Indiana Forest Action Plan 2020 Update

Strategic Goals:

- *Conserve, manage and protect existing forests, especially large forest patches, with increased emphasis on oak regeneration*
- *Restore, expand and connect forests, especially in riparian areas*
- *Connect people to forests, especially children and land-use decision makers, and coordinate education training and technical assistance*
- *Maintain and expand markets for Indiana hardwoods, with special focus on secondary processors and promoting the environmental benefits of wood products to local communities and school groups*
- *Double the size of Indiana's urban forest canopy with a focus on native species diversity and community and youth stewardship*

Document requirements checklist:
https://www.stateforesters.org/wp-content/uploads/2018/10/Assessments-Strategies-10-Year-Revisions-Checklist_final.pdf

Statewide Forest Resource Assessments and Strategies (State Forest Action Plans) Requirements Checklist for <insert State/equivalent>

State Forest Assessments and Strategies must be updated at least every 10 years and submitted to the relevant USDA Forest Service (FS) Region, Area, or IITF with this checklist signed by the State Forester. Federal review will focus on these requirements as outlined in the Cooperative Forestry Assistance Act SEC. 2A. [16 U.S.C 2101a] (amended by the 2008 and 2014 Farm Bills).

Submitted by the State Forester: Name: _____ Date: _____

State Forester certifies the required elements below are included. FS Region, Area, or IITF fills out the checklist.

Statewide Forest Resource Assessment Includes:

The conditions and trends of forest resources in the state ..... Yes ❑ No ❑
The threats to forest lands and resources in the state consistent with national priorities ..... Yes ❑ No ❑
Areas or regions of the state that are a priority ..... Yes ❑ No ❑
Any multi-state areas that are a regional priority ..... Yes ❑ No ❑

Statewide Forest Resource Strategy Includes:

Long-term strategies to address threats to forest resources in the state* ..... Yes ❑ No ❑
Description of resources necessary for state forester to address statewide strategy* ..... Yes ❑ No ❑
Strategy addresses national priorities for state and private forestry ..... Yes ❑ No ❑

** Can be presented in a strategies matrix with columns for (a) programs that contribute, (b) resources required, (c) national objective it supports, and (d) performance measure(s) that will be used for each strategy.*

Stakeholder Groups Coordinated with for the Statewide Assessment and Strategy:

Note: this can be identified in the body of the documents or in an appendix.

State Forest Stewardship Coordinating Committee (required) ..... Yes ❑ No ❑
State Wildlife Agency (required) ..... Yes ❑ No ❑
State Technical Committee (required) ..... Yes ❑ No ❑
Lead agency for the Forest Legacy Program (if not the state forestry agency) (required) ..... N/A ❑ Yes ❑ No ❑
Applicable Federal land management agencies (required) ..... Yes ❑ No ❑
Military installations (as appropriate and feasible) ..... Yes ❑ No ❑

Other Plans Incorporated in the Statewide Assessment and Strategy:

Community wildfire protection plans (required) ..... Yes ❑ No ❑
State wildlife action plans (required) ..... Yes ❑ No ❑
Other ..... Yes ❑ No ❑

Forest Legacy Program (FLP) Requirements Included (for States with FLP) ..... N/A ❑ Yes ❑ No ❑

See Forest Legacy Guidelines and the toolkit provided for State Forest Action Plans. Some options include:

- All required Forest Legacy components are integrated into the State Forest Action Plan (Assessment and/or Strategy), including Eligibility Criteria to identify Forest Legacy Areas, delineation of Forest Legacy Areas, and outline of the State's project evaluation and prioritization procedures. These elements are reviewed by the FS Region, Area, or IITF FLP staff as part of the assessment and strategy certification process. It is helpful to provide a crosswalk to identify location of FLP components in the State Forest Action Plan.
- A separate Forest Legacy Assessment of Need document (with above Forest Legacy requirements) is included as an appendix of the State Forest Action Plan. This document has been previously approved by the FS Region, Area, or IITF Forest Legacy Program staff. Documentation of FS approval and most recent review by the State Forest Stewardship Committee review should also be provided.

