

Impacts to rare or unique wildlife species from the loss of fire-dependent and boreal forests in the Lake States.

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Forest and wildlife managers must increasingly operate to sustain ecosystem services, such as suitable wildlife habitat, where landscape modification is happening at an accelerated rate due to shifting environmental conditions and land uses that alter natural disturbance regimes. In the Lake States, decades of fire suppression resulted in the decline and deterioration of fire-dependent ecosystems such as jack pine forests. The lack of early-successional jack pine forests was directly related to the decline and eventual federal listing of the Kirtland's Warbler. Kirtland's Warblers require young dense forests interspersed with openings typically created after fire. Managers reversed the population trend by using planting prescriptions that mimicked the spatial regeneration patterns after fire. However, continued provisions of essential nesting habitat across a large landscape are not without obstacles, such as managing a skewed age distribution because of creating large areas of young forests rapidly, balancing the habitat needs of other species of concern, and meeting the goals of several land management agencies with competing priorities such as timber production. In addition to competing management goals, rapidly changing environmental conditions are contributing to the loss of sensitive forest types in the Upper Midwest, such as boreal forests in northern Minnesota. The loss of thermal cover that boreal tree species provide moose in warming summers will have negative impacts on the long-term persistence of moose in the region. Forest managers are looking for actionable strategies to improve moose habitat in the near-term while also planning for future conditions in a warming climate. A recent project is investigating how adaptive silvicultural management strategies applied across ownerships may mitigate the impacts of climate change on moose including spatial design to reduce an expected increase in frequency of contact with an expanding white-tailed deer population that transmit fatal parasites. A landscape disturbance model (LANDIS) is being used to couple management strategies with climate change to project future forest conditions. These future landscapes will be coupled with moose and deer habitat suitability models. Managers can use this information to strategically identify areas across multiple land ownerships most suitable for improving regional moose foraging and cover habitat under current and future forest conditions.

Management Implications:

Understanding the cumulative effects of shifting land uses, unprecedented environmental conditions, altered fire regimes, and large-scale natural disturbances such as insect outbreaks requires a landscape perspective that integrates time, space and scale. Ecological problems often persist over decades and large ecosystems, but important variables that drive spatial patterns and processes are often measured in small areas or over short periods of time. The most pressing land management issues of our day (e.g., timber harvesting, environmental quality, forest fragmentation, loss of biological diversity and rare species) have a spatial component and cannot be resolved by considering them at a single scale. By considering large landscapes across multiple ownerships with different goals toward common desired outcomes of forest management, such as the examples presented, the resiliency of our forests and grasslands can be sustained in a changing world to provide necessary long-term wildlife habitat.

Climate Change and Biodiversity: Lessons from the Great Yellowstone Ecosystem

Scott Christensen

Greater Yellowstone Coalition Executive Director

The Greater Yellowstone Ecosystem is a place of remarkable ecological diversity and profound cultural importance. At more than 20 million acres, the region is defined by its two national parks, Yellowstone and Grand Teton, and the sprawling network of public and private lands that surround them. Diverse habitats support an array of fish and wildlife, from grizzly bears and bison to cutthroat trout and wolverines. It is the headwaters of the West's great rivers, supplying water for more than 60 million people downstream. It is also ancestral homeland and sacred ground to more than 30 Indigenous tribes. A warming climate is driving complex changes, with forests and watersheds experiencing historic dry conditions and cascading impacts to Greater Yellowstone's renowned fish and wildlife populations. A recently completed climate assessment projects continued declines in snowpack and streamflow, further challenging human and natural communities. Conservation and management strategies must account for climate driven changes. As a regional, non-profit conservation organization, the Greater Yellowstone Coalition is striving to integrate a set of climate change resilience and adaptation principles that guide its land, water, and wildlife advocacy and on-the-ground projects.

Management Implications

The intertwined challenges of climate change and loss of biodiversity call for conservation and management approaches that recognize existing stressors and anticipate the impact of new climates on habitats and species. Guiding principles for the Greater Yellowstone Ecosystem and other similar regions could include:

- Reduce existing stressors on at-risk habitats and species
- Protect water quality and quantity
- Protect and enable natural movement and migration
- Improve capacity to predict
- Manage collaboratively across larger areas
- Design and implement climate-informed treatments, interventions, and conservation actions

A Changed Paradigm: Species Conservation In A New Era

Michael Brown

Sage Grouse Initiative and Pheasants Forever Field Capacity Coordinator

For years habitat conservation and recovery efforts have been focused on a species. Spotted owls, salmon, wolves. Have these efforts been limited in their impact by focusing on a species rather than the landscape or biome they call home? The Natural Resources Conservation Service's (NRCS) Working Lands For Wildlife (WLFW) Sage Grouse Initiative has changed how the conservation community approaches landscape partnerships and implementation and is now embarking on a new way of delivering meaningful conservation. Built around a shared vision and at a biome scale the new Sagebrush and Grassland frameworks pave the way for a new era in community led partnerships and conservation.

Homegrown National Park

Doug Tallamy

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Our parks, preserves, and remaining wildlands – no matter how grand in scale – are too small and separated from one another to sustain the native trees, plants, insects and animals on which our ecosystems depend. We can fix this problem by practicing conservation outside of wildlands, where we live, work, shop, and farm. Thus, the concept for Homegrown National park: a national challenge to create diverse ecosystems in our yards, communities, and surrounding lands by reducing lawn, planting native, and removing invasives. The goal of HNP is to create a national movement to restore 20 million acres with natives, an area representing $\frac{1}{2}$ of what is now in lawn. We are at a critical point where we are losing so many native plant and animal species that our natural life support is in jeopardy. However, if many people make small changes, we can restore healthy ecological networks and weather the changes ahead.