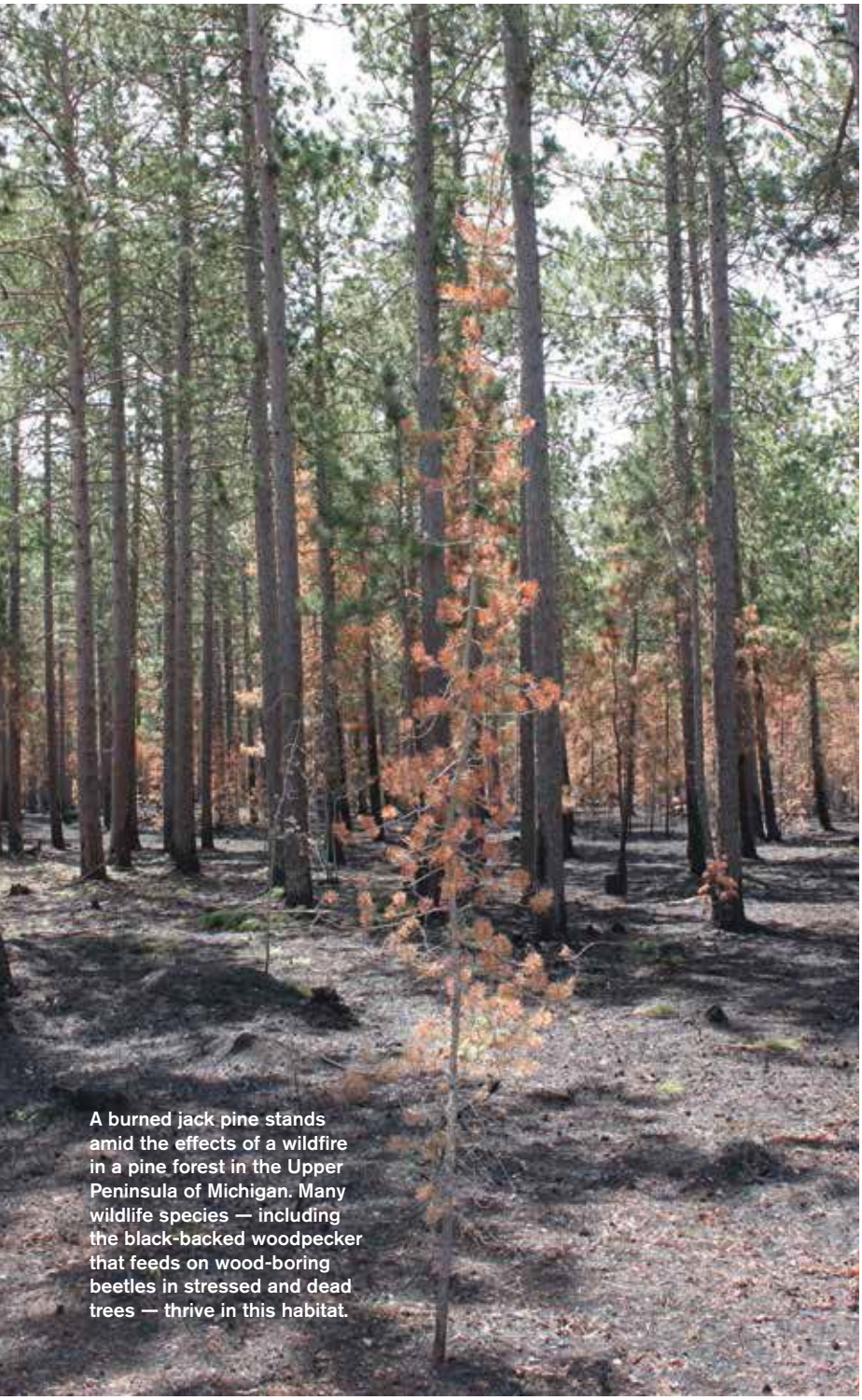
Fire-Dependent Ecosystems and Wildlife

WORKING TOWARD A BETTER UNDERSTANDING IN THE NORTHERN LAKE STATES



A burned jack pine stands amid the effects of a wildfire in a pine forest in the Upper Peninsula of Michigan. Many wildlife species — including the black-backed woodpecker that feeds on wood-boring beetles in stressed and dead trees — thrive in this habitat.