Review by FS Regional Forester, NA S&PF Director, or IITF Director *(as relevant):*

❑ **Deemed Sufficient (all requirements met)**
Comments:

❑ **Deemed Not Sufficient (missing one or more requirements)**
Corrective Action(s) Necessary to Meet Sufficiency Requirement:

Certified by Regional Forester or NA or IITF Director: Name: _____ Date: _____

DECISION BY FS DEPUTY CHIEF FOR STATE & PRIVATE FORESTRY:

Approval authority delegated from the USDA Secretary. **Approve:** ❑ **Disapprove:** ❑

USDA FS, Deputy Chief for State & Private Forestry: Name: _____ Date: _____

Executive Summary

The 2020 Indiana Forest Action Plan is an update to the 2010 Indiana Statewide Forest Assessment and Indiana Statewide Forest Strategy. The purpose remains unchanged: to address the sustainability of Indiana's statewide forests and develop a plan to ensure a desired future condition for forests in the state. This plan is distinct from the Indiana DNR Division of Forestry Strategic Direction 2020-2025. Indiana forest stakeholders participating in developing this Forest Action Plan maintained the broader perspective of all forest lands, public and private, and based recommendations on the roughly 5 million acres of forest in Indiana throughout the document.

This document includes conditions and trends of forest resources in the state, threats to forest lands and resources, areas of the state that are a priority and multi-state areas that are a regional priority. It contains a description of resources necessary for state forester to address statewide strategy, long-term strategies to address threats to forest resources in the state and addresses State & Private Forestry National Priorities codified in the Cooperative Forestry Assistance Act of 1978:

- Conserve and Manage Working Forest Landscapes for Multiple Values and Uses
- Protect Forests from Threats
- Enhance Public Benefits from Trees and Forests

Further, this updated Forest Action Plan incorporates the Indiana State Wildlife Action Plan, existing Community Wildfire Protection Plans and other statewide and regional planning documents relating to natural resource conservation and management. The updated Forest Action Plan includes Forest Legacy Program (FLP) requirements as an appendix.

The 2020 Indiana Forest Action Plan is a stakeholder-driven document. It was developed by the Indiana Division of Forestry, through coordination with the Forest Stewardship Coordinating Committee, State Technical Committee, DNR Division of Fish & Wildlife, Hoosier National Forest and other partners. The hope is that this plan enables the leveraging of partner resources toward shared goals for landscape-scale forest conservation.

The Strategic Goals:

- Conserve, manage and protect existing forests, especially large forest patches, with increased emphasis on oak regeneration
- Restore, expand and connect forests, especially in riparian areas
- Connect people to forests, especially children and land-use decision makers, and coordinate education training and technical assistance
- Maintain and expand markets for Indiana hardwoods, with special focus on secondary processors and promoting the environmental benefits of wood products to local communities and school groups
- Double the size of Indiana's urban forest canopy with a focus on native species diversity and community and youth stewardship

Table of Contents

Introduction

The Agriculture Improvement Act of 2018, commonly referred to as the Farm Bill, was enacted in December of 2018. The legislation amended the Cooperative Forestry Assistance Act of 1978 (CFAA) and requires each state to complete a Statewide Forest Resource Assessment and a Statewide Forest Resource Strategy, or Forest Action Plan, in order to receive, or continue to receive, funds under CFAA.

CFAA funds are provided to states through the State and Private Forestry (S&PF) organization of the USDA Forest Service. Currently, Indiana receives these funds annually to assist private forest landowners, promote healthy forest practices, assist communities with their urban forests and protect communities from wildfire. A large portion of the CFAA funding received by the Indiana Division of Forestry is passed to local organizations by way of grants that provide matching funds and additional implementation resources.

The 2010 Indiana Statewide Forest Assessment https://www.IN.gov/dnr/forestry/files/fo-Assessment_6_2010.pdf was the first geospatially based assessment of all private, public, urban and rural forest resources in the state. This updated Forest Action Plan takes that Assessment and integrates its companion 2010 document, the Indiana Statewide Forest Strategy https://www.IN.gov/dnr/forestry/files/fo-Statewide_Forest_Strategy.pdf, while adding updates for 2020.

Prior to the 2010 Assessment, the last comprehensive assessment of Indiana's statewide forest resources was produced in August 1981. Before that time and since, Indiana's forests have continued in their constant process of change and evolution. Adding a layer of complexity, society is interacting with forests in new and different ways.

