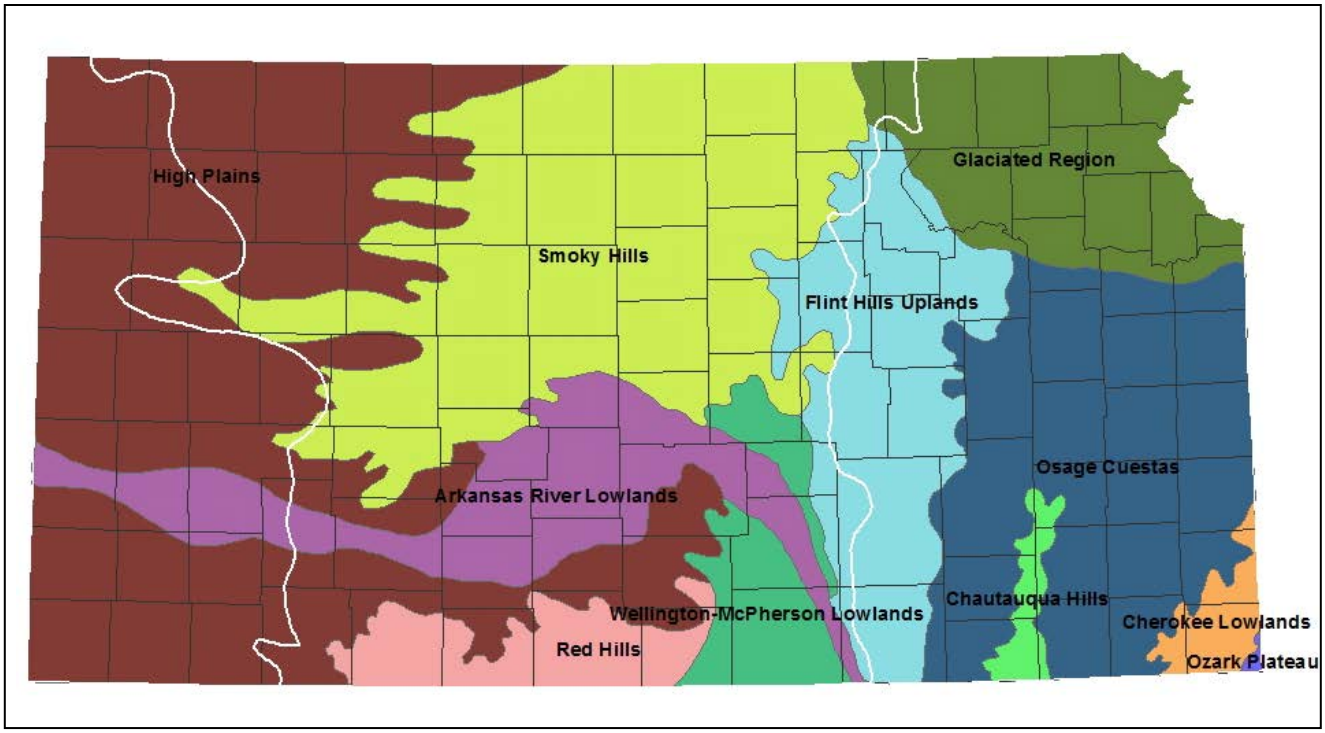
STATEWIDE PERSPECTIVE

Kansas is a state of variety in terms of landscape, weather, waters, and wildlife. The 82,276 square miles of natural Kansas offer displays of environmental change and associated diversity of plant and animal species. The land gradually rises from east to west; with elevation ranging from 684 ft. to 4,039 ft. (Collins 1985). In general the topography of the state, moving from west to east, consists of flat, rolling, and hilly terrain. The exceptions to the generalities of Kansas' topography offer remarkable diversity of land forms, like the deep box canyons of the Arikaree Breaks in the northwest corner to the dripping ledges of Schermerhorn Cave in the southeast; from the towering chalk formations of the High Plains to the eroded cutouts of the Red Hills along the south central border (Collins 1985). Millions of years ago, the majority of Kansas was covered by a shallow ocean of salt water called the Permian Sea. The sea, along with its wildlife, created many of the natural resources Kansas provides today, including limestone, coal, oil, natural gas, and thick salt deposits. Geologically, the sedimentary layers of Kansas are relatively young, of Mississippian age and younger (Wilson and Bennett 1985) with the oldest strata exposed in eastern Kansas and most recent near the Colorado border.

Figure 4. Physiographic regions of Kansas (Kansas Geological Survey 1997)



Not only do the physical properties of the bedrock create different land forms but also the soil that develops from their upper layers. Broad areas of distinct physiography (Figure 4) are produced by the breakdown of differently composed bedrock belts (Savage 2004). This can lead to characteristic natural vegetation types developing on distinctive soil types (Wilson and Bennett 1985). Powerful forces of nature produced the land forms of the state. Forces such as fierce winds, alternations between blazing heat and blizzard cold, gushes of floodwater, or melting glaciers, have eroded and broken down the differently composed bedrocks. One result that illustrates these forces is the sand and gravel in western Kansas that was deposited through erosion of the Rocky Mountains (Wilson 1984).