Credit: Greg Corace

By Greg Corace, Shelby Weiss and Lindsey Shartell

The 2015 wildfire season brought more bad news for drought-stricken western states as hundreds of dwellings burned to the ground and several firefighters and private citizens lost their lives. But fire also plays an essential role in shaping the habitats of several well-known wildlife species. In the case of the endangered red-cockaded woodpecker (*Leuconotopicus borealis*), wildlife managers in the southeastern United States employ prescribed fires in biologically diverse longleaf pine (*Pinus palustris*) forests as an integral component of the bird's recovery plan (USFWS 2003). Similarly, in western states, fire creates a mix of live and dead trees used by the iconic black-backed woodpecker (*Picoides arcticus*) (Bond et al. 2012). In fact, wildlife managers across much of the West and South often include prescribed fire as either a habitat management tool or actively evaluate the effects of fire on wildlife habitat to determine important ecological relationships.

However, not much is known about the fire-dependent ecosystems in the northern Lake States, where numerous forests and wetlands occur over millions of acres of state and federal lands. While many of these ecosystems and their dominant plants and wildlife had once been more common, they have since been displaced by other ecosystem types and species following fire suppression and other land-use changes. In upland pine (*Pinus* spp.) forests, for instance, maple (*Acer* spp.) and other fire-sensitive tree species have displaced fire-dependent species such as red pine (*Pinus resinosa*) as dominant members of the overstory (Schulte et al. 2007).

To facilitate better stewardship of the land and its wildlife, as well as to fill information gaps, our group from the Lake States Fire Science Consortium (LSFSC) — one of 15 consortia established to address regional fire issues by the Joint Fire Science Program (JFSP) — has initiated an evaluation of fire-dependent ecosystems and wildlife in the northern Lake States. The LSFSC covers parts

of Minnesota, Wisconsin, Michigan, New York, Manitoba and Ontario. Our initial findings suggest that our understanding of fire's effects on wildlife and wildlife habitat is limited and that a greater appreciation of its importance within our coverage area is needed.

Credit: JFSP

To promote the integration of fire science with land management, a number of government agencies formed the Joint Fire Science Program in 1998. From its main office in Boise, Idaho, JFSP funds scientific research and distributes results to federal, state and other policymakers and land managers. It consists of 15 knowledge exchanges or consortia across the country.

Shaped by Fire

Over thousands of years, many plant species in the northern Lake States adapted different reproductive strategies relative to fire (Pausas and Keeley 2009). For instance, jack pine (*P. banksiana*) and black spruce (*Picea mariana*) are two tree species that have serotinous cones that open in the extreme temperatures of fire and then release their seeds. In addition, fire prepares the seedbed for regeneration of these and other tree species by reducing the litter layer and allowing seeds to find the mineral soil necessary for germination.

Fire also shapes structure within the lifespan of a given forest stand. Severe crown fires historically occurred over a relatively long fire return interval (more than 200 years) in red pine and eastern white pine (*P. strobus*), while less severe surface fires occurred at more frequent intervals in these forests. The severe fires established the forests, while the subsequent, less extreme ones influenced the composition and structure over the decades and centuries that followed.

Ultimately, fire created many different types of fire-dependent wetland and upland ecosystems across the northern Lake States (Frelich 2002). Although these ecosystems developed from different types of fire, current land management strategies across the region limit the use of fire as an ecological disturbance. Instead, many of these forests are regenerated today by artificial methods including direct seeding and hand or machine planting. Mechanical operations such as logging, shearing or mowing also change the structure of these northern forests.

The Fundamental Question

Efforts to create suitable young jack pine breeding habitat for the endangered Kirtland's warbler (*Setophaga kirtlandii*) by artificial means such as hand or machine planting of seedlings and sowing seed from the ground or the air provide a good example of how fire's role in shaping ecosystems in the northern Lake States has changed. The warbler nests in just a few counties in Michigan's northern Lower and Upper Peninsulas as well as Wisconsin and Ontario, where it relies upon mixed vegetation of grasses and shrubs below the living branches of 5- to 20-year-old jack pine forests. Its recent population increase, however, has occurred largely without the regenerative effects of fire that historically shaped these forests. While the artificial habitat creation strategy has helped the Kirtland's warbler recover, it's still not known how this approach has altered the habitat in this ecosystem for other fire-dependent wildlife species.