New technologies have been developed that improve 1) our understanding of complex forest ecosystem interactions, 2) the efficiency with which we harvest, create and market products derived from forests, and 3) how we communicate, learn and disseminate information about

this valuable resource. Despite this progress, conflict persists around balancing a resource base with an increasing user population. Additionally, society has created new issues and new roles for forests as providers of biomass for electricity generation, feed stock for cellulosic ethanol and storehouses of carbon to mitigate a changing climate and increased concentrations of carbon dioxide in the atmosphere.

As with many others areas of society, "sustainability" is a recognized buzzword for forestry and natural resources. The word means many things to many people. This Forest Action Plan attempts to address the sustainability of Indiana's forest resources and defines sustainable forests as those that can continue to provide broad and diverse benefits, among them ecosystem services and timber production, for generations to come.

Before using this Forest Action Plan, it is important to read the following sections in this Introduction: goals and objectives, document design and acknowledgments. These sections provide an understanding of the framework, purpose, scope and perspective of the document and will provide useful context for the Forest Action Plan. The 2010 Forest Action Plan, including both "assessment" and "strategy" components are provided here for reference: https://www.IN.gov/dnr/forestry/5436.htm.

Goals and Objectives

The "assessment" portion of the Forest Action Plan attempts to show the "state of affairs" of Indiana's private and public forests and analyze the sustainability of forested ecosystems on a statewide or landscape level. The assessment portion is titled "Priority Areas, Forest Conditions, Trends, Threats and Priority Landscape Areas by Issue". The "strategy" portion of the Forest Action Plan is titled "Long-term Strategies to Address Threats to Forest Resources in Indiana".

This Forest Action Plan will be used by (1) Indiana Department of Natural Resources ("DNR") staff to inform management and policy making, (2) external partners and stakeholders involved in landscape conservation and stewardship who require statewide data. The information is intended to be concise while remaining accessible and understandable to the general public.

The Forest Action Plan strives to present unbiased findings and conclusions to provide a valuable source of information for others.

Document Design

The statewide scope of this document reflects the distribution of benefits and services that are produced by all forests. Forest benefits and services, like clean water, forest products, and wildlife habitat are produced by all forests, statewide. Risks to forests, like fire, insects and disease or development, can occur anywhere and often spread across large areas affecting public and privately owned forests. The scope of this document is statewide, and it is intended to be a tool that informs landscape-level decisions. One risk of this statewide perspective is that, at times, a critical issue or threat unique to one region of the state may be masked by a stable overall condition statewide.

Indiana forest resource conditions, trends, threats and priority areas are presented according to the state's recognized forest issues and their relative importance. Indiana's forest issues and

strategies are also consistent with the USDA Forest Service's national priorities: conserve working-forest landscapes, protect forests from harm and enhance public benefits from trees and forests.

The relative importance of issues and their respective levels of concern were expressed by Hoosier landowners, resource professionals and other stakeholders in a 2010 Forest Action Plan survey. Significant focus is placed upon the issues of recognized importance but an effort is made to also consider items that are important but have perhaps not registered across this larger societal spectrum.

Indiana Forest Issue	Relative Importance Score
Fragmentation and/or conversion of forests to another land use	507
Conservation and maintenance of soil and water resources	425
The spread and control of invasive species	421
Conservation of biodiversity	364
Counterproductive government forest conservation related policies	249
Availability of land for public recreation	234
High cost of forest ownership and low incentives to retain	226
Conservation of forests that protect drinking water supplies	206
Overpopulation of white-tailed deer	194
Inadequate public education about forests	166
Sustaining Indiana's forest product industry	160
Lack of active management on forests	146
Sustainable regeneration of oak woodlands	138
Inadequate youth education about forests	94
Lack of healthy woodlands and trees in urban areas	90
The control of forest fires	73
The loss of fire dependent plant communities and habitats	67
Forests not managed for carbon storage	45

Based on meetings of the Forest Stewardship Coordinating Committee in 2017 and 2018, these 2010 Indiana forest issues remain of primary concern to Indiana forest stakeholders. However, it was recognized by the Indiana Forest Stewardship Coordinating Committee that urban forests, climate change, oak regeneration and lack of age class diversity (specifically older and younger forests) require increased focus and strategic action.

