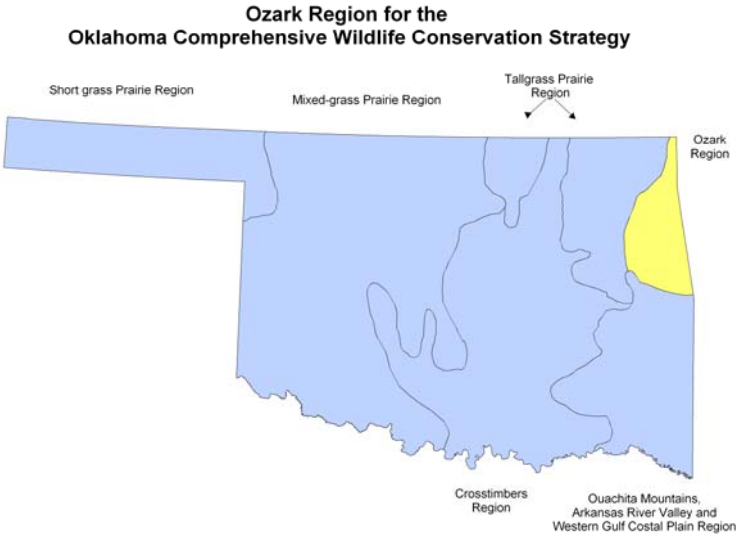
Ozark Region



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.

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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