The fundamental question here is whether wildlife professionals within the LSFSC coverage area understand the importance of fire for wildlife. For example, what impact have changes in land use had on local species such as the red crossbill (*Loxia curvirostra*), olive-sided flycatcher (*Contopus cooperi*), and northern flying squirrel (*Glaucomys sabrinus*) that breed in mature stands of coniferous forest types regenerated by fire but whose structure takes 100 or more years to develop post-fire? By the same token, should these

species be considered fire-dependent because they require late successional, coniferous forests that were established over time by fire?

Assessing Perceptions

To get a sense of how fire is regarded in the LSFSC, we looked at the State Wildlife Action Plans (SWAPs) of Michigan, Minnesota and Wisconsin and focused on fire-dependent ecosystems and wildlife species identified as being of greatest conservation need in each plan. While it is almost impossible to compare SWAPs across multiple states, investigating how fire was discussed within each SWAP is useful, particularly across landscape types. All three SWAPs contained positive discussions about fire, identifying it as an important process for many ecosystem types and including it as a potential conservation action for many wildlife species. However, fire's role in the forested, fire-dependent ecosystems of the LSFSC was emphasized much less compared to its role in other non-forested ecosystem types outside the LSFSC management area in the more southern parts of Michigan, Minnesota and Wisconsin.

For example, Michigan's SWAP details landscape features within four ecoregions of the state and gives conservation recommendations for each. Within the discussion of these landscape features, the words fire or burn are mentioned with different frequencies across ecosystem types and ecoregions, which we interpreted as a rough index of the importance attributed to fire within that ecosystem type. Overall, fire was discussed most often in association with non-forested prairie, savannah or agricultural ecosystems that are not included in the LSFSC area, even though our consortium covers nearly 70 percent of the state.

We also compared the SWAPs for Minnesota and Wisconsin to evaluate how they treat different ecosystem types included in two consortia that encompass most of these states: the LSFSC and the Tallgrass Prairie and Oak Savanna Fire Science Consortium (TPOS), which is dominated in its southern portion by agriculture and prairie. Both SWAPs mention fire in the context of using prescribed burns as a potential management tool; however, the plans discuss fire more frequently for landscapes within the TPOS coverage area. In Minnesota, fire is mentioned only twice over 13 ecoregions associated with the LSFSC, while it is mentioned 23 times for TPOS' 12 ecoregions.

We believe this geographic difference reflects greater familiarity with prescribed burns in the prairie region where the effects of a frequent fire return interval are immediate in ecosystems dominated by herbaceous vegetation. The findings also may indicate a lack of appreciation for the effects of succession within forest-dominated ecosystems in the northern reaches of these states or reflect the intricate balance that exists among fire, timber production, forest ecosystems and wildlife needs. Our personal exchanges with professionals in these areas as well as one-on-one interviews also seem to support these notions.

Credit: Seney NWR

An aerial photo shows the effects of prescribed fire in wetlands at Seney National Wildlife Refuge in the Upper Peninsula of Michigan. Fires like this are integrated with other management strategies for ecological integrity and to benefit numerous fire-dependent marsh birds such as American bittern (*Botaurus lentiginosus*) and yellow rail (*Coturnicops noveboracensis*).

A Knowledge Exchange

Evidence-based wildlife management hinges on using peer-reviewed science in planning and decision making. To this end, LSFSC investigators also conducted a knowledge assessment of fire science in the northern Lake States and prepared a literature database. They found only four peer-reviewed papers that related directly to fire effects on herpetofauna and seven and 18 papers, respectively, related to small mammals and bird species (LSFSC 2012). Even in the case of the Kirtland's warbler, of the hundreds of peer-reviewed papers, theses, dissertations and other published documents, the vast majority focus on aspects of population dynamics and conservation issues other than fire, with only 17

papers even remotely covering fire issues. Based on these data, it appears that our understanding of the role of fire in the context of wildlife is incomplete in the northern Lake States.