The weather in Kansas can often be described as dramatic and dynamic. The state has seen record high temperatures climb to 121° F, and the record cold drop to -40° F. Kansas temperatures can soar to over 100° F in both October and March, but also drop to freezing or below in every month of the year (Eagleman and Simmons 1985). Snowfall has been recorded in every month except July and August. The average amount of snowfall varies from 10 inches in the south central part of the state to 24 inches in the northwest (Busby and Zimmerman 2001). Although Kansas displays a great variation of temperature regimes, the mean annual temperature is about 55° F (Eagleman and Simmons 1985). The state's varied weather displays are due in part to its diverse topography. Moisture from the Gulf of Mexico is blown to Kansas by strong surface winds. Eastern Kansas (the Tallgrass Prairie region) receives warm moist air from the Gulf more often since normal surface winds blow from a southerly direction (Savage 2004). The average annual amount of rainfall in the eastern part of the state is around 40 inches, while the western part of the state's average annual rainfall amount drops to 15 inches (Eagleman and Simmons 1985). Summer thunderstorms account for much of the annual rainfall, with 75% of precipitation occurring during the growing season (April through September) (Busby and Zimmerman 2001). The western third of Kansas (the Shortgrass Prairie region) consists of a semiarid climate, caused by the "rain shadow" of the Rocky Mountains. The mountains pull the moisture from the east moving air masses from the Pacific Ocean. The air that does move over the mountains and across the plains is much drier. The subtle rise in elevation leads to a long, subtle gradient of temperature and moisture regimes across the state (Eagleman and Simmons 1985).

Water, which aided in sculpting the landscape and is a major factor in the location and dispersal of plants and animals, is available in diverse forms throughout Kansas. Kansas is a land of few natural lakes such as river ox-bows or playa lakes. Almost all of the large lakes seen in Kansas today are manmade reservoirs and the result of flood-control projects (Madson 1985). Shallow wetlands and playa lakes, another type of water source in Kansas, are scattered across the state. They are found along major rivers and in natural depressions (Busby and Zimmerman 2001). The large wetlands, Cheyenne Bottoms and Quivira National Wildlife Refuge, of central Kansas are the best known wetlands of the state. The northern half of the state lies in the Kansas River Basin. Those streams and rivers begin on the flatlands east of the Rocky Mountains, eventually draining into the Missouri River (Wilson 1984). The southern part of the state is in the Arkansas River Basin. The Arkansas River, running along the south-western corner of the state, is the only major river in the state that originates in the mountains. Most of the sandy-bottomed streams in the western portion of the state exist thanks to the underground reservoir called the Ogallala

Aquifer (Madson 1985). Unlike the streams in the eastern part of the state, the western streams are not particularly fertile. There is less vegetative growth and cover, leaving the streams vulnerable to increased evaporation and erosion. The eastern streams typically have more growth and cover, due in part to the more constant supply of water and nutrients from fertile soil erosion.

The location and abundance of Kansas plants and animals are dictated by the combined factors of landscape, weather and water. Kansas, situated almost entirely within the Great Plains, is home to the prairie. The plants of the prairie have become well-adapted to extreme temperatures and rainfall, large grazing herbivores, and fire (Busby and Zimmerman 2001). The Kansas prairie is broadly divided into three groups based on dominant species and height of vegetation; the Shortgrass prairie, Mixed-grass prairie, and Tallgrass prairie. The Shortgrass prairie occurs in the western third of the state and the Tallgrass prairie in the eastern third of the state. The mixed-grass prairie comprising the central third of the state is a zone of transition from tallgrass prairie species in the east to shortgrass prairie species in the west. In addition to many species of grasses, prairies contain many broad-leaved plants and a minor shrub component. The western limit of the Eastern Deciduous Forest spreads into far eastern Kansas, mingling with portions of the Tallgrass prairie (Savage 2004). The trees of the deciduous forest are large, and their expansive crowns shade the earth from the sun. They blanket river valleys, adjacent drainages, and their associated hillsides. Moving westward, the trees begin to hug waterways, and continuous strands of trees eventually disappear in the western half of the state (Brooks 1985). Woodlands in western Kansas keep to the riparian zones, but can spread into the uplands when they are protected from fire. Cottonwood, green ash, and elm are the dominant tree species in eastern Kansas, with occasional groves of oak, walnut, and hickory. Cottonwoods and willows are dominant in the west, where they can establish themselves quickly in the river bottoms that often experience flooding from torrential rains that scour the ground (Brooks 1985).

