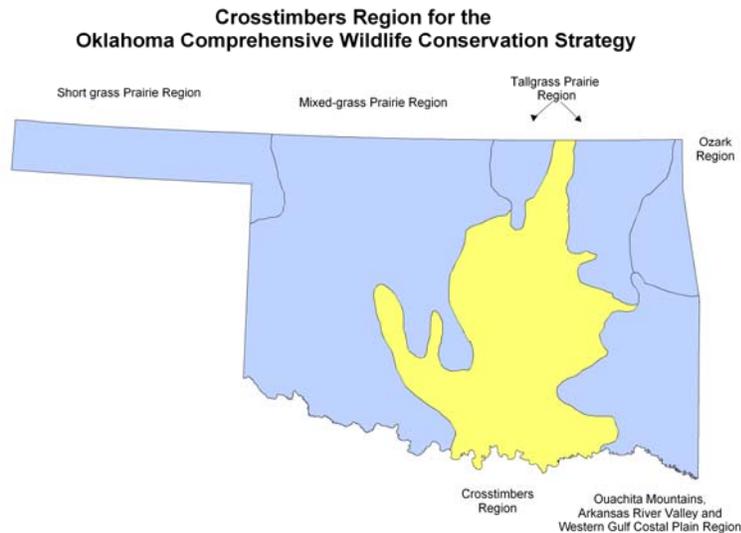


Crosstimbers Region

This region encompasses a mosaic of oak woodlands and tallgrass prairies in roughly the central one-third of Oklahoma. All or portions of the following counties are part of Cross Timbers Region: Kay, Noble, Pawnee, Payne, Logan, Lincoln, Oklahoma, Cleveland, McClain, Grady, Caddo, Stephens, Jefferson, Garvin,

Murray, Carter, Love, Marshall, Johnston, Pontotoc, Coal, Atoka, Bryan, Choctaw, Pittsburg, McIntosh, Hughes, Seminole, Pottawatomie, Okfuskee, Creek, Okmulgee, Tulsa, and Osage. In Bailey's ecological classification system, the Crosstimbers Region is equivalent to the combination of the Crosstimbers and Prairies Section and the Blackland Prairies Section. In Omernick's classification system, it is equivalent to the Oklahoma/Texas Plains Ecoregion.



The Crosstimbers Region is a complex mosaic of upland deciduous forest, savanna, and prairie communities that highlight the broad ecotone between the eastern forests and the grasslands of the Great Plains (Hoagland et.al. 1999). The Crosstimbers are dominated by Post Oak and Blackjack Oak. It extends from central Texas, across eastern Oklahoma, and into southeastern Kansas. The presettlement Crosstimbers may have covered nearly 20 million acres and consisted largely of low-stature oaks that were not suited for lumber production. The Crosstimbers may be the least disturbed forest ecosystem that survives in the eastern United States.

According to Duck and Fletcher (1945)¹, the Crosstimbers represent the largest single ecosystem type in the state of Oklahoma. Eastern Oklahoma, north central Texas, and southeastern Kansas contain some of the most extensive tracts of ancient woodland in the eastern United States. Most of these remnant woodlands are found in fragmented tracts from 40 to 1,000 acres in size along cliffs and rocky uplands. But, several areas are identified where ancient Crosstimbers are still present over thousands of contiguous acres and literally dominate the landscape. These ancient oak-dominated woodlands provide vital natural habitat in an increasingly human-dominated landscape and are becoming increasingly fragmented, but the remnants provide vital habitat for Neotropical migrant birds and other native flora and fauna.

Ecologically distinct lines do not exist between the Crosstimbers Region and the adjacent Mixed-grass Prairie and Tallgrass Prairie regions. Therefore, areas of overlap occur where patches of mixed-grass prairie habitat are embedded within oak woodlands and patches of oak woodland or

¹ Duck, L. G. and J. B. Fletcher. 1945. A survey of the game and furbearing animals of Oklahoma. Div. Wildl. Restor. and Res., Oklahoma Game and Fish Comm., Pitman-Robertson Ser. No. 2, State Bull. No. 3. Oklahoma City.

shrubland are embedded within mixed-grass and tallgrass prairie habitats. Tallgrass prairies occur throughout the region and comprise most of the region's historic grassland acres. Mixed-grass prairie habitat is more limited and occurs along the western edge of the region and the Arbuckle Uplift.

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

Conservation Landscapes listed in general priority order:

Very High priority Conservation Landscapes:

Small River

Large River

High priority Conservation Landscapes:

Oak and Hickory Bottomland Hardwood Forest

Post Oak/Blackjack Oak/Hickory Woodland and Forest

Tallgrass Prairie

Small Gravel (hard)-bottom Streams and Associated Riparian Forest

Herbaceous Wetlands

Sandstone Canyonlands and Post Oak and Blackjack Oak Shrubland

Moderate priority Conservation Landscapes:

Small Sandy (soft)-bottom Streams and Associated Riparian Forest

Mixed-grass Prairie

Limestone Cave

Springs

Conservation Landscape: Small River

Relative condition of Small River habitat is currently poor with a declining trend. Small Rivers within the Crosstimbers Region include all or a portion of four tributaries to the Red River (the Washita, Blue, Clear Boggy, and Muddy Boggy Rivers) and two tributaries within the Arkansas River system (the Little and Deep Fork Rivers). The water conditions and aquatic species compositions of these small rivers are variable but each river differs from the Large River habitats in having more moderate seasonal flow fluctuations and lacking the dynamic mosaic of ephemeral disturbance-maintained habitats such as sandbars, mudflats, scoured bends, and sandbar willow thickets. Each of these is a low-gradient river that meanders through a broad predominately forested floodplain.

The Blue and Clear Boggy Rivers originate within the rocky Arbuckle Uplift. The upper portions of these rivers are clear and swiftly flowing over gravel or cobble substrate. The lower portions of these rivers are more similar to the Washita, Muddy Boggy, Little and Deep Fork Rivers which are turbid slow-moving rivers with silty to sandy substrates that meander across relatively broad floodplains. Flow rates are generally greater during the winter and spring months and lower during the summer and fall, however the seasonal variation is less than that which is seen on the five large rivers.

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

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

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Fish	Blue River pop. of Least Darter	X				X			
Fish	Blue Sucker	X							X
Fish	Bluntnose Shiner	X							X
Fish	Crystal Darter	X							X
Fish	Kiamichi Shiner	X				X			
Fish	Paddlefish		X				X		
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Fish	Red River Shiner			X			X		
Fish	Redspot Chub		X				X		
Fish	Rocky Shiner		X						X
Fish	Taillight Shiner	X							X
Fish	Western Sand Darter	X							X
Inve	Bleufer			X			X		
Inve	Butterfly Mussel		X			X			
Inve	Faxonella blairi				X				X
Inve	Little Dubiraphian Riffle Beetle				X				X
Inve	Little Spectaclecase			X			X		
Inve	Monkeyface Mussel			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Creekshell	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Plain Pocketbook		X			X			
Inve	Texas Lilliput	X							X
Inve	Threeridge Mussel			X			X		
Inve	Wartyback Mussel		X				X		
Inve	Washboard			X			X		
Inve	Winged Mapleleaf	X				X			
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

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

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

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

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify the validity of existing data and assumptions.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct inventories and habitat surveys on all streams.
- Conduct genetic studies to assess gene flow among populations of aquatic animals.
- Conduct studies of spawning habitat.
- Conduct studies of invertebrates in all streams.
- Increase knowledge, capacity, and capability about stream restoration and stream management actions.
- Develop an accurate assessment and description of what small river habitat used to look like so that this can be used as a conservation target condition.
- Monitor response of wildlife populations to land management practices.

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

5. Aquifer pumping and water withdrawals have altered natural flow regimes.
6. Impoundments have altered natural flow regimes (e.g., channelization changes the ecology of river systems).

Conservation Actions:

- Study in-stream flow requirement for ecology, fish, wildlife, and recreation.
- Support the designation of the Blue River as Wild and Scenic.
- Encourage water conservation.
- Encourage and support the development of a state water plan and municipal water plans.
- Research and get involved with existing recharge rate studies to determine sustainability of aquifers and springs affecting wildlife and fish.
- Support the management oversight of potential problem aquifers.
- Support studies of recycling gray water for irrigation.
- Research and make a policy decision about lake water being pumped into aquifers.

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

7. Pollution of the water.
8. Degradation of riparian areas.
9. Sedimentation changes stream flow regimes.
10. Addition of nutrients via fertilizers and livestock waste in storm water runoff.
11. Endocrine disruptors related to agricultural runoff/discharge (e.g., poultry, cattle, and use on plants).

Conservation Actions:

- Develop better understanding of effects water quality, riparian degradation, in-stream flow, and endocrine disruptors.
- Enforce water quality standards.
- Use regional workshops to educate landowners with stream problems (e.g., spraying and stream management).
- Encourage riparian buffers in Conservation Reserve Program.
- Increase water quality monitoring.
- Study the response of wildlife populations to various land management practices and use this information to recommend improved management practices.

Conservation Issue: Habitat loss and fragmentation from geomorphic alteration and instability of river channels:

12. Geomorphic instability including degradation of riparian areas, inappropriate management of watersheds, sedimentation, alternate flow regimes, and decreasing spawning habitat management.