Today forested landscapes cover about 5 million acres or 21% of Indiana's land base. All of these forests are important for providing associated benefits and services but certain areas are prioritized to ensure that federal and state resources are being focused on important landscape areas with the greatest opportunity to address shared management priorities and achieve measurable outcomes. Strategic Target Forest Patches, described in the section titled "Priority & Multi-state Areas" represent priority landscape areas of greatest importance for conservation. There is also description of multi-state areas that are a regional priority.

The Forest Action Plan was not intended to duplicate or replace statewide plans that currently exist on topics addressed herein. Effort has been made to incorporate but not directly present information from existing statewide assessments, i.e., USFS Forest Inventory Analysis reports,

State Comprehensive Outdoor Recreation Plan and Wildlife Action Plan. Links to the plans that were incorporated or are referenced in the Forest Action Plan are provided in the appendix.

The 2020 Forest Action Plan keeps the same framework as exists in the previous documents, combines and updates them while addressing some changes that have taken place or progress that has been made on action steps. Also, new strategies and actions steps are proposed for priority implementation.

Acknowledgments

This document was compiled by the Indiana Division of Forestry through the generous assistance of the members of the Indiana Forest Stewardship Coordinating Committee and members of the general public that identified themselves as forest stakeholders. The following organizations took an active role in contributing material for the initial draft:

American Tree Farm System
City of Goshen, Parks Forestry
Friends of Lake Monroe
Indiana DNR, Division of Entomology and Plant Pathology
Indiana DNR, Division of Fish & Wildlife
Hoosier Mountain Bike Association
Indiana Association of Consulting Foresters
Indiana Backcountry Hunters and Anglers
Indiana Forest & Woodland Owners Association
Indiana Forest Alliance
Indiana Hardwood Lumbermen's Association
Indiana Land Protection Alliance
Indiana Legislative Sportsmen's Caucus
Indiana Society of American Foresters
Indiana Sportsmen's Roundtable
Indiana Wildlife Federation
Izaak Walton League of America, Indiana Division
Knobstone Hiking Trail Association
La Porte County Conservation Trust, Inc.
Mind the Gap
National Wild Turkey Federation
Natural Resources Conservation Service
Owen-Putnam Friends of the Forest
Oak Heritage Conservancy
Purdue University, Department of Forestry & Natural Resources
Ruffed Grouse Society
Southern Indiana Cooperative Invasives Management
Sierra Club, Hoosier Chapter
The Hoosier Environmental Council
The Nature Conservancy, Indiana Chapter
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Fish and Wildlife Service
U.S. Forest Service, Hoosier National Forest

Wild Tecumseh Friends

Organizations that are part of the Indiana Forest Stewardship Coordinating Committee as well as other groups that contribute to review and comment the initial draft will be listed in the public input appendix of the final update. Thanks are also due to Sustainability & Planning Coordinator and other staff with the State and Private Forestry division of the U.S. Forest Service's Eastern Region.

Also special recognition goes to Jill Flackskam of the Division of Forestry, who created the majority of the maps in the document.

Accomplishments

Major projects were established to directly address key forest threats like the Southern Indiana Young Forest Initiative and the Hoosier Hills and Highlands Oak Community Restoration Project a National Joint Chief's' Landscape Scale Restoration Initiative, a partnership between two USDA agencies, the Forest Service (USFS) and Natural Resources Conservation Service (NRCS). A Cooperative Conservation Partnership Initiative (CCPI) project used NRCS funding to direct additional incentives for forest conservation practices to private landowners. Over the 10 years 2008-2018, NRCS provided over $12 million to private forest landowners to increase the health and productivity of their forestlands, establish new trees and forests, and develop forest management plans among other things. The State of Indiana celebrated its bicentennial anniversary and created a Bicentennial Nature Trust that leveraged community funds to conserve important forest areas. Trails and corridor projects were expanded, for example, the Next Level Trails program will invest $90 million in State trail funding in Indiana. Rules (312 IAC 18-3-23 and 312 IAC 18-3-25) went into place to prohibit the sales of first aquatic and then terrestrial invasives species.

