

Addressing Concerns About Management of Indiana's Forests

Robert G. Wagner, John B. Dunning, Lenny D. Farlee, Elizabeth A. Jackson, Michael A. Jenkins, Brian J. MacGowan, Charlotte F. Owings, George R. Parker, Michael R. Saunders, Robert K. Swihart, Harmon P. Weeks, and Patrick A. Zollner

Department of Forestry & Natural Resources
Purdue University
West Lafayette, IN



Introduction

There has been substantial debate in recent months about how to best manage Indiana's state forests. Unfortunately, some information presented about forest management on the web, in letters to state government, and in op-ed articles to newspapers and other outlets has included statements that are not consistent with results from decades of forest and wildlife research. We believe that the public-policy debate on forest management in Indiana would benefit from clarification of key concepts and what research findings have generally concluded.

We address several questions arising from this debate that need better clarification:

1. *Are natural disturbances alone adequate to maintain a desirable structure and diversity of Indiana's forests and wildlife?*
2. *Is timber harvesting bad for wildlife?*
3. *How is "old-growth" forest defined and is it a relevant term for managing Indiana's forests?*

Question #1 - Are natural disturbances alone adequate to maintain a desirable structure and diversity of Indiana's forests and wildlife?

The forests of Indiana have been, and continue to be, shaped by people. For thousands of years before European settlers arrived, Native Americans routinely manipulated forests across today's Midwest.⁽²⁴⁾ Native peoples used fire to drive wild game and create better habitat. They also removed the bark of trees (girdling) to clear areas of land for agriculture.⁽¹²⁾ Early European settlers managed the forest similarly, albeit more intensively, by burning the forest to improve hunting areas, to create pastures for livestock, and to promote regeneration of important tree species. Settlers also cleared land by logging to greatly expand agriculture and to obtain timber products.⁽⁷⁾ Much of the resulting marginal farm and pasture land was abandoned during The Great Depression of the 1930s and returned to forest through both natural succession and some intervention (e.g., tree planting). These forests (created largely by human disturbance and subsequent abandonment) became the federal (Hoosier National Forest) and state forestland system that we know and value today. These forests have continued to develop without the same human disturbances that created and maintained the oak-hickory forest that characterize the region. Burning and overstory disturbances in particular are now lacking, which has created problems for the regeneration of oak and for many wildlife species.

Oak regeneration

The oak-hickory forest is not only an ecological legacy and part of the heritage of the state, but it is important for maintaining the health and biological diversity of Indiana's state forests. Unfortunately, due principally to the lack of disturbance (forest openings and fire) over previous decades, the oak that once dominated the forests of southern Indiana are now facing a regeneration crisis.^(1,13,18,9,32) For example, more than 80% of forested areas in the region have seen a decrease in oak abundance during the past 4 decades with white, post, red, and black oaks being reduced the most.⁽⁹⁾ In addition, damage from deer and competition from invasive plants have further contributed to oak decline.⁽⁷⁾

Letting "nature take its course" will not provide sufficient disturbance to regenerate oak and allow it to become a significant part of the future forest.⁽⁷⁾ The level of disturbance (including area, intensity, and frequency) that created Indiana's oak-dominated forests over the centuries resulted from a complex interplay of natural and human disturbances. Decades of research have shown that oak seedlings require periodic disturbances that remove or kill overstory trees and thus increase light levels, allowing oak seedlings to eventually reach the overstory.⁽¹⁴⁾ Well-designed harvests using group selection, shelterwood, clearcutting, and other silvicultural methods can create the proper conditions needed to regenerate oak.⁽⁷⁾ Prescribed fire also has been repeatedly shown to be an effective tool for regenerating oak,^(1,7) and fire is one of the primary reasons that oak was so prevalent in the forests created by the activities of Native Americans and early European settlers.

Without successful oak regeneration, Indiana's forests will become dominated by tree species (primarily maple and beech) that are favored by a lack of disturbance,^(18,1,13,32) resulting in the loss of an important part of Indiana's forest heritage and ecological diversity.

Wildlife habitat

A shift in forest composition away from oak also would have strong negative consequences for many wildlife species.⁽²³⁾ For example, many species of wildlife rely on oak for habitat and as a food source. Oaks alone support over 500 species of moths and butterflies.⁽³⁵⁾ The state-endangered cerulean warbler prefers to nest in white oak trees,⁽²⁶⁾ while the federally endangered Indiana bat uses both oak and hickory trees as roosts.⁽⁴⁾ An estimated 180 species of birds and mammals use oak acorns as food.^(29,22,17) Many wildlife researchers are now concerned about the impact that a long-term decline in oak regeneration will have on future wildlife populations.