Conservation Actions:

- Mitigate unnatural flows regimes on streams.
- Encourage private landowners to protect uplands and reduce runoff.
- Explore the U.S. Environmental Protection Agency's Watershed Restoration Programs and encourage a pilot project.
- Assist landowners to get grants to reduce runoff.
- Restore stream channels and riparian areas.
- Oklahoma Department of Wildlife Conservation should extend the stream program statewide.
- Small road crossings and un-engineered stream crossings should be reconstructed.

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

13. Erosion and runoff from cities and agricultural fields increase sediment transport and create problems for certain fish and invertebrates.
14. Grazing and vegetation degradation increase erosion and sedimentation.
15. Gravel mining alters the ecology of river systems.

Conservation Actions:

- Encourage programs and activities which restore river channel morphology.
- Encourage and support programs to improve water quality and flows below reservoirs.
- Encourage and support congressional reprioritizing of the U.S. Army Corps of Engineers projects to include fish, wildlife, and recreation as beneficial uses.
- Cooperate with the U.S. Army Corps of Engineers to establish more natural alternative flow patterns.
- Encourage and support legislation to establish minimum in-stream flow provisions.
- Encourage and support pollution abatement efforts.
- Encourage and support landowners and others efforts to create and maintain riparian buffer zones.

- Develop and distribute information to landowners and others concerning the value of water, grazing management, crop selection, fire management, energy development, natural systems, and invasive species.
- Encourage replacement of stock ponds with alternative water sources.
- Encourage and support programs that protect riparian areas from grazing.
- Encourage and support increased use of Farm Bill incentives.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Degraded and restored river miles of habitat.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of landowners participating in conservation practices.
- Number of new local conservation groups or watershed groups.
- Populations and trends of species of greatest conservation need.
- Public opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).

Conservation Landscape: Large River

Relative condition of Large River habitat in the Crosstimbers Region is currently poor with a declining trend. Portions of five large rivers pass through the Crosstimbers Region (the Arkansas, Cimarron, North Canadian, Canadian and Red Rivers). Each of these rivers has a seasonal period of high flow during the spring months followed by a period of much lower flow during the summer months. This seasonal fluctuation in water volume maintains a dynamic mosaic of ephemeral habitats such as sandbars, mudflats, sandbar willow thickets, and marshy sloughs along and within river channels that depend upon periodic scouring flows. For purposes of this Strategy, we consider the Large River habitat to be comprised of the river channel and these smaller ephemeral habitats that are tied to flooding and scouring flows. This mosaic of smaller habitats within the system supports a diversity of species of conservation need including the Least Tern (*Sterna antillarum*) on sandbars, shorebirds and wading birds on mudflats, Arkansas River and Red River Shiners in shallow braided channels, Bell's Vireos in willow thickets, and Alligator Gar in deep channels and pools.

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

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

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

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Peregrine Falcon	X							X
Bird	Piping Plover	X							X
Bird	Prothonotary Warbler		X						X
Bird	Sandhill Crane		X				X		
Bird	Snowy Egret								
Bird	Snowy Plover	X							X
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Bird	Western Sandpiper	X							X
Bird	Whooping Crane	X						X	
Bird	Wilson's Phalarope				X				X
Fish	Alligator Gar	X				X			
Fish	Arkansas River Shiner	X				X			
Fish	Blue Sucker	X							X
Fish	Chub Shiner				X				X
Fish	Paddlefish		X				X		
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Fish	Red River Pupfish			X			X		
Fish	Red River Shiner			X			X		
Fish	Shovelnose Sturgeon	X							X
Fish	Western Sand Darter	X							X
Inve	Bleufer			X			X		
Inve	Monkeyface Mussel			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Plain Pocketbook		X			X			
Inve	Threeridge Mussel			X			X		
Inve	Washboard			X			X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	River Otter		X					X	
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Spiny Softshell Turtle				X				X

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

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

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

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Research the presettlement river status of Oklahoma rivers.
- Support the sharing of information about the habitat needs of species of greatest conservation need between researchers and water management agencies such as the U.S. Army Corps of Engineers.
- Develop a monitoring program to track habitat condition/quality and status of species of greatest conservation need.

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

6. Clearing of riparian zone negatively affects the habitat for species of greatest conservation need.
7. Dredging and sand mining alter water quality, quantity, and channel maintenance.
8. Flood control management alters water quality, quantity, and channel maintenance.
9. Reservoir management plans do not adequately protect species of greatest conservation need in the reservoirs and downstream.
10. There are no established minimum in-stream flows below reservoirs.
11. Sandbars, which are important to some species of greatest conservation need, have diminished due to reduction in flooding/scouring flows due to reservoir construction and operation.

Conservation Actions:

- Land acquisition (e.g., conservation easements and leases) to protect headwaters.
- Modify management of reservoirs to protect species of greatest conservation need.
- Alter or remove structures that block the passage of fish and or alter the presettlement pattern of water flow and flooding.
- Encourage the public to work with the U.S. Army Corps of Engineers authority to establish more natural flow patterns.
- Raise the importance of recreation and alternative flow patterns.

- Support Congressional reprioritizing of the projects to include fish, wildlife, and recreation as beneficial uses.
- Cost share with U.S. Army Corps of Engineers for priority actions.
- Promote a better working relationship with the U.S. Army Corps of Engineers in economic, social, and political arenas.
- Research the applicability and use of e-SWIM model (Ecologically Sustainable Water Impoundment Management).
- Research the use of mitigation to fund and support fish and wildlife protection and management from hydropower projects and U.S. Army Corps of Engineers impoundment project agreements.
- Change the scope of hydropower and similar projects through legislation.
- Research ways to discourage building in the floodplain (e.g., look for tax incentives).
- Encourage the U.S. Army Corps of Engineers to reevaluate the flood risks for Oklahoma rivers and streams.
- Research alternative methods of flood control such as levee removal and floodplain mitigation as wetland banks.
- Identify spawning areas potentially impacted by dredging.
- Implement mitigation and reimbursement for fish losses to dam entrainment and stranding due to quickly dropping water.
- Standardize the water requirements below dams.
- Improve water quality requirements around dams.

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

12. Water quality issues (e.g., herbicides, nitrates, metals, oil, and pollution).
13. Grazing (i.e., degradation of river banks by trampling and grazing of cattle).

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) by providing better cost-sharing, more acceptable landowner incentives to reduce inputs, and other Best Management Practices in the watershed.
- Study the cumulative effects of development and runoff to develop recommendations for management options.
- Land acquisition (e.g., conservation easements and leases) to protect headwaters.
- Provide alternative water sources for livestock to get them out of the river.

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

14. Invasive species such as Salt Cedar and non-native fishes negatively impact species of greatest conservation need.
15. Inter-basin introductions of aquatic species (e.g., accidental introduction of Red River Pupfish from the Red River system to the Canadian River) have negative effects on species of greatest conservation need.

Conservation Actions:

- Increase public education about the potential problems with accidental releases of bait fish into rivers.
- Develop exotic and invasive species management plans.

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

16. Commercial harvest of minnows and mussels may affect the sustainability of species of greatest conservation need.

Conservation Actions:

- Study the effects of commercial harvest on species of greatest conservation need.
- Conduct management pilot studies to determine successful management strategies.

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

17. Increased recreational use of rivers and river beds by off-road and all terrain vehicles.

Conservation Actions:

- Understand the effects of recreation on species of greatest conservation need life requirements, habitat, and water quality and water hydrology.
- Conduct management pilot studies to determine successful management strategies.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Degraded and restored stream miles of habitat.
- Populations and trends of indicator species and endangered or threatened species.
- Numbers of new local conservation groups.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of landowners participating in conservation practices.
- Populations and trends of fish and wildlife species (i.e., species of greatest conservation need).
- Public opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- U.S. Geological Survey gauging station for natural flow regimes.
- Water quality parameters.

Conservation Landscape: Oak and Hickory Bottomland Hardwood Forest

Relative condition of Oak and Hickory Bottomland Hardwood Forest habitat is currently poor with a declining trend. Bottomland Hardwood forests are found in the floodplains of the larger streams and small rivers throughout the Crosstimbers Region. Between 80,000 and 100,000 acres of bottomland hardwood forest are thought to remain in the Region and the largest tracts occur along the Deep Fork, Little, Clear Boggy and Muddy Boggy Rivers (Brabander et al. 1985)². Over the past century, much of the former bottomland hardwood forests in the Region has been converted to agricultural land uses (e.g., crop fields or pasture) or permanently inundated by the construction of reservoirs. Bottomland hardwood forests are diverse plant communities and the composition of individual stands varies with soil conditions and the frequency and duration of seasonal flooding. Bottomland hardwood forests in this Region are dominated by oaks and hickories including Bur Oak (*Quercus macrocarpa*), Shumard Oak (*Quercus shumardii*), Chinkapin Oak (*Quercus muehlenbergii*), Pecan (*Carya illinoensis*), and Black Walnut (*Juglans nigra*). In the Red River watershed in the southern portion of the Region, Water Oak (*Quercus nigra*) and Bitternut Hickory (*Carya cordiformis*) are common bottomland forest trees. The canopy trees include Red Elm (*Ulmus rubra*), White Ash (*Fraxinus americana*), Green Ash (*Fraxinus pennsylvanica*), and Sugarberry (*Celtis laevigata*). Common understory vegetation includes Green Hawthorn (*Crataegus viridis*), Deciduous Holly (*Ilex decidua*), and Red Mulberry (*Morus rubra*). An unusual and unique bottomland association occurs in some of the deep canyons in Caddo County where an isolated population of Sugar Maples (*Acer saccharum*) is found growing with Shumard and Chinkapin Oaks.