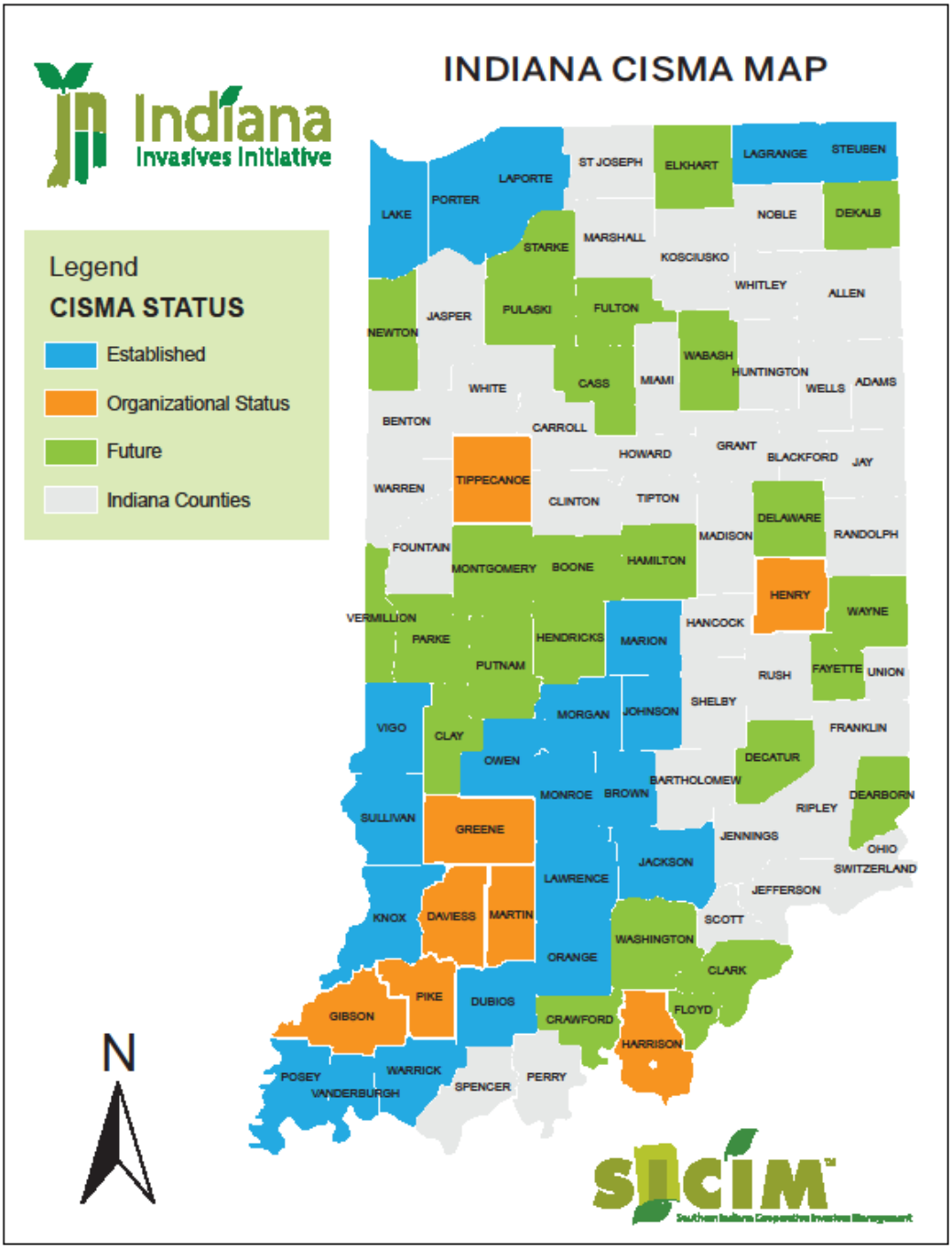
It is beyond the scope of this document to cover the accomplishments of all forest conservation efforts or the successes of all partners. It is important, though, to mention that over the past 10 years over 25 million new trees have been planted in Indiana, to highlight those efforts above and go into some more detail below on collaborative efforts. This listing is not meant to be comprehensive or to leave out valuable partner organization funding on-the-ground forest conservation like Great Lakes Restoration Initiative, Clean Water Indiana, Section 319 Grants and many other foundation and partner efforts.

Invasive species were a major focus of the 2010 Forest Action Plan and it is worth highlighting a collaborative effort to address invasives management in forests across the state. According to Southern Indiana Cooperative Invasives Management's (SICIM) 2019-2023 Strategic Plan, "at end of 2017, SICIM and the NRCS signed an agreement to develop local Cooperative Invasive Species Management Areas (CISMAs) throughout Indiana.