Many Kansas species, adapted to the extremes in temperature and precipitation, are able to live in abundance everywhere, but a fair number are restricted to eastern forest or arid High Plain (Collins 1985). Some restricted species may venture east or west, gradually declining in numbers as they leave the comfort of optimal habitat. Other habitat-specialists species may stay strictly within their distinct living conditions that keep them abundant and healthy. Restricted to water sources, the majority of amphibian species occur in eastern Kansas, especially the south-eastern portion. Reptile species richness follows a similar pattern, with the most reptile species occurring in the south-east quarter of the state. For the most part, resident bird species can occur across the state, but the greatest number of bird species occurs on the eastern side of the state. Located in the heart of the Central Flyway, along the flight path for many migratory bird species, Kansas offers areas of shelter, food, and rest for the weary travelers. Many mammal species occur across the entire state, but the highest number of mammal species occurs in the western portion of the state. This pattern is demonstrated by the wide variety of *Rodentia* in the area. The greatest number of fish species occurs in the forested region on the east side of the state. The highest species richness of freshwater mussels occurs in the southeastern Kansas rivers where more stable water flows and gravel substrates underlying riffles and runs are the home of many long-lived species. A few short-lived species that can survive in ponded water occur in the western Kansas streams. Insects are the most abundant group of species across the state. However, our knowledge of them is greatly lacking when compared with what is known about the taxa.

Kansas Wildlife Resources

In Kansas, as elsewhere, terrestrial and aquatic wildlife has historically been generically categorized as "game" and "nongame" species. This is driven by the financial and philosophical contributions of hunting and sport fishing interests. Those desgnations aside, the Department is tasked with regulating, monitoring, and managing populations of game and nongame wildlife. The Department has no statutory obligation for plant protection although many activities address plant conservation through biological community associations and wildlife habitat management (Appendix 5 contains plant Species of Concern). The Department is responsible for the management of about 798 species of vertebrates. This includes 468 bird species, 89 mammals, 144 fishes, 53 reptiles, and 30 amphibians. Additionally, approximately 24,000 species of invertebrates, including mussels, crustaceans, and insects are under jurisdiction of the Department. There are presently 30 threatened, 21 endangered, and an additional 83 species on the Species In Need of Conservation List. This list is reviewed every five years as per amendments to the Kansas Nongame and Endangered Species Act of 1975. The next listed-species review will commence in 2018. In the meantime, information is continually being gathered to assess the status of species or multiple-species groups.

Recently, the apparent decline in the multi-species group commonly referred to as "pollinators" has emerged as a major conservation concern. Animal pollinators are extremely important in meeting consumer demand and contributing to the profits generated from the harvest and sale of many agricultural crops. Roughly 75% of the 240,000 species of flowering plants world-wide rely on pollinators for flower reproduction. Available evidence indicates that certain pollinator species have been declining in the U.S. Declines in pollinator populations can be traced to a multitude of causes, such as intensive agricultural practices, use of certain pesticides, and habitat loss and degradation. Some species such as bumblebees and honeybees have experienced declines as a result of the spread of pathogens and disease from commercially produced colonies to native populations. The best known example is Colony Collapse Disorder in honeybees. Flower-visiting insects account for 50 percent of all known insect extinctions. Reduced pollinator populations can result in decreased pollination of plant species that require pollinators for reproduction. As a result, the plants corresponding to each pollinator could face population declines or even increased threat of extinction. Climate change is also expected to provide additional challenges to pollinator populations, ranging from disruption of migratory paths of pollinators such as hummingbirds and bats, to decoupling of plant-pollinator interactions when plants and pollinators respond differently to climate cues. State Wildlife Grants are a viable source of funding to assist in providing the needed research and habitat developments to stem the decline of pollinators.

There are other great sources, found below, that contain more detailed information regarding the specific threats to pollinators and the conservation actions needed to address those issues.

-"North American Monarch Conservation Plan" 2008. Commission for Environmental Cooperation.

-Hatfield, R., S. Jepsen, E. Mader, S.H. Black, and M. Shepherd. 2012. Conserving Bumble Bees. Guidelines for Creating and Managing Habitat for American's Declining Pollinators. 32 pp. Portland, OR: The Xerces Society for Invertebrate Conservation.

Kansas Recreational Opportunities

Kansas provides many unique and exciting opportunities for recreational outdoor activities. There are 88 public lands managed for wildlife. Public waters include 54 state fishing lakes as well as 24 federal reservoirs that allow fishing opportunities. The three navigable rivers (Kansas, Arkansas, and Missouri rivers) provide a variety of recreation opportunities to the public and the Kansas River was recently designated a National Water Trail by the National Park Service. There are presently 25 state parks that provide opportunities such as hiking, biking and horseback riding, trails, canoeing and kayaking, rivers, geocaching, archery, swim beaches, and shooting ranges. The three navigable rivers (Kansas, Arkansas, and Missouri rivers) provide a variety of recreation opportunities to the public and the Kansas River was recently designated a National Water Trail by the National Park Service. There are also a number of discovery centers and Outdoor Wildlife Learning Sites (OWLS) that provide hands-on environmental awareness experiences for children of all ages. More information on the recreational trends across the state can be found in the Statewide Comprehensive Outdoor Recreation Plan (SCORP).