Recognized plant associations within this habitat type include:

- Bur Oak – Shumard Oak – Bitternut Hickory Temporarily Flooded Forest
- Pecan – Sugarberry Temporarily Flooded Forest
- Water Oak – Red Elm – Shumard Oak Temporarily Flooded Forest
- Sugar Maple – Red Elm – Black Walnut Forest

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Amph	Crawfish Frog				X				X

² Brabander, J.J., R.E. Masters, and R.M. Short. 1985. Bottomland Hardwoods of Eastern Oklahoma: A Special Study of Their Status, Trends and Values. Joint Report of the U.S. Fish and Wildlife Service and the Oklahoma Department of Wildlife Conservation. 167 pages.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bell's Vireo		X			X			
Bird	Harris's Sparrow		X						X
Bird	Hooded Warbler	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Rusty Blackbird	X							X
Bird	Solitary Sandpiper	X							X
Bird	Wood Thrush	X							X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Eastern Harvest Mouse				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Marsh Rice Rat				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Scarletsnake				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X

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

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

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

3. Knowledge of bottomland hardwood forest habitat is incomplete.

Conservation Actions:

- Conduct research, using best professional judgment need to determine why species of greatest conservation need are low and/or declining and determine management strategies.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Inventory all bottomland hardwoods remaining and their status and trend.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Develop a monitoring program to track habitat condition.
- Collect information regarding wildlife abundance and density in order to translate acres of habitat changed into wildlife population changed.

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

4. Conversion of bottomland forest to pasture or crop may be detrimental to species of greatest conservation need.
5. Inappropriate herbicide use may cause damage to species of greatest conservation need.
6. Fragmentation of forest tracts can be due to creation of pastures, croplands, roads, homes, utility line right of ways, natural gas wells, and pipelines. Species that rely on unbroken tracts are susceptible to this trend.
7. Loss of temporary wetlands due to the draining of wetlands, reduction of flooding that maintains the hydrology for these wetlands or the filling of wetland by direct human action or increased siltation of wetlands within this habitat that serve as breeding areas for amphibians and foraging areas for waterfowl, shorebirds, herons, and species of greatest conservation need.
8. Many bottomland hardwood forest stands were clear-cut in the early 1990s for wood, creating unnatural stand ages/structures. The regrowth forests that developed after logging and widespread clear cutting tend to be dense even-aged stands with poor structural diversity, often having dense midstories and poorly developed understory vegetation.

Conservation Actions:

- Design landowner incentives to encourage the retention of riparian hardwood trees.
- Educate landowners about watershed concept, importance of riparian habitat, Best Management Practices, and existing Farm Bill type programs.
- Add Wildlife Habitat Improvement Program funding mechanism for restoration to Natural Resources Conservation Service conservation programs.
- Develop a Conservation Reserve type program for bottomland hardwoods.
- Place existing bottomland hardwood forests into conservation ownership through land acquisition or conservation easement by natural resource management agencies or private conservation organizations.
- Restore crop fields and pastures in floodplains back to bottomland hardwood forest habitat through cost sharing, easements, and acquisition.
- Explore economic alternatives to clearing and grazing bottomland hardwoods (e.g., support the development of hunting leases as a revenue source for landowners).
- Acquire fee title ownership or conservation easements on existing bottomland hardwood forest habitat that can be preserved or crop fields and pastures that can be restored to bottomland hardwood forest. Conservation of existing mature forest

habitat should be a higher priority than restoration because of the long time frame and uncertainty associated with restoring this habitat type.

- Reduce inappropriate aerial spraying of bottomland hardwoods through regulations, conservation easements, or landowner education of the water quality impacts.
- Enforce existing laws for application in aquatic habitats.
- Encourage and support hunting cooperatives in corridors and blocks.
- Use the wide range of programs (e.g., Wetlands Reserve Program and Natural Resources Conservation Service) to connect habitats for wildlife.
- Use private landowner assistance programs such as U.S. Fish and Wildlife Service Partners for Wildlife and Landowner Incentive Program to provide cost-share funding to private landowners to restore hydrology through the construction of small dams and dikes to seasonally flood bottomlands.
- Study the “corridor concept” to see if this strategy addresses fragmentation issues.
- Craft laws that complete the protection of remaining wetlands.
- Construct vernal pools or similar small wetlands within bottomland forest sites.
- Encourage and support the development of a state water plan and a state wetlands plan.
- Eliminate federal funding assistance for clearing forests and establishing introduced grasses.
- Develop Best Management Practices for logging bottomland hardwoods that encourage structural diversity and retain understory vegetation.
- Promulgate legislation that requires the use of Best Management Practices for logging.
- Encourage the protection of private forest land through conservation easement programs and information/education programs.
- Use thinning or selective tree removal to increase structural diversity within forest stands and increase understory vegetation.

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

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

Conservation Actions:

- Modify reservoir management to allow periodic flooding of bottomland hardwood tracts below dams.
- Remove structures that block the movement of fish or prevent natural flooding regimes.
- Remove cost-share programs that encourage the construction of ponds and lakes on perennial streams.
- Develop incentives for the restoration of stream channels and bottomland forest habitat.
- Seek acquisition and easements of existing habitats to protect bottom hardwood forest.
- Use mitigation funds to acquire existing bottomland hardwood forests and to protect them from future development (e.g., urban development, agricultural development, and future reservoir construction).
- Support the development of a state water plan or state wetland plan.

- Support water conservation education to decrease the needs for reservoirs.
- Work with the U.S. Army Corps of Engineers within their authority to restore bottom hardwood forest under their management.
- Provide the results of ecological studies to land and water use planners and encourage the incorporation of them into state and local management plans.
- Restore stream channel structure to reconnect streams with their riparian zones.
- Use private landowner assistance programs such as U.S. Fish and Wildlife Service Partners for Wildlife and Landowner Incentive Program to provide cost-share funding to private landowners to restore hydrology through the construction of small dams and dikes to seasonally flood bottomlands.
- Remove flood control structures that are no longer needed.
- Research alternative flood control methods used in different places in the country (e.g., flood other areas, restore or plant new bottomlands inside existing levees, or create wetland mitigation sites/ banks).
- Use the Wildlife Habitat Improvement Program as a funding mechanism for restoration.
- Restore hydrology and natural standing water to bottomland hardwood habitat.
- Reconnect bottomland hardwoods with the river/stream system along which they developed.
- Manage for the natural hydro period through restoration of the natural meanders of streams and historic flooding patterns.

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

11. Several species of non-native plants and animals (e.g., Japanese Honeysuckle, Autumn Olive, Chinese Privet, feral hogs) have become established within bottomland hardwood forest habitat and now compete with native species for food, water, and space.

Conservation Actions:

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

Potential indicators for monitoring the effectiveness of the conservation actions:

- Forest stand health and composition structure.
- Forests converted to pasture or cropland (e.g., Natural Resources Conservation Service records).
- Number or percentage of acres acquired or placed into conservation programs (e.g., incentive programs).
- Percent of available habitat in conservation programs (e.g., measure net gain or loss of habitat).
- Relative condition (populations/trends) and distribution changes of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.

Conservation Landscape: Post Oak/Blackjack Oak/Hickory Woodland and Forest

Relative condition of Post Oak/Blackjack Oak/Hickory Woodland and Forest habitat is currently good with a stable trend. Dry woodlands, known locally as Crosstimbers, historically covered over 2 million acres of the Crosstimbers Region. The Crosstimbers were a diverse mosaic of oak savannahs, oak/hickory woodlands and oak/hickory forests that varied geographically depending upon soil, rainfall, and fire history. The dominant tree species in this habitat are the Post Oak (*Quercus stellata*) and Blackjack Oak (*Quercus marilandica*) and these two oaks may comprise as much as 90 percent of the canopy cover. Other common trees include Black Hickory (*Carya texana*), Black Oak (*Quercus velutina*) and Eastern Redcedar (*Juniperus virginiana*). Black Hickory and Black Oak are more common in the more mesic sites in the eastern part of the Region. Eastern Redcedar is common throughout the Region and has increased in abundance during the past century as a result of the reduction of periodic fires. Prominent understory plants include Chinkapin Oak (*Quercus muehlenbergii*), Chittamwood (*Bumelia lanuginosa*), Eastern Redbud (*Cercis canadensis*), Roughleaf Dogwood (*Cornus drummondii*), Mexican Plum (*Prunus mexicana*), and Winged Sumac (*Rhus copallina*). In the eastern portion of the Region, Winged Elm (*Ulmus alata*) is a common understory tree. In sites that are drier and/or have a higher frequency of fire, the Crosstimbers has a more woodland or savannah-like structure. These areas typically have a grassy understory dominated by Little Bluestem (*Schizachyrium scoparium*) but also with Indian Grass (*Sorghastrum nutans*), Big Bluestem (*Andropogon gerardii*), and Small Panicgrass (*Panicum oligosanthes*). On rocky limestone soils in the Arbuckle Mountains, Texas Oak (*Quercus shumardii texana*), Chinkapin Oak (*Quercus muehlenbergii*), Ashe Juniper (*Juniperus ashei*), and Texas Ash (*Fraxinus texensis*) are common associates with Post Oak and Blackjack Oak.

