

CLIMATE CHANGE and POTENTIAL IMPACTS TO WILDLIFE IN TENNESSEE

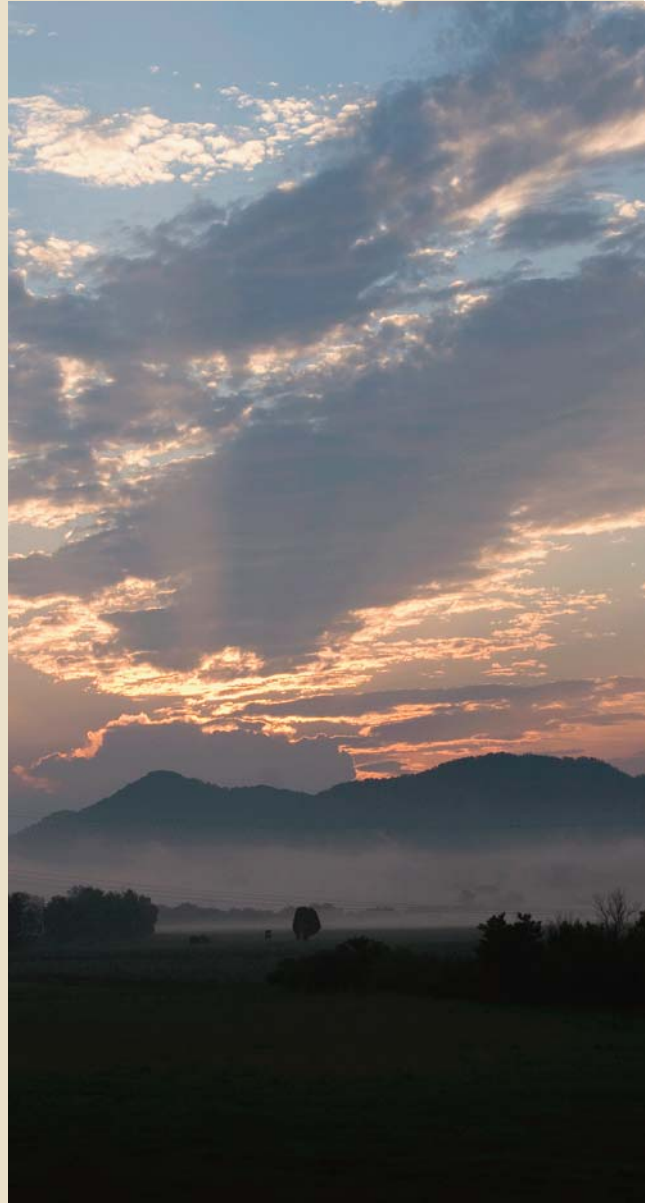
Tennessee is blessed with an abundance of wildlife and natural resources. From the peaks of the Great Smoky Mountains to the fertile farms of the Nashville Basin to the rich bottomlands along the Mississippi River, we are a state defined by our natural environment. Our forests, mountains, streams and caves provide habitat for an array of waterfowl, bats, salamanders, songbirds and fish, many of which are unique to Tennessee. These resources provide the state with a range of economic benefits, both directly (timber production, outdoor recreation) and indirectly (water purification, wildlife habitat).

Unfortunately, Tennessee's wildlife and natural resources face a serious threat from climate change. Warmer temperatures and changes in precipitation could disrupt the state's delicate forest and aquatic ecosystems. Furthermore, the cumulative impacts of climate change in concert with other sources of stress—pollution, sprawl, and invasive species—could produce significant impacts to Tennessee's incredible diversity of habitats and wildlife.

To better understand the threat, the Tennessee Wildlife Resources Agency has completed a comprehensive assessment of the potential impacts to wildlife and their habitats from a changing climate, which is projected to warm for the remainder of this century. Key findings from the study include:

- Tennessee's forests are expected to undergo changes in forest growth and composition, with some tree types expanding at the expense of others. Some high elevation forest types will be dramatically impacted or lost entirely.
- Brook trout populations are expected to decline as surface water temperatures increase.
- Migratory songbirds may alter their ranges, with some species disappearing from Tennessee altogether
- Larger floods and longer droughts could cause increased erosion, reduced water supply and the spread of invasive species.

If Tennessee hopes to preserve its rich biodiversity, we must take action today to help safeguard wildlife from the future threats of climate change. By developing strategies to address local climate change-related vulnerabilities, we can prevent the worst damage to our natural systems and the habitats that both people and wildlife depend upon.



FROM BIRDS TO BASS: POTENTIAL IMPACTS ON TENNESSE'S WILDLIFE

Warmer temperatures, longer droughts, increased flooding and shifts on forest composition caused by climate change will significantly impact Tennessee's wildlife and the habitats upon which they depend.

Aquatic Resources and Fisheries

1. Tennessee's aquatic diversity - 320 species of fishes, 77 species of crayfishes, and 129 species of freshwater mussels - makes Tennessee one of the last strongholds of aquatic diversity. Effects on fish and mussel populations are expected to be greatest in mountainous parts of the Cumberland Plateau and east Tennessee where large numbers of rare endemic species exist.

2. The coldest headwaters and spring influenced habitats are at risk of being lost. Twenty-two greatest conservation need species are dependent on spring or headwater streams. Brook trout are likely to lose the most habitat. Brown and rainbow trout might be able to shift upstream in a warmer headwater habitat.