Land Use History

Since pre-settlement times, Kansas has changed a great deal and people are the primary agent of change now and in the past. The diversity and abundance of animals and plants have declined. The land and waters have been altered, affecting how the remaining Kansas creatures live (Collins 1985). In the east, starting around the 1850s, settlement and accompanying agricultural development swept across the state. Fifty years later, 82.2% of the state was covered with farms (Busby and Zimmerman 2001). The major crops of the state were, and still are, wheat, corn, soybeans, and grain sorghum. Land that was too steep or rocky to plow was spared from conversion and left as grassland often used for livestock production. Today, there is relatively little prairie remaining in the shortgrass prairie regions of western Kansas (Savage 2004) (Cushman and Jones 1988). The most remaining tallgrass prairie in North America occurs in the Flint Hills of eastern Kansas (Duncan 1978).

Due to the relatively small amount of rainfall, especially in western Kansas, several crops require irrigation. Water is pulled from underground aquifers or, where surface water is abundant, from rivers, streams, and sometimes lakes, detrimentally lowering water levels and negatively affecting wildlife (Madson 1985).

Fire was, and continues to be, a natural part of the life cycle of the prairie, contributing to its growth and stability. These fires, which were once started naturally by lightning strikes or purposely by Native Americans, removed old growth from pervious years and prevented or limited shrub and tree invasion of the grasslands. Because of fire's beneficial and rejuvenative effects, fires are still purposely set in prescribed areas, under specific conditions, to manipulate vegetation structure and composition (Savage 2004).


Photo © Victoria Cikanek

Success Story – Recovery Plans

Perhaps the most relevant program to the implementation of the State Wildlife Action Plan is the State's existing and continuing program to develop recovery plans for state-listed threatened and endangered species and those on the Species in Need of Conservation lists. These are distinct from federal recovery plans for federally listed species. Species on the state sensitive species lists represent the most logical group of animals in jeopardy and likely candidates for potential future federal listing status. Recovery plans which offer specifics at an operational planning level have already been developed as listed below. Other recovery plans to be finalized in the near future include draft plans for the Eastern Spotted Skunk, Redbelly Snake, Smooth Earth Snake, and the Longnose Snake. We plan to complete recovery plans for all species on the Kansas list. The following plans have been completed:

- Recovery Plan for Four Freshwater Mussels in Southeast Kansas: Neosho Mucket—*Lampsilis rafinesqueana;* Ouachita Kidneyshell—*Ptychobranchus occidentalis;* Rabbitsfoot—*Quadrula cylindrica cylindrica;* Western Fanshell—*Cyprogenia aberti*
- Kansas Recovery Plan for Freshwater Mussels in the Upper Osage River system, Kansas: Mucket, *Actinonaias ligamentina*; Elktoe, *Alasmidonta marginata*; Rock Pocketbook, *Arcidens confragosus*; Purple Wartyback, *Cyclonaias tuberculata*
- Kansas Recovery Plan for Three Big River Fish Species: Sicklefin Chub *(Macrhybopsis meeki)*, Sturgeon Chub *(Macrhybopsis gelida),* and Western Silvery Minnow *(Hybognathus argyritis)*
- Recovery Plan For Four Salamander Species of Cherokee County, Kansas: Cave Salamander, *Eurycea lucifuga* (Rafinesque); Many-ribbed Salamander, *Eurycea multiplicata griseogaster* (Moore and Hughes); Grotto Salamander, *Typhlotriton spelaeus* (Stejneger); Longtail Salamander, *Eurycea longicauda melanopleura* (Cope)
- Recovery Plan for the Arkansas Darter, *Etheostoma cragini* Gilbert, in Kansas
- Kansas Recovery Plan for the Slender Walker Snail, *Pomatiopsis lapidaria (*Say) in Kansas
- Recovery Plan for the Scott Riffle Beetle, *Optioservus phaeus,* in Kansas
- Kansas Recovery Plan for the Snowy Plover (*Charadrius alexandrinus*)
- Recovery Plan for the Topeka Shiner (*Notropis topeka*) in Kansas

These recovery plans are an example of how the planning process brings people together. Before a recovery plan is signed by the Secretary of KDWPT it is reviewed and commented on by a Scientific Task Committee and a local committee that represents agriculture, industry and conservation. Typically members of Kansas Farm Bureau, Kansas Livestock Association, Westar Energy and the Nature Conservancy are sought to serve on a local committee to provide input on recovery plans.