The Crosstimbers Woodland is one of the most widespread and abundant native habitat types in the Crosstimbers Region, however many acres have been converted to pasture. Much of the remaining Crosstimbers habitat has a more forest-like structure than it did historically as a result of fire suppression that has allowed for increased survival and density of young oaks as well as the dramatic increase in abundance of Eastern Redcedar

Recognized vegetation associations in this habitat type include:

- Chinquapin Oak – Shumard Oak Forest
- Texas Oak – Texas Ash – Chinquapin Oak Forest
- Post Oak – Blackjack Oak – Black Hickory Forest
- Post Oak – Shumard Oak – Bitternut Hickory Forest
- Post Oak – Winged Elm Forest
- Post Oak – Eastern Redcedar Forest

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bachman's Sparrow	X							X
Bird	Bell's Vireo		X			X			
Bird	Black-capped Vireo	X				X			
Bird	Harris's Sparrow		X						X
Bird	Kentucky Warbler		X						X
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Prairie Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Inve	American Burying Beetle		X						X
Inve	Byssus Skipper	X							X
Inve	Prairie Mole Cricket	X				X			
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Mamm	Ringtail				X				X
Rept	Northern Scarletsnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Diamond-backed Rattlesnake				X				X

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

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

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

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Support economic studies and models about the costs of fragmentation.

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

3. Fragmentation of woodland tracts by urbanization, conversion to tame pastureland, road construction, and utility/pipeline right of ways.
4. Loss of the natural fire regime that has increased the density of some woodland stands relative to their historic condition.
5. Loss of native understory vegetation, due in part to a combination of dense canopies, grazing by cattle, and introduced forbs.
6. Herbicide treatment of oak woodlands to convert this habitat type to pasture.
7. Oil and gas exploration and development results in increased numbers of roads, increased erosion around well sites, increased potential for oil or saltwater spills, and causes other reductions in quantity and quality of this habitat.

Conservation Actions:

- Establish demonstration areas where landowners can see the results of management practices.
- Identify focus areas to get the most value for the dollar.
- Restore woodlands community structure on public lands.
- Acquire easements to prevent development of important habitat.
- Conduct ecological and economic studies to quantify the costs of fragmentation.
- Reinvigorate fire management as a management technique.
- Help non-profit organizations disseminate information to landowners.
- Encourage the development of burning cooperatives or contractors (e.g., Native American tribes).
- Help write prescribed burn laws to reduce liability and provide a right to burn.
- Support burn crews by making it affordable to landowners, reducing liability, and reducing heavy equipment costs.
- Prepare for and address the air quality issues associated with fires.
- Help encourage overgrazing education about Best Management Practices for landowners.
- Study how to overcome overgrazing that facilitates the spread of Eastern Redcedar.
- Monitor response of wildlife populations to various land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Support more outreach to industry and landowners.
- Help encourage herbicide use education and Best Management Practices.
- Provide incentives to use Best Management Practices.
- Create an incentive program to restore habitat.
- Eliminate federal funding assistance for clearing forests and establishing introduced grasses.
- Acquire land fee title where appropriate and with willing sellers.
- Assist the industry to minimize the impacts of roads.
- Help find funds to clean up abandoned sites.
- Support research of new and less expensive cleanup methods.
- Encourage more remediation of abandon sites.

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

8. Invasive species create problems for agriculture and species of greatest conservation need.

Conservation Actions:

- Monitor response of wildlife populations to various land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Increase cost share on invasive species control for private landowners.

- Encourage the invasive species task force's research for controls.
- Conduct management pilot studies to determine successful strategies.
- Support tax credits for invasive species control.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres protected, acquired, and restored.
- Amount of technical assistance being provided.
- Landowners participating in landowner incentive programs.
- Population response of species of greatest conservation need and the vegetation (e.g., grasses and woody plants) response to fire.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Use of fire on the landscape (e.g., number of acres burned).
- Wildlife population response to management.

Conservation Landscape: Tallgrass Prairie

Relative condition of Tallgrass Prairie habitat is currently poor with a declining trend. Tallgrass Prairies are herbaceous plant communities dominated by four common, Tall Grass species: Big Bluestem (*Andropogon gerardi*), Indian Grass (*Sorghastrum nutans*), Switchgrass (*Panicum virgatum*), and Little Bluestem (*Schizachyrium scoparium*). This is a widespread habitat in the Crosstimbers Region and is found on a variety of deep, fine textured silt, and clay soil types. The structure of this habitat type is maintained by frequent, naturally occurring fires that limit the growth of woody plant species and favor grasses and some forbs. All four of the dominant grass species are present in most Tallgrass Prairie sites, however Big Bluestem and Indian Grass tend to be most prevalent in mesic sites, while Big Bluestem and Little Bluestem are most common on drier sites. In mesic loamy soils such as those found in floodplains and bottomlands, Switchgrass and Big Bluestem are often the dominant grasses. Other widespread or common grasses include Prairie Dropseed (*Sporobolus heterolepis*), Sideoats Grama (*Bouteloua curtipendula*), and Eastern Gamagrass (*Tripsacum dactyloides*). Common forbs include Western Ragweed (*Ambrosia psilostachya*), Rosinweed (*Silphium integrifolium*), Compass Plant (*Silphium laciniatum*), Lead Plant (*Amorpha canescens*), Wild Alfalfa/Scurf Pea (*Psoralea tenuifolia*), Illinois Bundleflower (*Desmanthus illinoensis*), Blazing Star (*Liatris sp.*), Goldenrod (*Solidago sp.*), Roundhead Lespedeza (*Lespedeza capitata*), Indian Paintbrush (*Castilleja coccinea*), and Maximillian Sunflower (*Helianthus maximilliani*).

In the Red River valley, pockets of dark alkaline soils over limestone parent material support a rare and locally occurring variation of Tallgrass Prairie known as Blackland Prairies. This southern Tallgrass Prairie community is comprised of Indian Grass, Eastern Gamagrass, Big Bluestem, Tall Dropseed, Longspike Tridens (*Tridens scricetus*), Maximillian Sunflower (*Helianthus maximilliani*), Ashy Sunflower (*Helianthus mollis*), and Rattlesnake Master (*Eryngium yuccifolium*). The distribution of Blackland Prairies in Oklahoma is poorly known.

Though Tallgrass Prairie remains a fairly common and widespread habitat type in the Region, much of the habitat has been tilled and converted to introduced pastures planted to Bermuda grass and other non-native grasses. Further habitat has been converted to cropland for the production of wheat, alfalfa, cotton, or peanuts. The extent of the remaining prairies is unknown but most tracts of native prairie appear to be scattered and relatively small. Where prairie habitat remains, decades of continuous grazing, fire suppression, and encroachment of non-native plants has resulted in changes in to the plant community composition and structure. These changes include a greater abundance of Eastern Redcedar and other woody plants, increased abundance of exotic grasses, and decreased abundance of native forbs.

Recognized plant associations within this habitat include:

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

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

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

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

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

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

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

2. Baseline knowledge about flora/fauna and both the historic and current distribution and condition of this habitat type is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct management pilot studies to determine successful strategies.

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

3. Knowledge about the impacts of many land management practices on populations of many of the species of greatest conservation need in this habitat is incomplete.
4. Conversion of prairie to other land uses (e.g., oil, highways, wind farms, agriculture conversion, utilities, private land ownership, and hay biomass production).
5. Urban communities are sprawling into open spaces and agricultural fields and adversely affecting species of greatest conservation need.
6. Inappropriate use of herbicides.
7. Inappropriate fire and grazing regimes and suppression, including too much fire; management agencies need to better understand and manage fire use.

Conservation Actions:

- Collaborate with the Natural Resources Conservation Service to find ways to alleviate habitat loss and fragmentation.
- Support tax reform to keep people on the land and be able to pass land between generations.
- Support tax shelters for ranch businesses to reduce fragmentation.
- Acquire perpetual easements.
- Support private acquisition by land trusts and organizations such as The Nature Conservancy.
- Increase funding from the subsidy side of the Farm Bill for the Conservation Reserve and Grassland Reserve Programs.
- Restore native Tallgrass Prairie by converting Bermuda grass pastures back to native warm season grasses and forbs.
- Remove federal and state involvement or cost sharing or funding in projects that cause fragmentation.
- Reduce oil production impacts using incentives.
- Use impact fees and tax disincentives for practices that cause habitat community fragmentation.
- Eliminate Farm Bill programs that promote the destruction or conversion of native prairie.
- Develop programs that preserve prairies and community structure so that species of greatest conservation need are protected and restored.
- Encourage accountability for Farm Bill conservation practices.
- Subsidize burn schools for cooperatives and contractors.
- Increase diversification of farming and open new markets.

- Create and fund Regional Planning Organizations to address agricultural land, fragmentation, urban sprawl, open space, and watershed protection.
- Assist and work with the Council of Governments and use regional plans to assist their private and public clients.
- Use conservation easements and non-development easements on both public and private land.
- Use new suburban development (i.e., sustainable development) techniques that minimize impacts such as cluster development and integrated and protected open space.
- Develop disincentives and safe guards against inappropriate suburban and urban development.
- Support the study of economic analysis and nutritional analysis of forage production on ranching and herbicide use.
- Encourage better uses of herbicide by rights-of-way managers.
- Encourage or cost share the development of a demonstration model showing and describing grazing and fire regimes (e.g., with OSU Agriculture Extension).
- Encourage an economic study for profitability and nutrition of diverse forbs pastures.
- Support education components for ranch diversification.
- Improve fire laws and agency management of fire on the landscape.
- Support fire management cooperatives so that effective and efficient fire management by knowledgeable and trained workers can be accomplished.
- Promote regional fire management contractors.
- Help with legislation to reduce liability for fire contractors, yet protect the private parties.
- Update Best Management Practices for farming and resource management practices.
- Encourage the marketing of land for other purposes and revenue sources.
 - Encourage and support ranch diversification for lower grazing to be off set by lease hunting, fishing access, and ecotourism viewing.
 - Support pilot studies to determine the economic factors, net profits for alternative markets and the resulting protection or restoration of species of greatest conservation need.
 - Remove hurdles to lease hunting and hunting cooperatives.
 - Remove restrictive hunting seasons and provide for more uniform seasons and timing so an industry can be built up.