The lack of disturbance also has led to a loss of young forest habitats upon which many wildlife species depend. The majority of Indiana's forests are currently between 40- and 80-years-old, with less than 4% of the forest area consisting of stands 10-years-old or younger.⁽³³⁾ While the area of older forests has been increasing (particularly on public lands), younger forests continue to decline and be underrepresented on the landscape. A number of bird species that are in rapid population decline in Indiana (including the American woodcock, golden-winged warbler, ruffed grouse, brown thrasher, yellow-breasted chat, and whip-poor-will) require young forest habitats that are created following disturbance.^(3, 33, 21)

By creating a diversity of forest conditions (ages, compositional diversity, structural complexity, and spatial heterogeneity) across a landscape, a full diversity of plant and animal species can be sustained. To provide these conditions, forest and wildlife managers must have access to all available tools, especially timber harvesting and prescribed fire. These tools also need to be used at a greater rate than has occurred during previous decades in order to create a full mosaic of forest

and wildlife habitat conditions. Relying on natural disturbances alone will not produce the environments needed to regenerate oak, manage for key wildlife species, or promote overall biodiversity.

Question #2 - Is timber harvesting bad for wildlife?

Because of concerns about the influence of timber harvesting on wildlife and wildlife habitat, research on the effects of various kinds of harvesting has been conducted over many decades. The general findings from this research are that, depending on the wildlife species being considered, the effects of forest harvesting can be negative, neutral, or positive. For example, decade-long monitoring of the Hardwood Ecosystem Experiment (HEE), which has taken place on Indiana state forestlands, has monitored 64 bird species following various kinds of timber harvesting.⁽¹⁶⁾ Among these, 20 species have increased in abundance after specific kinds of harvesting, only 4 have decreased in abundance, and the remaining have shown no response.

Examples of wildlife species in Indiana's hardwood forests that can be negatively influenced by harvesting include birds such as the Acadian flycatcher, ovenbird, and red-eyed vireo,^(16, 2) and small mammals such as shrews.⁽³⁷⁾ Several large-scale studies have examined the effects of timber harvesting on amphibians and reptiles. Negative effects have been shown for eastern red-backed salamanders, northern slimy salamanders,⁽²⁰⁾ eastern box turtles,⁽⁶⁾ timber rattlesnakes,⁽¹⁹⁾ and northern zigzag salamanders.⁽²⁰⁾ Differences in movements have been shown for eastern box turtles⁽⁶⁾ and timber rattlesnakes,⁽¹⁹⁾ but the longer-term effects on their populations is unclear. Studies of reptiles and amphibians have indicated that avoiding negative impacts of timber harvesting is neither possible nor desirable, since many disturbance-dependent and mature-forest dependent wildlife species also require young forests during parts of their lifecycles.^(36,11,5)

Some wildlife species that have been shown to be positively influenced by timber harvesting include American woodcock, chestnut-sided warbler, ruffed grouse, black-and-white warbler, and worm-eating warbler.^(30,31,36,11,16) Bird species showing positive responses also include some prominent conservation targets for the state and region (e.g., cerulean warbler, red-headed woodpecker, yellow-breasted chat, and prairie warbler). Small rodents, which serve as important prey for numerous predators, benefit from creation of young forest conditions following harvesting.^(25,37,17) The endangered Indiana bat also has been shown to benefit from timber harvesting when it creates forest edges, and promotes oak and hickory that can be used as maternity colony trees.⁽⁴⁾ For wildlife species that are generally positively affected, timber harvesting is commonly prescribed to increase populations of those species.⁽²³⁾

While it is beyond the scope of this paper to provide a full literature review for all species of wildlife, the above examples reveal that the responses of wildlife to timber harvesting are complex and variable. In cases where negative effects are likely to occur, the intensity, timing, and extent of timber harvesting can be adjusted to reduce negative effects. When negative outcomes do occur, they are generally short-term with local populations returning relatively quickly as the forest grows and develops. Moreover, these negative effects are often balanced by the habitat provided in the surrounding forest matrix. Related to this point, it also is important to recognize that wildlife interact with habitat at multiple spatial and temporal scales. Therefore, the impact of any single timber harvest event needs to be considered in the context of the surrounding landscape over time to understand the effect on wildlife species of interest. For those species benefitting from forest openings and younger forest conditions, the proper use of timber harvesting can be central to their management.

Question #3 - How is “old-growth” forest defined and is it a relevant term for managing Indiana’s forests?

The term “old-growth” has been commonly used in recent public discussions about Indiana’s forests. Forest scientists have debated the definition of this term for several decades now. There are over a hundred definitions of the term that vary with the purpose and forest ecosystem being discussed.⁽²⁸⁾ Definitions range from those that are highly specific and technical to those that are subjective and value-based. Any definitions of old-growth forests for Indiana would also incorporate the long-term effect of historical disturbances by Native Americans (especially from burning and/or land clearing). When one considers the ecological value of old-growth forests, centuries-long time periods and a landscape-scale perspective (rather than discussing individual patches of forest) need to be considered. Beyond a few scattered remnants across the region (e.g., Davis-Purdue Research Forest), large continuous tracts of old-growth forest no longer exist to any significant degree in Indiana or the surrounding states, and were gone long before any scientific measurements could be made or a historically meaningful definition developed.

