlife Conference, with a reminder to register.
Email – USFWS Federal Assistance Region 2	May 27, 2004	Region-wide	Bob Anderson (USFWS) to other Regional USFWS Federal Assistance employees	Announcing Oklahoma's Wildlife Conference.

What	When	Where	Who	Why
			and state Federal Assistance Coordinators	
Meeting with PARC	May 28, 2004	Norman, OK	Mark Howery (ODWC) Luke Feduwa (IAFWA-PARC)	To discuss PARC and how it might assist Oklahoma with the CWCS
The Wild Side – ODWC Newsletter to Non-game Mailing List: "Conference Will Follow-Up Public Meetings"	June 7, 2004 Spring/ Summer Edition	Statewide	Jenny Thom (ODWC) to public constituents interested in non-game wildlife	To follow up on public meetings and announce the Wildlife Conference.
Website, linked from ODWC home page	June 14, 2004 (tweaked on June 17, 2004)	Statewide and beyond	Andrea Crews (ODWC) to public constituents	Information about the CWCS: adapted the IAFWA brochure for Oklahoma, added news releases, etc.
Email Listserv	June 16, 2004	Nationwide	CWCS Coordinators	To facilitate communication among states regarding CWCS development.
Meeting with Arkansas Game and Fish Commission	June 18, 2004	Fort Smith, AR – AGFC office	Andrea Crews (ODWC) Mark Howery (ODWC) John Sunderland (AGFC) Jeff Johnston (AGFC) Jane Anderson (AGFC)	Coordination with bordering states – compare species list, Regions, CWCS process, etc.
Email	June 18, 2004	Stillwater, OK Norman, OK	Harold Namminga (ODWC) to Zoology Department chairs at OU and OSU, the leaders of the USFWS Coop Unit at OSU and the Natural Heritage Inventory at OU	To encourage registration and attendance at the Wildlife Conference.
Playa Lakes Joint Venture Science Circular	June 21, 2004	Throughout PLJV states	From Debbie Slobe (PLJV) to interested parties in the PLJV states	Brief article promoting the upcoming conference.
Email	June 22, 2004	Oklahoma City, OK	Andrea Crews (ODWC) to all ODWC Division Chiefs	To show them the list of registered conference attendees and encourage them to send appropriate employees.
Meeting with Texas Parks and Wildlife Department	June 25, 2004	Grand Prairie, TX – TPWD office	Andrea Crews (ODWC) Mark Howery (ODWC)	Coordination with bordering states – compare species list, Regions, CWCS process, etc.

What	When	Where	Who	Why
			Steve Bender (TPWD)	
Meeting with Kansas Parks and Wildlife Department	June 29, 2004	Byron, OK – Byron Fish Hatchery	Andrea Crews (ODWC) Mark Howery (ODWC) Ken Brunson (KPWD) Laurie Yasui (KPWD)	Coordination with bordering states – compare species list, Regions, CWCS process, etc.
Your Side of the Fence – ODWC Landowner Newsletter: "Comprehensive Wildlife Conservation Strategy – 'Blueprint' for the Future"	July 2004, Summer edition	Statewide	From ODWC to Landowners	Front-page article to promote the conference, explain the CWCS.
News Release: Free Wildlife Conference to be Held in Stillwater	July 8, 2004	Statewide	Media outlets, individual subscribers	Another overview of CWCS, announce conference.
Meeting with TNC	July 9, 2004	Tulsa, OK – TNC office	Andrea Crews (ODWC) Mark Howery (ODWC) 8 people from TNC	To discuss the Regional boundaries ODWC plans to use in the CWCS, compare with TNC eco-regional boundaries.
Email to Advisory Group and Technical Experts	July 9, 2004	Statewide	Tommy Shropshire (DSG) to Advisory Group and Technical Experts	Sent Advisory Group and Technical Experts the link for previewing and downloading the Wildlife Conference workbook, parking information and a reminder to register.
Website, linked from ODWC home page	July 12, 2004	Statewide and beyond	Public	Removed feedback link, added additional news releases, 8 elements, work plan, Advisory Group list, etc.
Oklahoma Wildlife Conservation Strategy Conference	July 13-15, 2004	Stillwater, OK Wes Watkins Center	Andrea Crews (ODWC) Mark Howery (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Tommy Shropshire (DSG) Spencer Amend (DSG) Bruce Hawkinson (DSG) 99 participants from a variety of agencies and walks of life	To gather vital information on species, habitats, threats and conservation actions for Oklahoma, from technical experts and other wildlife enthusiasts. Also to continue gathering references for other planning documents that are pertinent to the CWCS.
Email to Advisory Group	July 18, 2004	Statewide	Tommy Shropshire (DSG) to	Sent Advisory Group the list of Wildlife