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

8. Invasive species and control methods may have detrimental impacts to species of greatest conservation need.
9. Invasive native woody species management is required because land management practices are not producing stable community structure for species of greatest conservation need.

Conservation Actions:

- Develop management plans to control the abundance and distribution of exotic species and invasive species.
- Develop alternatives to aerial spraying.
- Remove federal subsidies for programs promoting invasive species (e.g., new invasive species of Bermuda grass and turf from other countries).
- Promote certified hay programs that are exotic free.
- Help change the way hay is graded.
- Improve the screening process for genetically modified plants and imported plants.
- Use weed laws to help private property owners manage exotics.

- Require roadside re-vegetation following construction to native species and improve management of roadsides.
- Help support burning cooperatives and independent contractors.
- Encourage rights-of-way managers to manage invasive and exotics species.
- Use patch burning as a tool and rotate cattle around larger pastures rather than additional fencing to create smaller pastures as additional fences fragment prairie habitat and encourage the growth of tree lines across prairies.
- Work through Natural Resources Conservation Service to increase cost share for tree clipping and change Farm Bill ranking factors so that important techniques are encouraged.
- Use tax incentives and tax relief for maintaining good quality prairie.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres burned or treated.
- Changes in acreage/coverage of exotic vegetation.
- Changes in virgin prairie.
- Diversity of agriculture production and agriculture economy.
- Acres of native plant communities (species composition) restored.
- Number of easements secured and acreage protected.
- Relative condition (populations/trends) of species of greatest conservation need and key indicator species.
- Relative condition and quantity of habitat.
- Status of species declining elsewhere but still common in Oklahoma.
- Use of fire (acres burned).
- Vegetation response to management.

Conservation Landscape: Small Gravel (hard)-bottom Streams and Associated Riparian Forests

Relative condition of Small Gravel (hard)-bottom Streams and Associated Riparian Forests habitat is currently unknown with an unknown trend. Gravel or rock-bottom streams are uncommon in the Crosstimbers Region and occur locally in and to the east of the Arbuckle Mountains. The soils in this area are shallow and rocky and the streams originating here have a gravel, cobble, or boulder substrate. Many of these streams have well defined riffle and pool sections, well-developed floodplains, high width to depth ratios, and only slightly entrenched channels. Gravel-bottom streams often support diverse riparian forest communities. One unique riparian plant found in several streams originating in the Arbuckle Mountains is the Seaside Alder (*Alnus maritima*) that is found in only three other states along the Atlantic coast.

Recognized riparian plant associations within this habitat type include:

- Sycamore – Boxelder Temporarily Flooded Forest
- American/Red Elm – Sugarberry/Hackberry – Green Ash Temporarily Flooded Forest
- American/Red Elm – Chinquapin Oak Temporarily Flooded Forest
- Seaside Alder – False Indigo Temporarily Flooded Shrubland

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bald Eagle	X						X	
Bird	Bell's Vireo		X			X			
Bird	Canvasback	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Peregrine Falcon	X							X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Trumpeter Swan	X							X
Fish	Blue River pop of Least Darter	X				X			
Fish	Bluntnose Shiner	X							X
Fish	Plains Minnow			X		X			
Fish	Redspot Chub		X				X		
Fish	Rocky Shiner		X						X
Fish	Shorthead Redhorse	X							X
Inve	Byssus Skipper	X							X
Inve	Little Dubiraphian Riffle Beetle				X				X
Inve	Little Spectaclecase			X			X		
Inve	Ohio River Pigtoe	X				X			
Inve	Ouachita Creekshell	X				X			
Inve	Ouachita Kidneyshell		X			X			
Inve	Threeridge Mussel			X			X		
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Eastern Spotted Skunk				X				X
Mamm	Meadow Jumping Mouse				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Northern Scarletsnake				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X
Rept	Western Massasauga				X				X

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

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

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There is limited historic data from which to evaluate the condition of streams and riparian forests prior to large-scale human alteration of this habitat.

3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is incomplete information from which land managers can predict the effects of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

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

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

5. The presence of confined animal feeding operations such as cattle feedlots, poultry houses, hog farms, and waste application fields close to streams and drainages may affect water quality and the habitat of some species of greatest conservation need.
6. Additional nutrients enter streams as a result of cattle/livestock watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae that can result in other water quality impacts such as increased fluctuations in dissolved oxygen.
8. Pollutants from pesticides, including endocrine disrupters, enter streams in storm water runoff from agricultural fields, altering the growth, reproduction and/or survival of fish, amphibians, and invertebrates in the streams.

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) through Best Management Practices, Farm Bill cost-share programs, and landowner incentive programs.
- Provide alternative water sources for livestock to keep them out of streams.
- Increase landowner education efforts regarding the watershed concept, importance of riparian habitat, Best Management Practices for controlling nutrients, and existing Farm Bill conservation programs to control nutrients.
- Develop conservation easements or acquire land to maintain or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Establish setback distances and Best Management Practices between streams and confined animal feeding operations, and their waste lagoons, and land application areas.

- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit their access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve the knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.
- Conduct management pilot studies to determine successful new management strategies.

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

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

Conservation Actions:

- Provide cost-share funding or grants to restore stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Work collaboratively with public managers and Legislature to develop regulations to reduce gravel mining from within streams.
- Work with local communities and counties to reduce stream channel impacts including in-stream gravel mining, placement of rip-rap on stream banks at bridge crossings, and recreational use of streams by off-road vehicles.

- Establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Stop the proposals to sell water outside of the state or the transfer of water between basins within Oklahoma.
- Brief water use planners and permit writers on ecology and the importance of their work in protecting species of greatest conservation need.
- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals, and interbasin transfers of water.
- Work collaboratively with landowners to remove ponds and impoundments that are obsolete but have been shown to block the movement of fish species of conservation need.
- Work collaboratively with landowners to remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Work collaboratively with landowners to replace ponds that have been constructed on streams with alternative water sources (e.g., for livestock).
- Work collaboratively with public land managers to modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.

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

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

Conservation Actions:

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

- Increase the availability of aquatic resource educational information in the public schools.

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

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

Conservation Actions:

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

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of riparian forest with diverse structure.
- Creation of new local conservation and watershed groups.
- Degraded and restored stream miles of habitat.
- National Wild Turkey Federation GIS data sets.
- Number of acres acquired or proportion of acres protected/acquired within a given watershed.
- Number of acres under easements or conservation practices.
- Number of enhanced or restored acres of quality habitat.
- Number of landowners participating in conservation practices.
- Number of partnerships.
- Populations of indicator species.
- Populations and trends of fish and wildlife species with emphasis on species of greatest conservation need.
- Public opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- Create relational databases and use GIS to monitor habitat change.
- Water quality parameters (e.g., sediment).

Conservation Landscape: Herbaceous Wetlands

Relative condition of Herbaceous Wetlands habitat is currently poor with a declining trend. Herbaceous wetlands are rare and their distribution and biological characteristics are poorly known in the Crosstimbers Region. Herbaceous wetlands are often small seasonally flooded, depressions between dunes and hills or in relatively level prairies and river floodplains. The conditions that maintain herbaceous wetlands are poorly understood but probably involve the interaction of fire and fluctuating water levels. Other herbaceous wetlands are found in association with streams where beaver activity impounds small reaches and creates permanently flooded marshes and other emergent wetlands.

Recognized herbaceous wetland plant associations within this habitat include:

- Ravenfoot Sedge Seasonally Flooded Marsh
- Common Rush Seasonally Flooded Marsh
- Common Reed Semi-permanently Flooded Marsh
- Softstem Bulrush – Common Spike Rush Semi-permanently Flooded Marsh
- Narrowleaf Cattail – Southern Cattail Semi-permanently Flooded Marsh
- Broadleaf Cattail Semi-permanently Flooded Marsh
- Broadleaf Cattail – Powdery Thalia Semi-permanently Flooded Marsh
- Broadleaf Arrowhead – Longbar Arrowhead Semi-permanently Flooded Marsh
- Prairie Cordgrass Temporarily Flooded Marsh

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

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

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

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

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

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete information regarding wetland locations and wildlife:
 - o distribution and locations wetland habitats (e.g., small size of wetlands is very important but the small size makes them difficult to locate and protect within larger habitat types such as prairies and woodlands),
 - o distributions and ecological needs of wetland species (i.e., which species occupy which wetland types), and
 - o the effects of management practices on wetlands animal and plant communities.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Conduct regional survey for wetlands.
- Develop a database of wetland locations and conditions.
- Conduct biological inventories of wetlands to determine plant community composition and the distribution and abundances of wildlife species of conservation need.
- Conduct studies to determine the ecological needs of wetland wildlife species (e.g., types of plant communities and the timing and duration of flooding needed for each wildlife species).
- Produce educational information for landowners and conservation agency staff regarding the ecology of herbaceous wetlands by region and wetland type.
- Develop descriptions of what quality wetland habitats look like. These can serve as the target condition for wetland restoration and enhancement efforts.
- Conduct management pilot studies to determine successful management strategies incorporating Department of Agriculture and Natural Resources Conservation Service wetland information/data for Oklahoma.