Kansas was once home to large herds of bison, elk and pronghorn. They were intensively hunted for their hides and meat to very low numbers (Meade 2008). Today there are no natural populations of bison left in the state. A few small herds of bison occur throughout the state, primarily in conservation areas or on private lands where they are managed as livestock. There are some free-range elk in north-east and south-west Kansas though populations are lower than they were historically. Similarly, pronghorn herds still persist but not to the magnitude that they once did. These extant populations are largely the result of reintroduction efforts which occurred after the natural populations had been extirpated from the state. With the once prevalent prey sources dwindled, larger predators such as mountain lions, grizzly bears, black bears, and grey wolves, began to diminish in numbers. Ranchers interested in protecting their livestock, helped in eliminating the large predators from the state (Choate 1987).

The native diversity of flora and fauna in Kansas is declining due to a variety of stresses, including habitat loss, habitat degradation, diseases, and competition and predation from invasive species. Past conservation actions have had noteworthy successes, but have not provided sufficient achievement in addressing the overall current decline in species. There is a need for a comprehensive, systematic and proactive approach that involves multiple agencies and an interested public, for conserving Kansas' biological diversity.

Overall, Statewide Issues

Following are the primary statewide issues regarding the conservation of native wildlife in Kansas. It is recognized that only when issues are well-identified, then strategies to address those issues will be more focused and effective in addressing those issues. From the many perspectives we listened to concerning the future of Kansas' fish and wildlife, certain themes emerged over and over. These issues are closey related to each other and can be complex in the way they interact. The goal here is to highlight the most crucial conservation and research needs while stressing the importance of on-going conservation planning at the smaller habitat specific landscape scales. The actions to address the conservation issues are listed in each EFA section.

Although the details are shown in the chapters that address specific geographic areas and habitats, the general themes are identified here for providing an overall, statewide perspective. Here are the primary issues related to the threats that affect many SGCN and/or are issues widely distributed across the state. This list is not exhaustive and is meant to illustrate the ways in which various threats interact with species and/or their habitats.

The diversity of flora and fauna in Kansas is declining due to a variety of stresses, including habitat loss, habitat degradation, habitat fragmentation, diseases, and competition and predation from invasive species. Past conservation actions have had noteworthy successes, but have not provided sufficient achievement in addressing the overall current decline in species. There is a need for a comprehensive, systematic and proactive approach that involves multiple agencies and an interested public, for conserving Kansas' biological diversity. This plan is the blueprint to implement that proactive approach by addressing these issues.

Statewide Conservation Issues

1. **Residential and commercial development – human settlements or other nonagricultural land uses with a substantial footprint**

   The most notable impact of residential and commercial development is the loss of functional native habitats due to human infrastructure developments. Residential and commercial development and accompanying roads, utility corridors, and other infrastructure cause direct loss, alteration, and fragmentation of native habitats. Fragmentation can reduce the size of intact habitat below the threshold required by a species or negatively impact species ability to move between suitable habitats if adequate travel corridors are not present. Species dynamics, such as predator/prey relationships and competition among species for resources, can also be altered by habitat changes resulting from residential and commercial development. An example is the proliferation of exotic or introduced non-natives that out-compete native plant species and change the food and cover resources available for wildlife. Hydrology is often negatively affected by impermeable surfaces. For instance, pavement prevents infiltration of storm water, decreasing the groundwater amount available for plants' root zones. The lack of infiltration increases the quantity of runoff into surface creeks and streams, which can carry fertilizers and pesticides. The local hydrology is also impacted by actions that seek to provide increased water availability for larger human populations, such as damming and diversion of natural waterways. Stream degradation and downstream scour has caused many road crossing structures, particularly culverts, to become perched over time. These structures then act as barriers that fragment stream habitat and prevent aquatic organism passage.

2. **Agriculture-threats from farming and ranching as a result of agricultural expansion and intensification**

   Cropland

   Conversion of prairie, wetlands, and woodland to cropland replaces native habitat with grain crops or non-native forage crops. Activities such as plowing, tilling, mowing, and the use of pesticides can have direct or indirect impacts on native species or their habitats. Agricultural fields can still provide food and cover for some wildlife species, however, the activities associated with agricultural production can be fatal to some species inhabiting the fields**.** Many wetlands have been drained or are being farmed through, greatly reducing their functions and habitat value. Farming near stream channels can reduce riparian habitats, resulting in erosion, sedimentation, and can increase total suspended solids in flowing waters. Drainage systems accelerate flow and reduce the natural filtration process that recharges groundwater and reduce peak flood flows. Another important concern is the groundwater depletion and loss of base flows in western Kansas streams due to irrigation to sustain crop agriculture. Some of the same concerns for residential and commercial development relative to water quality and quantity also apply to cropland.