What	When	Where	Who	Why
			Advisory Group	Conference attendees for editorial review. Also told them to expect a draft of the CWCS in September or October.
State Wildlife Strategies "One Year Out" Conference	August 1-4, 2004	Nebraska City, NE Lied Lodge Conference Center	Andrea Crews (ODWC) Mark Howery (ODWC) 46 other states 3 territories Multiple federal agencies and NGO's	To learn from other CWCS planning efforts, get additional national guidance, and share Oklahoma's experiences with other states. Mark Howery delivered a presentation to demonstrate how Oklahoma developed and ranked the species list.
Meeting with ODWC Law Enforcement	August 10, 2004	Oklahoma City, OK ODWC Auditorium	Andrea Crews(ODWC) Mark Howery (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Dennis Maxwell (ODWC) John Streich (ODWC) 8 District Chiefs	To update Law Enforcement on the CWCS and get input for LE activities that should be included in the plan. Limited input received at this point, decided to wait until the first draft comes out to think more about the role of LE in the CWCS.
Website, linked from ODWC home page near NR section	August 18, 2004	Statewide and beyond	Andrea Crews (ODWC) to public constituents	Updated information about the CWCS: removed old Conference information, added species list and Mark's PPT presentation explaining the evolution of the species list.
Wildlife-O-Gram, ODWC Employee Newsletter: "CWCS Conference in Stillwater A Success"	September 2004	Statewide	Andrea Crews to ODWC employees and Commissioners	Article discussing success of July Conference and alerting employees of CWCS draft to be available in the fall.
ODWC and Ouachita National Forest Annual Coordination Meeting	September 21, 2004	Broken Bow, OK Oklahoma Forestry Heritage Museum	Mark Howery (ODWC) 7 USFS employees 8 ODWC employees	Mark gave a presentation updating attendees on the CWCS progress.
Oklahoma Ornithological Society Fall Meeting	October 23, 2004	Tulsa Community College Tulsa, OK	Mark Howery (ODWC) 36 OSS members representing 7 universities, 7 Audubon Society chapters, Oxley Nature Center, Sutton Avian Research Center, and the Tishomingo National Wildlife Refuge	Mark gave a presentation updating attendees on the CWCS progress and the role of bird conservation.

What	When	Where	Who	Why
Email to Advisory Group	December 9, 2004	Statewide	Andrea Crews to Advisory Group	Announcing the release of the first draft for review.
Wildlife-O-Gram: CWCS Update	December 10, 2004	Statewide	Andrea Crews to ODWC employees and Commissioners	Announcing the release of the first draft for review.
Email to Advisory Group	December 12, 2004	Statewide	Tommy Shropshire to Advisory Group	More detailed instructions for commenting on the first draft, soliciting help with public meetings in April.
Email to Technical Experts	December 15, 2004	Statewide	Tommy Shropshire to Technical Experts	Announcing the release of the first draft with instructions for commenting.
News Release	December 16, 2004	Statewide	Media outlets, individual subscribers	Announcing the release of the first draft.
Website	December 16, 2004	Statewide and beyond	Andrea Crews (ODWC) to public constituents	Announcing the release of the first draft, update Advisory Group list, work plan, and news release list.
Email to IAFWA CWCS Discussion Group	December 16, 2004	Nationwide	Andrea Crews to other states and conservationists involved with the CWCS across the nation	Announcing the release of the first draft for review.
Oklahoma Wildlife and Prairie Heritage Alliance Journal	December 2004	Statewide	OWPHA coordinator to members and interested public subscribers	Announcing the availability of the draft and comment period.
Email to Advisory Group	January 4, 2005	Statewide	Tommy Shropshire to Advisory Group	Reminder about the availability of the draft, review period deadline, and second request for help with April public meetings.
Email to Technical Experts	January 4, 2005	Statewide	Tommy Shropshire to Technical Experts	Reminder about the availability of the draft and review period deadline.
Email to Advisory Group and Technical Experts	January 5, 2005	Statewide	Written by Andrea Crews, forwarded by Tommy Shropshire to the Advisory Group and Technical Experts	Announcement of CWCS layers available on the ODWC data viewer website, which might be helpful in reviewing the draft.
Wildlife Diversity Technical Committee annual meeting	January 13, 2004	Oklahoma City, OK Oklahoma City Zoo	Mark Howery, Ron Suttles and 12 Wildlife Diversity Technical Committee	Update on CWCS progress, reminder about draft review period and deadline. Asked for advice on better ways to describe habitat quality/condition.