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

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

Conservation Actions:

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

- Improve small landowner access to and use of existing cost-share programs.
- Develop new or update existing Best Management Practices for controlling nutrients and sediment around wetlands.

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

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

Conservation Actions:

- Develop management plans to control exotic plants and reduce their abundances and distributions.
- Remove exotic wetland plants and restore native plant communities.
- Monitor response of wildlife populations and habitat to various management practices.

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

11. Woody plants such as willows and Salt Cedar encroach on and dominate herbaceous wetlands because of fire suppression and/or overgrazing.
12. Heavy grazing of wetlands by cattle removes plant cover for wildlife, reduces the abundance of some wetland plants, and can lower overall plant diversity.
13. Seasonal wetlands are plowed and cropped, reducing perennial vegetation and altering plant community composition and structure.

Conservation Actions:

- Use fire or mechanical cutting to remove woody vegetation that has encroached upon herbaceous wetlands.
- Provide cost-share funding or grants to construct fencing around wetlands to control access to this habitat by cattle.
- Use land acquisition, perpetual easement programs, or non-development easement programs to place wetlands into conservation ownership or stewardship.
- Acquire wetlands or purchase conservation easements on cropped wetlands.
- Provide funding to preserve or enhance wetlands.
- Improve the economic incentive to retain wetlands in agricultural areas.
- Improve the incentives for Wetland Reserve Program enrollments.
- Provide incentives or funding to cover the costs of maintaining wetlands.

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

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

Conservation Actions:

- Provide cost-share funding or grants to restore farmed wetlands.
- Provide information to landowners and the public regarding the ecological values of wetlands, especially seasonal wetlands.

- Improve the technology of irrigation to conserve groundwater and reduce groundwater withdrawals.
- Produce education and outreach materials about swampbuster laws and practices.
- Increase the knowledge of and utilization of Farm Bill programs to conserve wetlands (e.g., Wetland Reserve Program).
- Use land acquisition and conservation easement programs to place herbaceous wetlands under conservation ownership or stewardship.
- Acquire former wetlands and restore them through a combination of dredging, diking, and re-vegetation.
- Facilitate crop selection and diversification to move agriculture away from crops with high water needs.
- Improve landowner access to cost-share programs (e.g., improve cost-share ratios, economic incentives, and increase the total amount available).
- Develop tax breaks for landowners that maintain wetlands.
- Connect wetland owners with entities seeking wetland mitigation credits.
- Improve the economic incentive to retain wetlands in agricultural areas.
- Improve the incentives for Wetland Reserve Program enrollments.
- Provide funding or incentives to cover the costs of maintaining wetlands.
- Increase Conservation Reserve Enhancement Program enrollments.
- Help the Natural Resources Conservation Service do wetland conservation planning.
- Conduct management pilot studies to determine successful management strategies.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acreage and distribution of wetlands.
- Acres of farmer conversion to alternative crops and diversifying.
- Acres of Wetlands Reserve Program, Conservation Reserve Program, Grassland Reserve Program and other important Natural Resources Conservation Service programs.
- Appropriate permitting and regulations for cattle confinement operations.
- GIS monitoring loss of wetlands using the National Wetland Inventory data base.
- Incentives to landowners from Legislature and Congress.
- Population status of wetland dependent species of greatest conservation need.
- Stream buffer use.
- U.S. Geological Survey groundwater levels/checks.

Conservation Landscape: Sandstone Canyonlands and Post Oak and Blackjack Oak Shrubland

Relative condition of Sandstone Canyonlands and Post Oak and Blackjack Oak Shrubland habitat is currently poor with a declining trend. Post Oak and Blackjack Oak Shrublands occur locally throughout the Crosstimbers Region in areas where the soil is thin and rocky and underlain by sandstone in most of the Region or limestone in the Arbuckle Mountains. Oak shrubland communities are a mosaic of oak thickets and Tallgrass or Mixed-grass Prairie dominated by Little Bluestem (*Schizachyrium scoparium*), Indian Grass (*Sorghastrum nutans*), and Big Bluestem (*Andropogon gerardii*), and their structure is maintained by periodic fires and dry soil conditions. Post Oak (*Quercus stellata*) is the dominant woody species, but Blackjack Oak (*Quercus marilandica*), Chittamwood (*Bumelia lanuginosa*), Eastern Redbud (*Cercis canadensis*), Roughleaf Dogwood (*Cornus drummondii*), Mexican Plum (*Prunus mexicana*), and Winged Sumac (*Rhus copallina*) are also common. Historically, these shrublands supported nesting populations of the endangered Black-capped Vireo but fire suppression has altered the structure of many patches of oak shrubland habitat and allowed for an increase in the abundance and dominance of junipers such as Eastern Redcedar (*Juniper virginiana*) and Ash Juniper (*Juniper ashei*).

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Black-capped Vireo	X				X			
Bird	Northern Bobwhite		X			X			
Bird	Painted Bunting		X						X
Bird	Swainson's Hawk		X						X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Desert Shrew				X				X
Mamm	Ringtail				X				X
Rept	Texas Gartersnake				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Diamond-backed Rattlesnake				X				X
Rept	Western Massasauga				X				X

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

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

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Baseline knowledge of the plant and animal community and presettlement fire patterns is incomplete.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Evaluate the current and historic distributions and conditions of this habitat and determine the factors that maintain this vegetation community.

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

3. Eastern Redcedar encroachment due to a combination of fire suppression and historic overgrazing.
4. Inappropriately heavy grazing may facilitate the spread of Eastern Redcedar.
5. Fire suppression which has allowed for a dramatic increase in Redcedar and some increase in oak numbers and height; this unnaturally high amount of woody vegetation growing on thin dry soils makes the trees (e.g., oaks) more susceptible to disease and drought stress.

Conservation Actions:

- Facilitate fire management by supporting burning cooperatives.
- Establish demonstration pilot studies to determine successful management strategies so that private and public landowners can see the results of management practices.
- Identify focus areas to get the most return on the dollar.
- Create an incentive program to restore habitat.
- Acquire public land and perpetual easements.
- Implement land management practices such as thinning, deferred grazing, and prescribed late winter burning.
- Restore oak shrubland on public lands.
- Seek alternative methods of cedar removal.
- Develop descriptions of quality habitat.
- Increase education about grazing, fire, natural systems, invasive species, and Best Management Practices.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Use of fire on the landscape (e.g., number of acres burned).
- Develop GIS datasets to monitor change in habitat acreage.
- Populations and trends of indicator species.
- Number of acres acquired and number of acres restored.
- Number of landowners participating in landowner incentive programs.

- Species of greatest conservation need distribution.
- Species of greatest conservation need populations' response to management.

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

Relative condition of Small Sandy (soft)-bottom Streams and Associated Riparian Forest habitat is currently unknown with an unknown trend. The majority of streams in the Crosstimbers Region have predominantly sandy or silty substrates, though these same streams may have sections of gravel or rock substrates in riffles. Narrow forests of often fast-growing trees grow along the banks of most streams. These forests were comprised of a diversity of tree species including American Elm (*Ulmus americana*), Sugarberry (*Celtis laevigata*), Green Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood (*Populus deltoides*), Black Willow (*Salix nigra*), Sycamore (*Platanus occidentalis*), and Boxelder (*Acer negundo*). Historically, larger streams in the eastern part of the Region often supported extensive shrublands of Giant Cane (*Arundinaria gigantea*).

More work is needed to examine the historic condition of streams in the Region but at one time many streams appear to have had well developed floodplains, been only slightly entrenched, had moderate to high degrees of sinuosity and relatively low width to depth ratios. Currently, many streams in the Region have been altered by human activity such as the removal of riparian vegetation and the straightening of the channels to remove stream meanders. These efforts to reduce the amount of acreage occupied by streams and their floodplains have resulted in many streams cutting deep incised channels that separate the stream from its former riparian zone.

Recognized plant associations within this habitat include:

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

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Woodcock	X							X
Bird	Bell's Vireo		X			X			
Bird	Canvasback	X							X
Bird	Kentucky Warbler		X						X
Bird	Lesser Scaup		X			X			
Bird	Little Blue Heron		X						X
Bird	Louisiana Waterthrush		X						X
Bird	Northern Pintail		X			X			
Bird	Painted Bunting		X						X
Bird	Prothonotary Warbler		X						X
Bird	Red-headed Woodpecker		X			X			
Bird	Snowy Egret								
Bird	Solitary Sandpiper	X							X
Bird	Trumpeter Swan	X							X
Fish	Pallid Shiner (Chub)	X							X
Fish	Plains Minnow			X		X			
Fish	Western Sand Darter	X							X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Meadow Jumping Mouse				X				X
Mamm	River Otter		X					X	
Mamm	Seminole Bat				X				X
Mamm	Swamp Rabbit				X				X
Rept	Alligator Snapping Turtle				X				X
Rept	Eastern River Cooter				X				X
Rept	Midland Smooth Softshell				X				X
Rept	Mississippi Map Turtle				X				X
Rept	Ouachita Map Turtle				X				X
Rept	Razor-backed Musk Turtle				X				X
Rept	Spiny Softshell Turtle				X				X
Rept	Western Chicken Turtle				X				X
Rept	Western Massasauga				X				X

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

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

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. There is limited historic data from which to evaluate the condition of streams and riparian forests prior to large scale human alteration of this habitat.