   Livestock Farming & Ranching

   Native grasslands have historically been maintained by grazing and browsing animals leaving a heterogeneous landscape. Some ranching practices can create homogeneous structure and reduce native forb species making less suitable conditions for many grassland wildlife species. Overgrazing can also degrade riparian habitats, reducing natural filtration capacity of the soil

and increasing nutrient loads and increasing peak flood flows into streams. Runoff from concentrated livestock feeding operations often contains bacteria, nutrients and other contaminants known to impair water uses (including use by aquatic life) by causing excessive algae growth, spikes in unionized ammonia and lower dissolved oxygen. Another way livestock ranching may reduce habitat suitability for wildlife is the conversion of native rangeland by seeding non-native pasture grasses, thereby altering the structure and composition of native prairie habitats.

3. Energy Production – threats from production of non-biological resources (oil and gas drilling and renewable energy)

Oil and Gas Drilling

Oil and gas development involves a complex series of exploration and production activities, and includes associated infrastructure such as pipelines, well pads, and roads. Some terrestrial wildlife are impacted by habitat conversion, alteration, and fragmentation that can result in reduced reproductive success or behavioral avoidance of those impacted areas. Similarly, aquatic wildlife can be affected as well by infrastructure construction and water use. A significant amount of water is used in oil/gas drilling, followed by disposal of contaminated water post-drilling.

Renewable Energy

Wind energy production continues to grow throughout the state. Renewable sources of energy are important for a variety of reasons, but they also come with the potential for adverse impacts to wildlife. For instance, the development of wind farms increases habitat fragmentation with associated roads and transmission lines. Migratory bird collisions and bat mortality are also concerns with wind farms that need further research. Habitat loss caused by conversion to energy development use or causing wildlife to vacate an area because of adversion to structures has been documented after wind farm development. Newer types of industrial-scale energy production moving into the state likely present many of the same issues. Biofuel production can exacerbate the issues caused by crop production by increasing land use intensification and conversion. Solar energy development, which is poised to be the next renewable energy boom in the state, poses many of the same concerns inherent in wind energy development.

4. Natural system modifications-threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare

Fire and Fire Suppression

The Kansas landscape has evolved with periodic wildfires. Fire can maintain a heterogeneous landscape, and therefore a variety of habitat types, by controlling the density of trees and shrubs, removing thatch and dead plant litter from the ground surface, opening up space for the regeneration of forbs, and much more. The suppression of natural fire regimes causes trees to become denser and understory fuels to accumulate. On the other hand, annual fires on vast tracts of prairie can limit ground cover needed for ground nesting birds. Some alternative approaches such as rotational grazing or patch-burn grazing are economically feasible and provide a more heterogeneous habitat that benefits many wildlife populations.

Dams and Water Management/Use

The impacts of dams, and the use and management of water on wildlife and their habitats are complex. Dams not only replace habitat, but their operation affects the timing, volume, and temperature of flows. These changes may also indirectly affect closely related habitat characteristics (oxygen levels, sediments, type of riparian vegetation, etc.). Crucial habitat for many wildlife species such as riparian and wetland plants, require specific conditions for growth and reproduction. The amount of surface water and groundwater relates to the survival of these species. Likewise the amount of water, the water temperature, chemical composition and amount of sedimentation affect survivability of fish. Dams and impoundments also fragment stream habitat by preventing or reducing aquatic organism movement. The ways in which water is managed and used can either support or degrade the specific habitats for aquatic and riparian species. Long-term the water releases from dams can increase the rate of streambank erosion by keeping high flows within the banks of a stream for long periods. Dam operation can reduce out-of-bank flows onto the floodplain to protect agricultural crops although by doing so, it also short-circuits groundwater recharge, sediment deposition that enriches floodplain soils, the ability of floodplains to reduce peak flow events, and the capacity of floodplain soils to filter and reduce nutrient loading.

Many Kansas streams have been channelized in attempts to rapidly move storm water or to increase farmable acreage. Channelization reduces stream length and stream habitat available for aquatic organisms. The lack of sinuosity in channelized systems also reduces the ability of a stream to effectively dissipate energy, resulting in higher velocities and increased erosion. Excessive erosion can cause streams to become incised, which reduces floodplain connectivity and the quality and quantity of riparian habitat. Subsequent attempts to stabilize eroding banks with riprap or concrete further exacerbate stream incision and riparian habitat loss. Channelization and resulting high stream velocities combined with reduced floodplain connectivity often lead to more dangerous and destructive flood events. Furthermore, commercial sand and gravel dredging operations can lead to stream bed degradation, channel incision, and bank instability.

5. **Invasive and other problematic species and genes-threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance**

Invasive & Non-Native Species

Non-native species are plants or animals that have been introduced into ecosystems due to human activity. Often these non-native species are termed as “invasive”, because they are able to out-compete native species for needed resources, or prey on native species. A few native species can also be considered invasive. Invasives spread and can overtake and dominate native ecosystems because of a lack of biological or environmental controls. This can change native

species distribution and abundance. Also, the use of pesticides to control invasive, non-native species can impact native wildlife.