What	When	Where	Who	Why
			members in attendance, eight absent members sent meeting notes	Also presented a list of technical questions that need resolution regarding the species list and species-habitat matrix – mid February deadline.
Email to Advisory Group and Technical Experts	January 17, 2005	Statewide	Tommy Shropshire to the Advisory Group and Technical Experts	Final reminder about the availability of draft, review period deadline, and CWCS layers on the data viewer.
The Wild Side – ODWC Newsletter to Non-game Mailing List	Winter 2005 Edition	Statewide	Jenny Thom (ODWC) to public constituents interested in non-game wildlife	Update on CWCS and announcing April meetings.
Conference call	January 21, 2005	Southwest Region states	Mark Howery and Ron Suttles, representatives from AZ, NM, CO, KS, TX, USFWS and IAFWA	Effort to share information and coordinate between states in the Region. Conference call topic: Identification of priority species and habitats
Conference call	January 27, 2005	Southwest Region states	Mark Howery and Ron Suttles AZ, NM, CO, KS, OK and TX, USFWS and IAFWA	Effort to share information and coordinate between states in the Region. Conference call topic: Identification of conservation threats/problems/issues
Conference call	February 4, 2005	Southwest Region states	Mark Howery and Ron Suttles AZ, NM, KS, OK and TX, USFWS and IAFWA	Effort to share information and coordinate between states in the Region. Conference call topic: Conservation actions and monitoring
DSG Website	February 4, 2005	Statewide	DSG	Announcement of April public meeting locations and times.
Annual Scorecard meeting of ODWC, USFWS, The Nature Conservancy and the Oklahoma Natural Heritage Inventory	February 9, 2005	Oklahoma City, OK Oklahoma City Zoo	ODWC Wildlife Diversity program, OU Biological Survey (Sutton Avian Research Center, OK Natural Heritage Inventory, and Bebb Herbarium), TNC and USFWS Tulsa field office. Sixteen in attendance.	Update on CWCS progress, announced plans for next draft release, encouraged participation and comments. Asked for advice on prioritizing conservation actions.
Second Draft on DSG website	March 1, 2005	Statewide	DSG to the public.	Draft available for public review.
News Release	March 3, 2005	Statewide	Media outlets, individual subscribers	To announce availability of second draft, invite comments and announce April meetings.

What	When	Where	Who	Why
Email to Advisory Group and Technical Experts	March 4, 2005	Statewide	Tommy Shropshire to the Advisory Group and Technical Experts	Announcement of 2nd draft and second round of public meetings, asking for co-hosts.
Package	March 16, 2005	Statewide	ODWC Field Offices	Letter announcing employee and public meetings and printed copy of the second draft.
News Release	March 17, 2005	Statewide	Media outlets, individual subscribers	To announce availability of second draft, invite comments and announce April meetings.
Letter	March 18, 2005	Statewide	ODWC employees	Letter announcing employee and public meetings and the second draft.
Memo	March 24, 2005	Statewide	ODWC Commissioners	Memo announcing employee and public meetings and the second draft.
Region II Federal Assistance Coordinators' Meeting	March 29, 2005	Quartz Mountain State Park, OK	Mark Howery to AZ, NM, OK and TX Federal Assistance staff, USFWS employees	Update on CWCS progress.
News item – Buckmasters	March 2005	Nationwide	Buckmasters	ODWC's 3/17/05 news release posted on Buckmasters website to promote April meetings.
Email to Advisory Group and Technical Experts	March 30, 2005	Statewide	Tommy Shropshire to the Advisory Group and Technical Experts	Reminder about 2nd draft and second round of public meetings.
News item – Inside IAWFA	March 31, 2005	Nationwide	Inside IAWFA Special Edition	Link to Buckmasters website to promote April meetings.
News item – Playa Post	April 1, 2005	Region wide	Playa Lakes Joint Venture	April meetings announced on website.
ODWC Employee Meeting – Central Region	April 4, 2005	Oklahoma City, OK ODWC auditorium	Andrea Crews (ODWC) Harold Namminga (ODWC) Ron Suttles (ODWC) Mark Howery (ODWC) Bruce Hawkinson (DSG)	Gather input on CWCS draft.