3. The resources of riparian forests and streams are difficult to monitor because most of the habitat occurs on private land and is distributed in small tracts across many individual landowners.
4. There is incomplete information from which land managers can predict the affect of habitat changes on populations of species of greatest conservation need.

Conservation Actions:

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

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

5. The presence of large confined animal feeding operations (e.g., cattle feedlots, poultry houses, hog farms, and their waste application fields) may contribute nutrients to the water through storm water runoff into streams and drainages.
6. Additional nutrients enter streams as a result of cattle and livestock watering in streams and grazing in riparian areas.
7. Increased nutrient levels in streams increases the abundance of algae, resulting in other water quality impacts such as increased fluctuations in dissolved oxygen.
8. Pollutants, including endocrine disrupters, enter streams in storm water runoff from agricultural fields altering the growth, reproduction and/or survival of fish, amphibians, and invertebrates in the streams.

Conservation Actions:

- Reduce nutrient inputs (i.e., point and non-point sources) through Best Management Practices, Farm Bill cost-share programs, and landowner incentives programs.
- Provide alternative water sources for livestock to keep them out of streams.
- Increase landowner education efforts regarding watershed concepts, importance of riparian habitat, Best Management Practices for controlling nutrients, and existing Farm Bill conservation programs to control nutrients.
- Develop conservation easements or acquire land to maintain or restore natural riparian vegetation along streams to reduce or limit agricultural development in and adjacent to riparian areas.
- Establish setback distances between streams and confined animal feeding operations, waste lagoons, and land application areas.

- Provide cost-share funding to construct fencing along streams and riparian areas to control/limit access by cattle.
- Provide cost-share funding or increase promotion of existing programs to restore riparian vegetation along streams.
- Develop better cost sharing programs to increase the acceptability and use of Best Management Practices to control nutrients and pesticides by landowners.
- Reduce the use of herbicides and other pesticides in floodplains and riparian areas.
- Conduct management pilot studies to determine successful strategies.
- Develop local watershed councils, stream teams, and citizen's groups to address local concerns through education and to monitor water quality and wildlife populations.
- Improve landowner knowledge of and access to Farm Bill incentives and cost-share programs to improve water quality through the implementation of Best Management Practices and establishment of streamside buffer zones.

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

9. Many streams in the Region have been channelized and straightened, becoming deeply incised and no longer connected with their riparian vegetation.
10. Streams with incised channels have cut banks that are prone to erosion that increases sediment loads in the streams.
11. Lack of connection between streams and riparian vegetation due to the channelization and incising of streams results in reduced riparian vegetation and a loss of wetlands within the stream floodplain.
12. Water is being pumped from streams for irrigation.
13. Groundwater is being pumped from shallow aquifers for municipal and agricultural purposes, lowering water tables and reducing the flow volume of springs and seeps that feed streams.
14. Increased pond construction may be lowering the inflow that sustains streams.
15. Bridges can impact streams by altering stream channels, erosion, and flow.
16. Some types of culverts can become barriers to the movement of fish during low-flow conditions.
17. Dams and bridges across streams can create fish barriers that affect the populations of fish and freshwater mussels.
18. Dams and diversion structures alter the natural flow patterns and other processes of streams, especially the frequency and magnitude of natural flooding events that are required to maintain downstream channels and banks.

Conservation Actions:

- Provide cost-share funding or grants to restore stream channels and establish natural vegetation on stream banks for stability.
- Restore or construct seasonal wetlands/vernal pools within the riparian zones or floodplains of streams to enhance flood storage and create shallow water habitat for shorebirds, waterfowl, and amphibians.
- Conduct management pilot studies to determine successful management strategies.
- Reconnect stream and riparian vegetation through the restoration of stream channels.
- Establish minimum in-stream flow levels on all biologically important streams (e.g., those streams that support populations of species of greatest conservation need or diverse aquatic communities).
- Manage water withdrawals to have the least impact on aquatic biota.
- Anticipate and articulate to the Legislature and the Congressional delegation the potential effects of proposals to sell water outside of the state or the transfer of water between basins within Oklahoma.
- Provide the results of ecological studies to water use planners and those who issue permits.

- Support the development of a state water management plan with sound biological data that demonstrates the ecological impact of water sales, water withdrawals, and interbasin transfers of water.
- Work collaboratively with landowners to remove ponds and impoundments that are obsolete and have been shown to block the movement of fish species of conservation need.
- Work collaboratively with landowners to remove or rehabilitate culverts and road crossing with new structures that do not create barriers to fish.
- Work collaboratively with landowners to replace ponds that have been constructed on streams with alternative water sources (e.g., for livestock).
- Work collaboratively with public managers to modify pond and reservoir management to ensure that minimum in-stream flows are maintained below these structures.

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

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

Conservation Actions:

- Provide cost-share funding or grants to fence riparian forests to control/limit their access by cattle.
- Purchase easements to protect or enhance existing riparian vegetation or to restore riparian forests.
- Encourage the planting/construction of alternative shading for livestock to reduce their use of riparian areas.
- Provide landowner incentives or cost-share programs to protect or restore riparian forests, stream banks, and in-stream habitat.
- Use fee-title purchase of stream and riparian habitat to place this into conservation ownership to conserve or enhance existing habitat.
- Fee-title acquisition of headwaters to streams to control/limit the introduction of sediment, nutrients, and chemical pollutants.
- Develop new and promote existing Best Management Practices for the grazing of cattle in or adjacent to riparian zones.
- Conduct management pilot studies to determine successful new management strategies.

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

29. Exotic plant species such as Chinese Privet, Salt Cedar and Japanese Honeysuckle have become established and are becoming more abundant in riparian forests,

competing with native plants and altering the structure of the habitat that can be used by animals.

30. Feral hogs that forage in streams and along stream banks damage riparian vegetation and reduce bank stability.
31. Some native plants and animals have become more abundant in riparian forests.
 - Eastern Redcedar has increased in abundance due to heavy grazing and reduced fire frequency in riparian areas.
 - Brown-headed Cowbirds have become more abundant in riparian areas due to cattle grazing. Brown-headed Cowbirds lay their eggs in the nests of other birds thus reducing the number of chicks from the host species.

Conservation Actions:

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

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres of riparian forest with diverse structure.
- Creation of new local conservation groups.
- Degraded and restored stream miles for habitat.
- GIS to monitor change and computerize data into relation data.
- Number of acres acquired.
- Number of acres under easements or conservation practices.
- Number of enhanced or restored acres of quality habitat.
- Number of landowners participating in conservation practices.
- Number of partnerships or easements.
- Population of indicator species
- Populations and trends of fish and wildlife species (species of greatest conservation need)
- Proportion of acres protected/acquired within a given watershed.
- Public opinion toward conservation actions.
- Stream flow and habitat quality (e.g., measure return of stream flow with range of natural variation).
- U.S. Geological Survey monitoring stations data and U.S. Geological Survey groundwater levels check.
- Water quality parameters.

Conservation Landscape: Mixed-grass Prairie

Relative condition of Mixed-grass Prairie habitat is currently poor with a declining trend. Mixed-grass Prairies occur locally on relatively dry and well-drained upland sites along the western edge of the Crosstimbers Region and in areas of relatively coarse and/or thin soils in the southern part of the Region south and east of the Arbuckle Mountains. This habitat type is maintained by a combination of soil conditions and frequent fire. Mixed-grass prairies are dominated by Little Bluestem (*Schizachyrium scoparium*) and Sideoats Grama (*Bouteloua curtipendula*). Other grasses that may be common include Big Bluestem (*Andropogon gerardi*) and Blue Grama (*Bouteloua gracilis*). Forbs are often abundant and include Poppy Mallow (*Callirhoe involucrata*), Heath Aster (*Symphotrichum ericoides*), and Dotted Blazing Star (*Liatris punctata*).

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	American Golden Plover		X						X
Bird	Barn Owl	X							X
Bird	Bell's Vireo		X			X			
Bird	Buff-breasted Sandpiper	X				X			
Bird	Burrowing Owl	X							X
Bird	Chestnut-collared Longspur	X							X
Bird	Ferruginous Hawk	X							X
Bird	Harris's Sparrow		X						X
Bird	LeConte's Sparrow		X						X
Bird	Loggerhead Shrike		X			X			
Bird	Northern Bobwhite		X			X			
Bird	Prairie Falcon	X							X
Bird	Red-headed Woodpecker		X			X			
Bird	Sandhill Crane		X				X		
Bird	Short-eared Owl				X				X
Bird	Smith's Longspur	X							X
Bird	Sprague's Pipit				X				X
Bird	Swainson's Hawk		X						X
Bird	Upland Sandpiper				X		X		

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	Prairie Mole Cricket	X				X			
Mamm	Black-tailed Prairie Dog		X					X	
Mamm	Eastern Spotted Skunk				X				X
Mamm	Long-tailed Weasel				X				X
Rept	Texas Horned Lizard				X				X
Rept	Western Diamond-backed Rattlesnake				X				X

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

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

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

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Conduct microclimate studies to understand effects and management alternatives for working landscapes.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.

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

4. Loss of historic fire regimes and the subsequent increase of woody plants such as Juniper.
5. Introduced exotic species such as Old World Bluestem and Bermuda grass harm species of greatest conservation need.
6. Some grazing practices (e.g., overgrazing) harm species of greatest conservation need.
7. Conversion to cropland or introduced pasture may harm species of greatest conservation need.