Pathogens

There are some pathogens impacting Kansas wildlife species that will require monitoring and research. Avian cholera is a contagious bacterial infection that commonly affects geese, coots, gulls and crows. White-nose syndrome is a fungal disease impacting bats throughout the nation and will probably be confirmed in Kansas in the near furture. The Chytrid fungus is a pathogen impacting some amphibian species. Chronic Wasting Disease is a neurological disease of deer and elk. Though the about examples may be the most notable to readers, they certainly do not constitute an exhaustive list of potentially devastating wildlife pathogens.

6. Pollution – threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources

Pollution sources vary from housing and urban areas to industrial and agricultural activities. Harmful pollutants such as inadequately treated discharge from municipal waste treatment plants, and contaminants such as fertilizers and pesticides via runoff often end up in water sources where they change water chemistry and thereby impact aquatic vegetation, invertebrate communities, amphibians, and fish.

7. Climate Change

The distribution and abundance of species is strongly influenced by climate. Temperature extremes, along with the variation and frequency of precipitation, regulates factors such as growing season lengths and the water cycle, determining where species occur and how well they thrive. Climate changes are likely to influence species and ecosystems by altering fundamental interactions with other species and the physical environment, potentially creating a cascade of impacts throughout ecosystems (Staudinger, et al. 2012). Climate models predict changes in annual precipitation that vary geographically and temporally. The eastern half of the state could see increases in precipitation of up to 11 inches (28 cm) per year in the 2090-2099 timeframe. The west will likely see a drying climate in the short and long term, but there is a high level of disagreement between models. The contrast between expected east and west precipitation changes due to climate change could have substantial implications for future water use and allocation patterns in the state of Kansas.

There is much uncertainty when it comes to climate change and how it will impact the state. Given the information available and the research being done, we can only estimate potential impacts climate change may have on habitats and species.

Species are already being significantly impacted by climate change. Effects such as shifts in species distributions, changes in phenology of species, and de-coupling of co-evolved interactions have been documented. At a regional scale, there is uncertainty in the variations of climate change impacts, but there are predicted impacts that wildlife and their habitats are expected to experience. Changes in temperature and precipitation will lead to changes in the water cycle impacting both aquatic and terrestrial species. An increase of extreme events such as floods, droughts, heat waves, and severe storms are expected, which can alter species

habitats by increasing wildfires, pests, diseases, and invasive species. Increasing temperatures may cause range shifts or contractions of flora and fauna. Species that have limited mobility or are unable to migrate may become extirpated or even extinct. Increasing temperatures may also change seasons and their associated physiological processes, shifting phenology of species. The temporal alignment of food availability and reproduction may be shifted. Many aquatic species will suffer due to reduced precipitation and increased temperatures in streams, rivers, and lakes. Altered flooding regimes will affect spawning and rearing habitat.

Individual species and habitats will have very different responses to climate change. Many species and habitats will be negatively affected by climate change and will require a special set of actions to ensure their survival. Some species may benefit from a changing climate and could expand their range or increase in abundance; requiring a separate set of actions. In addition, the movement of species will create new communities of species for which there will be no previous examples and will require new management regimes. Wildlife management plans will need to reflect these changes and will likely need to be updated on a more frequent basis. Climate change is a large and growing threat to wildlife and natural systems, but it will also exacerbate many existing threats. Efforts to address climate change should not diminish the immediate need to combat threats that are independent of climate change, such as habitat loss, invasive species spread, pollution, and wildlife diseases. Our goal should be to sustain ecosystems and viable wildlife populations regardless of the threat.

As part of the SWAP revision a climate change vulnerability assessment was conducted on a number of SGCN. The methods and results of that work are summarized in Appendix 6.

There are also conservation issues considered by this plan that are not direct threats to biodiversity. These issues occur statewide and impede effective conservation planning and implementation.

8. **Lack of Knowledge and Data**

For effective wildlife management and conservation efforts there is a requirement for sufficient understanding of species life history and habitat requirements, distributions, relationships among and between species, effects of management and conservation efforts. Incomplete knowledge inhibits our ability to identify and interpret potential threats and decide on appropriate actions.

9. **Organizational Capacity and Management**

Differing goals, bureaucratic obstacles, personnel turnover and lack of resources can all impact the efficiency and effectiveness of conservation actions. Agencies, researchers, non-governmental and governmental organizations must collaborate, share information and resources, and support each other's efforts to effectively manage and conserve wildlife and their habitats. The implementation of this plan is a forward step toward this collaboration.