What	When	Where	Who	Why
			Tommy Shropshire (DSG) ODWC Employees	
Public Meeting – Central Region	April 4, 2005	Oklahoma City, OK Metro Tech Spring Lake Campus	Harold Namminga (ODWC) Ron Suttles (ODWC) Mark Howery (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) Public constituents	Gather input on CWCS draft.
ODWC Employee Meeting – Northwest Region	April 5, 2005	Woodward, OK Northwestern Electric Co-op	Andrea Crews (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) ODWC Employees	Gather input on CWCS draft.
Public Meeting – Northwest Region	April 5, 2005	Woodward, OK City of Woodward Pioneer Room	Andrea Crews (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) Public constituents	Gather input on CWCS draft.
ODWC Employee Meeting – Southwest Region	April 6, 2005	Lawton, OK Great Plains Technology Center	Harold Namminga (ODWC) Bruce Hawkinson (DSG)	Gather input on CWCS draft.

What	When	Where	Who	Why
			Tommy Shropshire (DSG) ODWC Employees	
Public Meeting – Southwest Region	April 6, 2005	Lawton, OK Cameron University	Harold Namminga (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) Public constituents	Gather input on CWCS draft.
ODWC Employee Meeting – Southeast Region	April 7, 2005	Higgins, OK ODWC Office	Mark Howery (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) ODWC Employees	Gather input on CWCS draft.
Public Meeting – Southeast Region	April 7, 2005	McAlester, OK Kiamichi Vocational Technical Center	Mark Howery (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) Public constituents	Gather input on CWCS draft.
ODWC Employee Meeting – Northeast Region	April 8, 2005	Jenks, OK Oklahoma Aquarium	Mark Howery (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) ODWC Employees	Gather input on CWCS draft.

What	When	Where	Who	Why
Public Meeting – Northeast Region	April 8, 2005	Tulsa, OK OSU-Tulsa Campus	Ron Suttles (ODWC) Bruce Hawkinson (DSG) Tommy Shropshire (DSG) Public constituents	Gather input on CWCS draft.
Radio interview	April 16, 2005, 4-6 p.m.	Oklahoma City	Mark Howery interviewed by "Hunt, Sleep, Fish" host Gary Leiter on WKY 930 AM	The main topic of conversation for the majority of the 2-hour interview was the Comprehensive Strategy.

Appendix I: Advisory Group Charter

For Oklahoma's Comprehensive Wildlife Conservation Strategy

1) Purpose of the Advisory Group:

(a) Provide information and identify information sources,
(b) Serve as an idea generator related to the steps in the planning process,
(c) Represent the diversity of interests in fish and wildlife conservation,
(d) Serve as a sounding board or "reality check" on elements of the conservation strategies, and
(e) Serve as reviewers of interim steps and products.

This is an "advisory" group only; the Oklahoma Department of Wildlife Conservation (ODWC) retains final authority and responsibility for decisions.

2) Time Frame:

The Advisory Group will not continue beyond the end of preparation of the Comprehensive Wildlife Conservation Strategy (CWCS). The CWCS is required to be delivered to the U.S. Fish and Wildlife Service by October 2005.

3) Advisory Group Roles and Responsibilities:

As an Advisory Group Member I will:
(a) Respond promptly to requests from ODWC for information or input,
(b) Be open and honest with my ideas and perspectives,
(c) Be responsive to guidance from facilitators hired by ODWC,
(d) Be open-minded and respectful of people sharing differing opinions,
(e) Plan to meet in person only once (additional work will be done by email and/or telephone),
(f) Be invited to assist with a statewide round of public meetings and a statewide conference,
(g) Look for creative ways to assist in the preparation of the CWCS
(h) Communicate with my organization or group, keeping members informed of the CWCS process as well as bringing their ideas forward, and
(i) Work as a team member to address the responsibilities of the group.