Conservation Actions:

- Change the Conservation Reserve and Grassland Reserve Programs to be more effective at protecting species of greatest conservation need.
- Implement appropriate patch burning and prescribed fire on the landscape.
- Encourage rangeland management and proper use (i.e., Best Management Practices).

Potential indicators for monitoring the effectiveness of the conservation actions:

- Acres acquired or in permanent easement.
- Acres burned and patch size.
- Acres of converted cropland planted to native grasses.
- Conversion acres of Mixed-grass Prairie.
- Create an index of fragmentation.
- Population trends or distribution changes of the species of greatest conservation need.

Conservation Landscape: Limestone Cave

Relative condition of Limestone Cave habitat is currently good with a stable trend. The presence of caves in the Crosstimbers Region is limited to the Arbuckle Mountains in portions of Murray, Pontotoc, and Carter counties. The Arbuckle Mountains are a limestone karst formation with numerous underground aquifers and a few surface caves. Cave locations are poorly known and poorly studied but they have the potential to harbor breeding or hibernating colonies of several bat species. There are no known vertebrate species found only in the Arbuckle Mountains but at least one cave/groundwater dwelling amphipod is restricted to this area.

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Inve	Caecidotea acuticarpa	X							X
Inve	Caecidotea antricola	X							X
Inve	Oklahoma Cave Amphipod	X				X			

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

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

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. In general, cave entrances are unknown.
3. Incomplete resource monitoring.
4. Unknown species that use cave habitat forage outside of caves (e.g., bats) or live in the aquifer (e.g., invertebrates).

Conservation Actions:

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

- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Study populations of cave species (e.g., Oklahoma Cave Amphipod).
- Delineate/map recharge areas around caves. Conduct surveys to identify caves (e.g., map certain caves).
- Surveys for populations of cave species.
- Study and research the ecological, life history, and management of cave species.

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

5. Pollution in the recharge zone around/above caves, groundwater quality degradation, and addition of nutrients could harm the species of greatest conservation need.
6. Water diversions and withdrawals (e.g., water regime changes such as patterns of flow).
7. Potential for water sale decreasing the amount available to these little know species and habitat.
8. Endocrine disruptors related to agricultural runoff/discharge (e.g., poultry, cattle, and use on plants).

Conservation Actions:

- Monitor cave parameters and establish management priorities.
- Conduct management pilot studies to determine successful management strategies.

Conservation Issue: Habitat loss from land management practices:

9. Heavy recreational use.
10. Land use around cave affects foraging habitat for bats.
11. Limestone quarrying may affect cave habitats.

Conservation Actions:

- Acquire interest in land through fee title or conservation easements and leases.
- Develop landowner incentives program for cave management (e.g., cave gating and maintenance).
- Development of education programs (e.g., cave resources and landowner opportunities).
- Maintain security of cave locations to protect cave organisms as well as landowners.
- Construct appropriately designed gates.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Air quality, temperature, and humidity in caves.
- Bat gates (e.g., effectiveness against vandalism).
- Groundwater quantity and quality.
- Population trends of cave species (e.g., bats and invertebrates).

Conservation Landscape: Springs

Relative condition of Springs habitat is currently good with a stable trend. Springs are rare in the Crosstimbers Region. The majority of biologically significant springs occur in the Arbuckle Mountains area where the limestone karst geology supports a large complex groundwater aquifer and several surface springs. This aquifer is the only habitat for the regionally endemic Oklahoma Cave Amphipod (*Allocragonyx pellucidus*).

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

Species status definitions:

Low – species is rare, has a small population size, and/or occurs in only a small portion of the Region.

Medium – species is uncommon and occurs over a large portion of the Region or species is common but occurs in only a small part of the Region.

Abundant – species is common and widespread within the Region in appropriate habitat.

Unknown – the status of this species is not known.

Species of Greatest Conservation Need		Status				Trend			
Group	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Bird	Louisiana Waterthrush		X						X
Fish	Blue River pop of Least Darter	X				X			
Fish	Orangebelly Darter			X			X		
Fish	Redspot Chub		X				X		
Inve	Caecidotea acuticarpa	X							X
Inve	Caecidotea macropoda	X							X
Inve	Caecidotea simulator	X							X
Inve	Oklahoma Cave Amphipod	X				X			
Inve	Rattlesnake Master Borer	X							X
Mamm	Brazilian (Mexican) Free-tailed Bat				X				X
Mamm	Marsh Rice Rat				X				X
Mamm	Seminole Bat				X				X

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

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

1. Data are incomplete for species of greatest conservation need (particularly those whose populations are low or unknown and for those whose status and trends of are declining or unknown) thus making it difficult to identify management issues and establish effective corrective strategies.
2. Incomplete data regarding spring locations.
3. Population data for spring and stream species is incomplete.

4. Springs are difficult to monitor because of small size and because habitat is mostly privately owned.
5. Small springs and seeps that are important to amphibians and crayfish are difficult to locate.

Conservation Actions:

- Conduct research to determine why species of greatest conservation need are low and/or declining.
- Conduct research on species of greatest conservation need to determine why populations are low and/or declining.
- Conduct research on species of greatest conservation need to establish baseline population data/information.
- Verify existing data.
- Use surveys, workshops, and data acquisition to update the Comprehensive Wildlife Conservation Strategy.
- Create a springs/stream data base to track location, land ownership, and biological data.
- Create spring teams and citizen teams to monitor springs (e.g., biota, habitat, flow, and water quality).

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

6. Habitat degradation and modification of springs by small dams, pipes, and recreational use.
7. Lack of adequate riparian zones and vegetation protection.
8. Some road crossings may create fish barriers that affect fish populations.
9. Groundwater withdrawal reducing spring and stream flow.

Conservation Actions:

- Educate landowners about the existence, importance, and significance of this habitat.
- Acquire land or conservation easements and leases.
- Assist landowners to modify their dams that keep fish from swimming upstream or that warm the water.
- Encourage the formation of groundwater districts to manage withdrawals.
- Manage water withdrawals to have the least impact (e.g., in-stream flow protection).
- Use landscape planning and water planning principles to demonstrate and establish the value and importance of this habitat for species of greatest conservation need.

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

10. High nutrient levels increase algae and affect oxygen levels and the sustainability of species of greatest conservation need.
11. Livestock in springs is detrimental to the sustainability and protection of species of greatest conservation need.
12. Groundwater contamination and withdrawal that reduces spring flows quantity and quality.
13. Fragile habitat is easily disturbed or modified, especially by exotic plant invasion.

Conservation Actions:

- Educate landowners about the existence, importance, and significance of this habitat.
- Acquire land or conservation easements and leases.
- Encourage the use of landowner incentive programs to protect and restore habitat, water quality, and riparian habitat.
- Delineate recharge areas of springs to protect water quality.
- Control or stop introduction of exotic species.

Potential indicators for monitoring the effectiveness of the conservation actions:

- Number of easements obtained to protect or restore springs.
- Number of protected springs/streams.
- Populations of spring/stream organisms.
- Stabilized stream and spring flow and quality.
- Water quality improvements.

Potential partnerships to deliver conservation for Crosstimbers Region:

State Government

- Oklahoma Biological Survey
- Oklahoma Corporation Commission
- Oklahoma Department of Agriculture and Forestry Service
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Transportation
- Oklahoma Department of Wildlife Conservation
- Oklahoma Energy Resources Board
- Oklahoma Legislature
- Oklahoma Natural Heritage Inventory
- Oklahoma State University, Cooperative Extension Service
- Oklahoma State University, Department of Forestry
- Oklahoma Tourism and Recreation Department
- Oklahoma Turnpike Authority
- Oklahoma Water Resources Board
- state universities and departments
- state-funded museums
- University of Arkansas's Cross Timbers Tree-Ring Laboratory
- University of Oklahoma, Oklahoma Biological Station
- University of Oklahoma, Sam Noble Oklahoma Museum of Natural History

Federal Government

- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Department of Agriculture, Farm Service Agency
- U.S. Department of Agriculture, Forest Service
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Agriculture, Resource Conservation and Development Councils
- U.S. Department of Defense, Tinker Air Force Base
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

Local Government

- Local Councils of Governments
- Municipalities in Oklahoma, and Texas
- Municipalities wanting to buy water
- Tribal governments

Businesses, Citizens and Citizen Groups

- Local Audubon Chapters
- Bat Conservation International
- Chambers of Commerce
- Citizens for the Protection of the Arbuckle-Simpson Aquifer
- Ducks Unlimited and local Oklahoma chapters
- Farm Bureau
- Farmers Union
- Hunting cooperatives
- Individual farmers
- Izaak Walton League
- Land Trusts

- Local citizen's groups
- Logging industry
- National Wild Turkey Federation and local Oklahoma chapters
- Oklahoma Anglers United
- Oklahoma Cattlemen's Association
- Oklahoma Native Plant Society
- Oklahoma Ornithological Society
- Oklahoma Section of the Society for Range Management
- Other sportsmen's groups
- Private contractors
- Private landowners
- Producer Cooperatives
- Railroad Companies
- Regional Planning Organizations
- Sierra Club
- Small logging companies
- Small Woodland Owner's Association
- Speleological Societies
- The Nature Conservancy
- The Samuel Roberts Noble Foundation, Inc.
- The Wildlife Society
- Urban development groups
- Wetland Mitigation Bankers