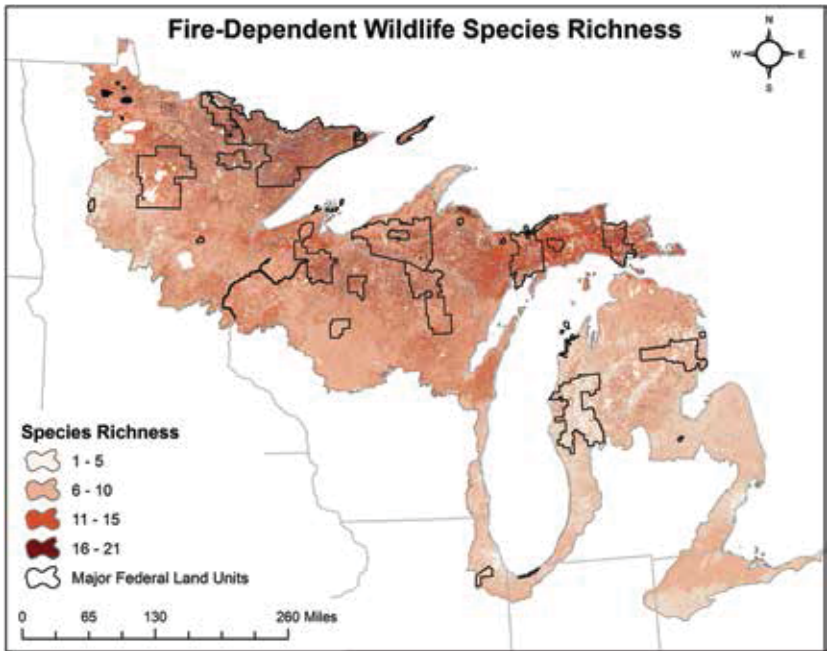
But human perceptions of ecosystem processes — especially fire — can have far-reaching management implications. Although wildlife and forestry professionals recognize that altering fire regimes can change the composition, structure and function of fire-dependent or fire-adapted ecosystems, the public's perception of fire as damaging and destructive has often limited its use for wildlife habitat management (Wilson et al. 2009).

In some parts of the U.S. — particularly the South and West where landforms, ecosystems and social contexts differ — wildlife managers routinely work with fire. Yet, elsewhere in the country, it appears that the influence of fire on vegetation and the corresponding distribution and abundance of wildlife is either less studied or underappreciated.

Knowledge gaps and differences in perceptions are plentiful and a need exists for a broader, nationwide dialogue on fire as an ecological process that vegetation and wildlife have adapted to. Recognizing these perceptions may help wildlife professionals identify a barrier to progressive land management across disciplines such as wildlife management, conservation biology, forest ecology and management and restoration ecology.

To help further this conversation, we are currently creating a list of wildlife species that may be considered fire-dependent based on their affinity for native fire-dependent ecosystem types in the region. Although many of these bird species, small mammals and herpetofauna may be unknown to the public, some charismatic game species also may be considered fire-dependent. Examples of such species include sharp-tailed grouse (*Tympanuchus pahsianellus*) that use open wetland and jack pine barrens habitats, snowshoe hare (*Lepus americanus*) that favor coniferous forest habitats and moose (*Alces alces*) that prefer peatlands and lowland coniferous forests.

More needs to be done to facilitate the exchange of knowledge on fire's role in ecosystem and wildlife management. In the coming years, LSFSC plans to offer field trips, webinars and research briefs on these topics. In doing so, we hope to better understand the perceptions of fire throughout the region and help to further integrate fire science with land management for the benefit of wildlife. Stay tuned. ■



Credit: Lindsey Shartell

Among the areas the LSFSC covers are the northern tiers of Michigan, Minnesota and Wisconsin that host a diversity of fire-dependent ecosystems and wildlife species. According to distribution data from the U.S. Geological Survey's National Gap Analysis Program, the area provides habitat for 53 wildlife species we characterize as fire-dependent, including upland sandpiper (*Bartramia longicauda*), Canada lynx (*Lynx canadensis*) and eastern massasauga (*Sistrurus catenatus*).

Disclaimer

The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service or other agencies or organizations.

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