4) Contractor and Planning Team Support:

Dynamic Solutions Group LLC (DSG) has been contracted by the ODWC as facilitators and planning experts to assist with development of the CWCS. DSG members and several ODWC employees make up the Planning Team for preparation of the CWCS. The Planning Team is expected to help the Advisory Group achieve its outcomes by:

(a) Planning, facilitating, and reporting the results of this initial Advisory Group meeting,
(b) Serving as impartial experts on the planning process for future communications,
(c) Assessing the Advisory Group's progress in meeting its responsibilities,
(d) Working with the Advisory Group to develop approaches for meeting its responsibilities,
(e) Establishing a clear context and structured framework for discussions,
(f) Helping create and maintain an environment where all parties are as comfortable as possible,
(g) Developing and maintaining trust and respect within the group so that all individuals can provide their opinions,
(h) Evoking and encouraging the creativity of all members of the group, and
(i) Asking appropriate questions as necessary to stimulate understanding among group members.

5) ODWC Roles and Responsibilities:

The Oklahoma Department of Wildlife Conservation will be responsible for the following:

(a) Identifying individuals from a broad range of interests in conservation to be members of the Advisory Group,
(b) Inviting those members to an initial meeting,
(c) Explaining the charge to the Advisory Group,
(d) Providing media resources as needed for the CWCS, including, but not limited to (i) website, (ii) news releases, (iii) video, (iv) magazine articles,
(e) Providing advice and counsel to the Advisory Group,
(f) Notifying the Advisory Group of changing circumstances, new information, etc. about CWCS preparation,
(g) Making clear and timely decisions regarding items and matters related to preparation of the CWCS, and
(h) Providing feedback to the Advisory Group.

Appendix J: Oklahoma's Comprehensive Wildlife Conservation Strategy Public, Advisory Group, and Oklahoma Department of Wildlife Conservation Staff Input Workshops

March 1 – 5, 2004 Report

Collecting public and Oklahoma Department of Wildlife Conservation (ODWC) staff input is an important part of the planning process for developing Oklahoma's Comprehensive Wildlife Conservation Strategy (CWCS). The general public was invited to participate in a series of open workshops (Oklahoma City – March 1, Woodward – March 2, Lawton – March 3, McAlester – March 4, Tulsa – March 5) to identify issues and advice regarding wildlife conservation in Oklahoma. On the same dates, ODWC staff (voluntary) workshops were also conducted for the same purpose.

To insure public participation at the workshops, the following methods of contact were utilized:

1. newspaper articles
2. radio announcements
3. direct mailings by the ODWC
4. public service news releases by the ODWC
5. direct contact by the CWCS Advisory Group members
6. ODWC employee newsletters and direct contact

Executive Summary:

Priority Issue Topics

Priority	Public and Staff Combined	Public	ODWC Staff	Advisory Group January 8, 2004
1.	Habitat	Habitat	Habitat	Habitat
2.	Constituents	Wildlife mgt.	Funding	Research
3.	Funding	Problem species	Constituents	Constituents
4.	ODWC	Constituents	ODWC	Funding
5.	Problem species	Access	Problem species	Problem species
6.	Wildlife mgt.	ODWC	Partnerships	Wildlife mgt.

Priority Advice Topics

Priority	Public and Staff Combined	Public	ODWC Staff	Advisory Group January 8, 2004
1.	Habitat	Habitat	Habitat	Habitat
2.	Constituents	Constituents	Constituents	Research
3.	Funding	Funding	Funding	Funding
4.	ODWC	Problem species	ODWC	Problem species
5.	Access	Research	Access	Wildlife mgt.
6.	Research	ODWC	Partnerships	Partnerships

Results of public and ODWC staff workshops combined:

Attendance: 205 combined total

1. Oklahoma City – 43
2. Woodward – 22
3. Lawton – 55

4. McAlester – 30
5. Tulsa – 55

Public and ODWC staff issues prioritized:

1. Habitat: Loss of habitat to development; lack of controlled burning; over grazing; lack of private lands management for wildlife and habitat; air and water pollution; poor water management; lack of habitat focus for species of concern
2. Constituents: Lack of public education about value of wildlife, habitat/species needs; recruitment of youth in hunting, fishing, and outdoor recreation
3. Funding: Lack of long-term funding for ODWC wildlife management, law enforcement, research, and habitat
4. ODWC: Lack of law enforcement support, public relations, planning, staff recruitment, retention, and training
5. Problem species: Lack of control over noxious/invasive/nuisance/exotic species such as Eastern Redcedar, Golden Algae, Cormorants, and Wild Hogs.
6. Wildlife management: Lack of focus on threatened/endangered and species of concern; declining quail population; deer over population and depredation; lack of restocking programs for fish; effects of predatory birds on fish
7. Access: Lack of public lands and access to private lands; over crowding of hunters on public lands; landowner liability; walk-in areas
8. Partnerships: Lack of cooperation between state, federal, and local agencies as well as with landowners
9. User conflicts: Conflicts between hunters and non-hunters; use of all terrain vehicles and personal watercrafts
10. Regulations: Lack of enforcement for all wildlife laws; lack of size limits on crappie at Waurika Lake
11. Research: Lack of knowledge about many species of wildlife, their habitats, and distribution

Public and ODWC staff advice prioritized:

1. Habitat: Develop education programs for landowners about burning and liability; counter rural development with community involvement programs, corridors, ODWC planning; create a national program equal to level of farm bill to protect/manage fish and wildlife habitat; purchase land or conservation easements/buffers especially in areas adjacent/close to existing public lands; develop water use policy; develop/protect wetlands
2. Constituents: Develop conservation education programs for youth, landowners, and politicians
3. Funding: Establish a value for wildlife; make law enforcement a priority; create fees for non-consumptive users; create multiple year licenses and incentives to buy licenses; create tax exempt organization to receive donations; register all terrain vehicles
4. ODWC: Solicit more input from field personnel (less micro management); increase customer service attitude; hire more rangers to improve enforcement of fish and game laws; Assume the leadership role in habitat management and lead by example -- manage WMAs for habitat and encourage other state/government owned lands to manage for habitat
5. Access: Create landowner incentives for public access
6. Research: Implement research-baseline surveys to learn current plants and animals to determine best ecosystem management practices and practical solutions for diversity
7. Partnerships: Build partnerships with agencies to be sure all programs result in good conservation; coordinate and standardize rules among agencies
8. Wildlife management: Do not multiple use land -- wildlife management areas (recreation, wildlife, no cows); improve genetic variation in elk; continue bio-diversity approach to management; discontinue programs that are not working
9. Problems species: Eliminate exotics (hogs, starlings, plants, and trees); control feral cats; manage invasive species (plants -- Redcedar, Salt Cedar); establish an aquatic nuisance species plan
10. Regulations: Establish penalties and enforcement to prevent misuse of public money

Results of public workshops:

Attendance: 103 total

1. Oklahoma City – 18
2. Woodward – 7 (rain)
3. Lawton – 36
4. McAlester – 14
5. Tulsa – 28

Public issues prioritized:

1. Habitat: Loss of habitat to development and urban sprawl; lack of controlled burning; over grazing; lack of private lands management for wildlife, and habitat; habitat fragmentation; water (mismanagement, contaminants, farm products)
2. Wildlife management: Lack of focus on threatened/endangered and species of concern; declining quail population; deer over population and depredation; lack of restocking programs for fish; effects of predatory birds on fish; disappearance of once common birds; trapping restrictions
3. Problem species: Lack of control over invasive, exotic, and non-native species such as Eastern Redcedar, Golden Algae, and Wild Hogs
4. Constituents: Loss of educational/awareness programs and accessibility to those programs; declining numbers of hunters esp. young and low income
5. Access: Lack of public lands; over crowding of hunters on public lands
6. ODWC: Lack of staff and funding especially for law enforcement
7. Funding: Disparity in funding between consumptive user and non-consumptive users; lack of funding for research and water testing for contamination
8. Regulations: Lack of size limits on crappie at Waurika Lake
9. Research: Unknown impact of wind power
10. User conflicts: PETA vs. hunters