3. Both the Striped Bass and the walleye can be expected to lose habitat in a warming climate.

4. In large tributary reservoirs, an increase in temperature will negatively affect cool to coldwater fish habitat and possibly benefit some warmwater species. Losers could be trout, smallmouth bass and walleye. Winners could be largemouth bass, crappie, catfish and bluegill.

Birds

1. Birds found in wetlands and mature forests may suffer habitat declines in Tennessee due to habitat loss attributed to climate change.

2. Birds who live in grasslands, scrub-shrub, and pine or oak savannas, may benefit with increased habitat availability.

3. Duck populations wintering in Tennessee are expected to decline, with lower reproductive success on their breeding grounds in the northern prairies of Canada and the U.S. Warmer winter weather to the north will retain open water conditions, thus many birds will stay further north, which would adversely impact waterfowl hunting in Tennessee.

Mammals

1. Northern Flying Squirrels, Rock Voles and Red squirrels, which are found in high elevation, cool, humid habitats are at risk.

Caves and Bats

1. Karst aquifers are important to both to the surface and subsurface ecology of a region and to domestic water supplies. If drought cycles increase in regularity and intensity these ground water resources could disappear.

2. Indiana bats prefer cold air caves and will only hibernate in caves that have stable winter temperatures ranging from 37 - 43 degrees F. Caves that are currently at the upper end of this range could become unsuitable for Indiana bats.

“With warming temperatures, the Tennessee River Basin is expected to undergo greater water stress during the remainder of the 21st century than other regional basins.”



Reptiles and Amphibians

1. Increased winter temperatures could increase the threat of exotic species to native amphibian and reptile populations by increasing the survival rate of these invaders.
2. Range expansions or contractions of several frog species may occur as temperatures become warmer. Affected species could include the Bird-voiced Treefrog, Green Treefrog and the Wood Frog.
3. Rare endemic salamander species found only in high elevation, cool, humid habitats are at risk. Affected species could include the Junaluska Salamander and the Pygmy Salamander.



TENNESSEE'S UNPARALLELED BIODIVERSITY

- Tennessee has 77 amphibians including 21 species of frogs and 56 species of salamanders, making it the third most diverse state in amphibians.
- Dubbed the “Hardwood Capital of the World,” Tennessee is the number one producer of hardwood flooring and is ranked second in the United States in hardwood lumber production.
- The Smoky Mountains have long been recognized as a global center of biodiversity. There are more tree species in the Smokies (130) than in all of Northern Europe.
- Tennessee is one of the nations most karst rich states. It is estimated that Tennessee has more than 9,000 caves.
- In 2002, Tennessee was ranked second nationally for number of fish species.

SAFEGUARDING WILDLIFE FROM CLIMATE CHANGE

Combating climate change requires a two-pronged approach. First, we must address the cause of climate change by reducing greenhouse gas emissions at the state, federal and global level. Second, we must address the inevitable impacts of climate change on wildlife and natural resources.

To achieve the latter, the Tennessee Wildlife Resources Agency, National Wildlife Federation, and The Nature Conservancy have identified the following as the most important and immediate strategies:

Protecting Key Ecosystem Features

Maintain or establish riparian buffers along streams to lessen impacts of temperature increases; Protect headwater streams of priority aquatic systems (e.g., Duck River, etc.); Maintain or establish corridors to facilitate migration routes for species and/or populations, and to facilitate gene flow.

Reduce Human-Associated Stresses

There are many human-associated stresses that will reduce the ability of species or ecosystems to withstand a stressful climatic event. A key issue in Tennessee and the southeastern region of the United States will be continued population growth, and the impacts of urbanization on the waters and landscapes of the region. Projections indicate that an additional 2 million people will make Tennessee their home by 2025, bringing our state's population to 8 million. Strategies to mitigate these stresses should be adopted as part of a climate change adaptation program.

Representation

Ensuring that biological systems come in a variety of forms will provide some level of resilience. We should maintain a mixture of habitat types, protect priority conservation areas identified in Tennessee's State Wildlife Action Plan, and maintain numerous viable populations for priority species as identified in the action plan.

CLIMATE CHANGE and TENNESSEE'S ECONOMY: WHAT'S AT RISK?

- Outdoor recreation contributes more than \$6.3 billion annually to Tennessee's economy and supports 67,000 jobs across the state.
- Tennessee is home to around 787,000 acres of wetlands. A 20 percent loss of wetland acreage would cost the state from \$55 million to nearly \$4 billion.
- In 2000, the forest product industry accounted for 6.6 percent of Tennessee's GDP, generated \$21.7 billion in economic output, and employed 180,000 people in the forest product industry.

Vulnerability Assessments

Research should be conducted to determine and identify those species and ecosystems that are most vulnerable to climate change.

Replication

Maintain numerous viable populations for priority species as identified in the action plan. Protect strategically important lands and waters through fee acquisition or conservation easement (Priority conservation areas identified in Tennessee's State Wildlife Action Plan).

Refugia

Refugia refers to areas or environments that are less affected by climate change than other areas. In many ways, strategies for creating refugia are included in the strategies above, such as representation or restoration. Acquisition and/or protection of subterranean systems may be good candidates for this strategy.

Monitoring and Adaptive Management

Long term monitoring systems that are strategically designed to evaluate climate change impacts and wildlife responses are a high priority for TWRA.

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