A forest researcher from Indiana has defined old-growth stands in the state as having overstory trees >150-years-old, little human-caused understory disturbance during the past 80-to-100 years, all-aged structure, and a multi-layer canopy with dominant trees of 30-to-60 inches in stem diameter that contain tree species commonly found in the later stages of forest succession.⁽²⁷⁾ More than 30 forest areas have been found that meet this definition across Indiana.⁽³⁴⁾ The area of forest stands meeting the above old-growth definition is also projected to increase in Indiana during the coming decades under current approaches to managing public forestlands.

Where management of wildlife habitat is concerned, it is more important to define mature-forest and interior-forest conditions, as each has different implications for the habitat needs of particular species. The characteristics associated with mature-forest conditions generally include diverse horizontal and vertical structures with multiple layers of forest canopy, as well as gaps in the canopy that are in various stages of growth following disturbance. Timber harvesting also can be an important tool to help accelerate the development of mature-forest or old-growth characteristics by promoting structural diversity and increasing the growth of remaining overstory trees.^(15,8,10)

State and federal public lands offer a unique opportunity to manage forest landscapes for the long-term. Private lands encompass most of the forestlands in Indiana, but parcels tend to be small, land tenure (ownership) is generally short, and the objectives of landowners can vary widely over time.⁽²³⁾ The majority of private landowners do not actively engage in forest management. Public lands have the large area, stable ownership, and long-term mandate needed to be successfully managed for a wide range of forest conditions. However, only a small percentage of Indiana’s public forests are currently managed for a broad diversity of age-classes and structures that can be created through the judicious use of harvesting and prescribed fire. The HEE and other large-scale forest experiments have demonstrated that this approach results in higher plant and animal diversity than would otherwise occur. Therefore, public forests are better suited than private forestlands to create and sustain the wide range of forest conditions needed to maintain the ecological diversity of Indiana’s oak-hickory forest over the long-term.

Conclusions

It is important that those making public policy about forest and wildlife management have the benefit of the best available scientific information. The overall assessment based on the weight-of-evidence from decades of forest and wildlife research indicate that:

1. **Relying on natural disturbances alone will not be adequate to maintain a desirable structure and diversity of forests and wildlife on Indiana’s public lands.** The rich mixture of plant and animal species currently found in Indiana’s public forests resulted from past disturbances by Native Americans prior to 1800, followed by extensive agricultural clearing, burning, and pasturing in the 1800s and 1900s. Transfer of these heavily disturbed forestlands to public ownership starting in the early 1900s, combined with better management, has allowed recovery to the rich forests present today. Active forest management is required to preserve the ecological legacy of Indiana’s oak-hickory forest. Increased use of timber harvesting and prescribed fire are badly needed to promote oak regeneration and increase the availability of young forest habitats that are important for many wildlife species. Therefore, it is crucial that forestry and wildlife professionals managing state forestlands have access to all available tools needed to promote the health of Indiana’s forests and wildlife.
2. **Timber harvesting is compatible with the protection and management of wildlife.** For wildlife species that require vegetation conditions associated with forest openings and young forests, timber harvesting can be a vital tool for maintaining their populations. In cases where the effects are likely to be negative, the intensity, timing, and extent of harvesting can be managed to mitigate any negative effects. If they do occur, most negative effects are generally short-term, local, and wildlife populations tend to recover relatively quickly as the forest develops. Moreover, these negative effects are generally balanced by habitat provided across the landscape over time.
3. **Care must be taken when using the term “old-growth” forest.** The term is controversial and there is no clear scientific consensus about the definition. Nearly all old-growth forests in Indiana were eliminated long before any meaningful scientific definition could be developed. The focus instead should be on identifying where mature-forest and interior-forest conditions are needed to meet specific landscape management objectives. Timber harvesting can be an important tool for accelerating the development of mature-forest or old-growth conditions by promoting structural diversity and increasing the growth of desired overstory trees. Public forests are better suited than private forestlands to create and sustain the wide range of forest conditions needed to maintain the ecological diversity of Indiana’s oak-hickory forest over the long term.

About the Authors

The authors of this white paper are forest and wildlife experts from Purdue University who have dedicated their careers to research and education on forest and wildlife ecology, especially the effects of management practices:

- Robert G. Wagner – Professor and Head of Forestry and Natural Resources
- John B. Dunning – Professor of Wildlife Ecology
- Lenny D. Farlee – Hardwood Extension Specialist
- Elizabeth A. Jackson – Hardwood Extension Specialist
- Michael A. Jenkins – Associate Professor of Forest Ecology
- Brian J. MacGowan – Wildlife Extension Specialist
- Charlotte C. Owings – Hardwood Ecosystem Experiment Project Coordinator
- George R. Parker – Professor Emeritus of Forest Ecology
- Michael R. Saunders – Associate Professor of Silviculture
- Robert K. Swihart – Professor of Wildlife Ecology
- Harmon P. Weeks – Professor Emeritus of Wildlife Ecology
- Patrick A. Zollner – Associate Professor of Wildlife Ecology

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