Statewide Conservation Partners

- Audubon of Kansas
- American Fisheries Society
- Baker University
- Bureau of Reclamation
- Central Plains Society of Mammologist
- County Conservation Districts
- County Extension Service
- Ducks Unlimited
- Emporia State University
- Fort Hays State University
- Great Plains Fish Habitat Partnership
- Kansas Applied Remote Sensing Program
- Kansas Alliance for Wetlands and Streams
- Kansas Association of Conservation Districts
- Kansas Association for Conservation and Environmental Education
- Kansas Biological Survey
- Kansas Cooperative Fish and Wildlife Research Unit
- Kansas Dept. of Ag, Div. of Conservation
- Kansas Dept. of Ag, Div. of Water Resources
- Kansas Dept. of Education
- Kansas Dept. of Health and Environment
- Kansas Dept. of Transportation
- Kansas Farm Bureau
- Kansas Forest Service
- Kansas Grazers Association
- Kansas Grazing Lands Coalition
- Kansas Geological Survey
- Kansas Native Plant Society
- Kansas Ornithological Society
- Kansas Herpetological Society
- Kansas State University
- Kansas State University Research and Extension
- Kansas National Education Association
- Kansas Section of Society of Range Management
- Kansas Livestock Association
- Kansas Prescribed Burn Association
- Kansas Prescribed Fire Council
- Kansas Rural Center
- Kansas Water Authority (Regional Advisory Committees)
- Kansas Wildlife Federation
- McPherson College
- National Center for Disease Control
- National Park Service

- National Wild Turkey Federation
- No-till On the Plains
- Pheasants Forever/Quail Forever
- Pittsburg State University
- Private Landowners
- State Authorized Land Trusts
- Sternberg Museum of Natural History
- Tabor College
- The League of Municipalities
- The Nature Conservancy
- The Wildlife Society
- The University of Kansas
- US Army Corps of Engineers
- US Dept. of Interior
- USDA Farm Services Agency
- USDA Natural Resources Conservation Service
- US Environmental Protection Agency
- US Fish and Wildlife Service, Ecological Services Field Office
- US Fish and Wildlife Service, Partners for Fish and Wildlife Program
- US Fish and Wildlife Service, Refuge System
- US Geological Service
- US Military Installations
- Westar Energy Green Team
- Watershed Restoration and Protection Strategy (local groups)

Success Story – Kansas 2011 Public Opinion Threatened Endangered Species Report

A scientifically rigorous survey regarding Kansans' attitudes toward rare wildlife species was conducted by Responsive Management, Inc. for Kansas Department of Wildlife, Parks and Tourism (KDWPT) to determine residents' knowledge of and opinions on threatened and endangered wildlife. Respondents were asked about their support for or opposition to various actions to protect threatened and endangered wildlife. The study used a telephone survey of Kansas residents ≥ 18 years of age and has a statistical error of ± 4%. The success story here may be that the Kansas Nongame and Endangered Species Conservation Act of 1975 continues to have widespread support of Kansas residents even though development interests have questioned its regulatory oversight when taxpayer funded or permitted projects are reviewed for critical habitat losses.

KNOWLEDGE OF THREATENED AND ENDANGERED WILDLIFE AND RELATED ISSUES

- 32% of Kansas residents say they know at least a moderate amount about threatened and endangered wildlife in KS. 67% say they know a little or nothing at all
- 55% of Kansas residents indicated that they were aware that there are, in addition to federal laws, state laws to protect types of wildlife that are threatened and endangered
- 68% were aware that there are state laws protecting the *habitats* of threatened and endangered wildlife

PERCEIVED THREATS TO WILDLIFE

- Regarding economic activities, 60% strongly or moderately agree that oil field development threatens some wildlife populations, 53% strongly or moderately agree converting land into agricultural crop production threatens wildlife

SUPPORT OF OR OPPOSITION TO VARIOUS DEPARTMENT ACTIONS TO ADDRESS THREATENED AND ENDANGERED WILDLIFE

- 74% of Kansas residents support having an official state list of threatened and endangered wildlife
- 72% strongly support the state imposing stiff fines on those who harm endangered wildlife or their habitats
- 91% agree that the Department should continue to identify and protect habitat critical to the existence of threatened and endangered wildlife
- Support for protecting peripheral species was indicated as 73% of the respondents agreed with the statement: "Wildlife that is threatened or endangered in Kansas yet abundant in other states should be protected in Kansas"

LAND OWNERSHIP, USES OF LAND, AND OPINIONS ON WILDLIFE ON THAT LAND

- 40% of surveyed residents who own land said that they have no particular feeling about threatened and endangered wildlife on their land
- 67% said they would be willing to follow a conservation plan to maintain habitat for threatened and endangered wildlife on their land, if they received monetary compensation
- 66% of landowners would support the reintroduction of a threatened and endangered wildlife species to its historical range if that range was near or adjacent to the landowner's property

Responsive Management, Inc. 2011. Kansas residents' opinions on threatened and endangered wildlife and actions to protect wildlife. Final Report to Kansas Dept. Wildl., Parks & Tourism. 495pp. www.responsivemanagement.com