Public advice prioritized:

1. Habitat: Develop education programs for landowners about burning and liability; counter rural development with community involvement programs, corridors, ODWC planning; purchase land or conservation easements/buffers especially in areas adjacent/close to existing public lands; develop water use policy; develop/protect wetlands; develop landowner incentives, grant, and provide technical assistance
2. Constituents: Educate homeowners and landowners on important issues (controlled burns for Eastern Redcedar control, cave protection, urban use of land by bird species of special concern, non-game)
3. Funding: Provide adequate funding for Fish and Wildlife and Law Enforcement management (MO and AR); appropriate general funds to ODWC; create tax exempt organization to receive donations
4. Problem species: Eliminate exotics (hogs, starlings, plants, and trees); control feral cats; manage invasive species (plants -- Redcedar, Salt Cedar)
5. Research: Implement research-baseline surveys to learn current plants and animals to determine best ecosystem management practices and practical solutions for diversity
6. ODWC: Hire more rangers to improve enforcement of fish and game laws; assume the leadership role in habitat management and lead by example -- manage WMAs for habitat and encourage other state/government owned lands to manage for habitat; recruit an train volunteers, certify for ODWC to aid Law Enforcement and education efforts
7. Wildlife management: Do not multiple use land -- wildlife management areas (recreation, wildlife, no cows); improve genetic variation in elk
8. Partnerships: Coordinate and standardize rules among agencies; create better cooperation between other government agencies (ODWC, USFWS, NRCS, USFS, OK Dept of Tourism, OWRB)
9. Access: Provide walk in hunting program on private land; limit lease hunting
10. Regulations: Set length and bag limits on an individual lake basis

Results of ODWC staff workshops:

Attendance: 102 total

1. Oklahoma City – 25
2. Woodward – 15
3. Lawton – 19
4. McAlester – 16
5. Tulsa – 27

Staff issues prioritized:

1. Habitat: Loss of habitat to development, degrading, and loss of wetlands; lack of controlled burning; over grazing; lack of private lands management for wildlife and habitat; air and water pollution; poor water management; lack of habitat focus for species of concern; lack of wildlife improvement on CRP lands
2. Funding: Lack of long-term funding for ODWC wildlife management, law enforcement, and disease studies
3. Constituents: Lack of public education about ODWC programs (law enforcement) and funding; recruitment of youth in hunting, fishing, and outdoor recreation
4. ODWC: Lack of law enforcement support, evaluation, public relations, planning, facilities, staff recruitment, retention, and training
5. Problem species: Lack of control over noxious/invasive/nuisance/exotic species such as Eastern Redcedar and Cormorants
6. Partnerships: Communication barrier between landowners and wildlife managers; confusion about who is the wildlife manager contact person for landowner -- NRCS, FSA, ODWC, FAA, ODOF, D of AG
7. Access: Lack of access to private lands; walk-in areas
8. User conflicts: Conflicts between hunters and non-hunters, use of all terrain vehicles, and personal watercrafts
9. Research: Lack of knowledge about many species of wildlife, their habitats and distribution
10. Wildlife management: Animal depredation; fish passage

Staff advice prioritized:

1. Habitat: Develop technical assistance programs for landowners/leasers about burning and liability; create a national program equal to level of farm bill to protect/manage fish and wildlife habitat; purchase more public land; develop statewide watershed councils; develop strict regulations for the sale and usage of water; develop base-line flow protection for streams
2. Constituents: Develop conservation education programs for youth, landowners, and politicians
3. Funding: Make law enforcement a priority; create multiple year licenses and incentives to buy licenses; register all terrain vehicles; develop cost-share programs for assistance in controlling or management or invasive species or exotics and for bottomland/floodplain management
4. ODWC: Solicit more input from field personnel (less micro management); increase customer service attitude; implement long-term planning and follow thru; increase outreach efforts; improve personnel recruitment; increase/streamline ODWC workforce; modify/update college course requirements
5. Access: Landowner incentives for public access
6. Partnerships: Build partnerships with agencies and conservation groups to be sure all programs result in good conservation; coordinate and standardize rules among agencies
7. Research: Data generation for non-game species
8. Wildlife management: Continue bio-diversity approach to management; discontinue programs that are not working
9. Regulations: Establish penalties and enforcement to prevent misuse of public money
10. Problem species: Establish an aquatic nuisance species plan

Results of the January 4, 2004 Advisory Group workshop (provided for comparative purposes):

Advisory Group issues prioritized:

1. Habitat: How to promote conservation strategy benefits to landowners; water resource allocation; statewide in-stream flow classification system
2. Research: Gathering sound scientific data; determining population status and identify gaps; establish standards for data acquisition and archival
3. Constituents: How to communicate with and educate the public about benefits of a conservation strategy
4. Funding: What is the cost of not having a conservation strategy; how to set funding priorities
5. Problem species: Management of invasive and problem species
6. Wildlife management: Balance urgent with common species; how will success be measures
7. Partnerships: Build on past work such as TNC, biodiversity plans
8. ODWC: How does law enforcement fit into this conservation strategy
9. User conflicts: Communication towers, wind generators, off road vehicles, feral animals

Advisory Group advice prioritized:

1. Habitat: Water allocation strategies that recognize multi-uses and demands; restore fire and natural hydrology
2. Research: Systematic use of inventories of species of concern; establish long-term monitoring
3. Funding: Cost share with landowner for habitat restoration and invasive species control; tax incentives to landowners; nature tourism
4. Problem species: Identify invasive species and problems and communicate to public
5. Wildlife management: Identify what is detrimental to wildlife
6. Partnerships: Involve landowners with this process; varied communication strategies to different groups; incorporate this with existing Federal Assistance programs
7. ODWC: Get Law Enforcement involved

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Key to Abbreviations:

Abbreviation	Name
AFS	Oklahoma Chapter American Fisheries Society
BASS	Oklahoma State B.A.S.S. Federation
CC	Oklahoma Conservation Commission
DEQ	Oklahoma Department of Environmental Quality
DSG	Dynamic Solutions Group
NSU	Northeastern State University
NWTF	National Wild Turkey Federation
OAU	Oklahoma Anglers Unlimited
OBS	Oklahoma Biological Survey
OCA	Oklahoma Cattlemen's Association
OCC	Oklahoma Corporation Commission
OCFWRU	Oklahoma Cooperative Fish & Wildlife Research Unit
OCL	Oklahoma Commissioners of the Land
ODA	Oklahoma Department of Agriculture
ODOT	Oklahoma Department of Transportation
ODWC	Oklahoma Department of Wildlife Conservation
OES	Oklahoma Environmental Services Office
OG&E	Oklahoma Gas and Electric Company
OMA	Oklahoma Marina Association
ONAR	Oklahoma Natural Areas Registry
OOS	Oklahoma Ornithological Society
OSE	Office of the Secretary of the Environment
OSU	Oklahoma State University
OTRD	Oklahoma Tourism & Recreation Department
OTWS	Oklahoma Chapter of The Wildlife Society
OU	University of Oklahoma
OWF	Oklahoma Wildlife Federation
OWPHA	Oklahoma Wildlife and Prairie Heritage Alliance
OWRB	Oklahoma Water Resources Board
SARC	George Miksch Sutton Avian Research Center
SEOSU	Southeastern Oklahoma State University
SEOSU	Southeastern Oklahoma State University
SNOMNH	Sam Noble Oklahoma Museum of Natural History
SRC	Scenic Rivers Commission
SRNF	The Samuel Roberts Noble Foundation, Inc.
SWOSU	Southwestern Oklahoma State University
TNC	The Nature Conservancy of Oklahoma
UCO	University of Central Oklahoma
UKBCI	United Keetoowah Band of Cherokee Indians
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDA/NRCS	US Department of Agriculture Natural Resources Conservation Service
USFS	United States Forest Service
USFS/BKNG	Black Kettle National Grassland
USFS/ONF	Ouachita National Forest
USFWS	Unites States Fish and Wildlife Service

Abbreviation	Name
USFWS/OES	United States Fish and Wildlife Service Oklahoma Ecological Services
USFWS/OPNWR	Ozark Plateau National Wildlife Refuge
USFWS/SPNWR	Salt Plains National Wildlife Refuge
USFWS/TNWR	Tishomingo National Wildlife Refuge
VAFB	Vance Air Force Base
WDTAC	Wildlife Diversity Technical Advisory Committee