SICIM then created the Indiana Invasives Initiative (III) project to implement the agreement. Through the III project, a team of 5 Regional Specialists employed by SICIM actively work at the county level with local conservation agencies to develop new CISMAs and provide technical assistance to landowners, surveys and public educational events." Since the inception of the

project they have helped to establish 10 operational CISMAs with 8 more counties currently being organized. This work is resulting in increased landowner surveys, outreach events, weed wrangles, and private landowner participation to address the threat of invasive species.

Map 1: SICIM provided map showing status of CISMAs in Indiana (2019)



Forest Action Plans cumulatively represent a strategic plan for the nation's forests that can direct limited resources where they are needed most. Through Forest Action Plans, state foresters can demonstrate how federal investments can be used to leverage other resources and produce measurable outcomes that address national priorities. The following

accomplishments identify how the Indiana Forest Action Plan is built around and aligns with the three national priorities in the Farm Bill.

National Priorities Section

National Priority 1: Conserve and Manage Working Forest Landscapes for Multiple Values and Uses

This national priority aligns with Indiana Forest Action Plan's Strategy 1: Conserve, manage and protect existing forests, especially large forest patches.

Indiana is committed to sustainably managing the forest land it owns and on woodlands enrolled in the Classified Forest & Wildlands Program. The State Forest system (158,000 acres) is third party certified through Forest Stewardship Council® (FSC®-C012858) and the Sustainable Forestry Initiative® (SFI®) Program. As a benefit of the Indiana Classified Forest & Wildlands Program landowners can opt to have their lands (480,000 acres total) certified under the Forest Stewardship Council® (FSC-C071226). Audits to these rigorous certification standards are conducted annually. State Forest audit and certification documents are available here: https://www.IN.gov/dnr/forestry/7532.htm

Since the 2010 Indiana Forest Action Plan, Indiana has increased 175,258 acres enrolled in the Indiana Classified Forest & Wildlands (CFW) Program with corresponding increase in the number of acres that have professional timber management plans. As of November 2019, there are 823,258 acres enrolled in this program and new enrollments are concentrated in targeted areas. This has enabled measurable accomplishment on Forest Action Plan action steps relating to increasing economic incentives including cost-share and conservation payments for forestlands.

According to information provided by NRCS Indiana forester for the Forest Action Plan, obligations for forestry practices, which include Brush Management, Forest Stand Improvement, Forest Trails and Landings, Herbaceous Weed Control, Riparian Forest Buffer, and Tree and Shrub Establishment among others have increased since 2010. The Indiana Division of Forestry has partnered cooperatively with the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) to serve as a technical service provider, write plans and check installed forestry practices under the Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program (EQIP).

These targeted increases in CFW program would not have been as successful without federal funding assistance provided through Northeastern Area State and Private Forestry (S&PF) Landscape Scale Restoration Request for Proposals. Two grant projects highlighted below helped achieve the successes mentioned.

Parcel Level Strategies

The Statewide Strategies at a Parcel Level project developed a statewide, private landowner contact database that was linked to geo-spatial data and included the ability for landowners to connect online for forestry information and update their mailing addresses with email and

phone numbers. This enabled targeted outreach to ensure owners of forested acres were aware of incentive and assistance programs that help retain working forests.

Large Block Outreach & Enrollment

Expansion of the Classified Forest & Wildlands (CFW) Program was a goal in the 2010 Forest Action Plan and other statewide plans. Legislated requirements, changes in state tax policy, and limited resources for the Division of Forestry to hire additional Cooperative Forest Management (CFM) staff created challenges in targeting outreach and new enrollments to large tracts in priority areas.

The project provided funding for outreach and for foresters to enroll targeted forestland according to a prioritized parcel list developed from (Parcel Level Strategies project) a geospatial forest landowner contact information database. The owners of the largest private parcels of existing forestland within Forest Action Plan target areas were contacted and received information about the CFW Program, federal programs, and other conservation options. Enrollments in the CFW Program ease the costs to maintain working forests by providing tax relief in addition to other benefits.

National Priority 2: Protect Forests from Threats

This national priority relates to maintaining forest sustainability and aligns with many strategies in the Forest Action Plan especially those relating to restoration and protection from pests, disease and invasive plants.

The 2010 Forest Action Plan assessment process specifically identified fragmentation, parcelization and forest invasive plants as the most important threats to forests in the state. While the 2010 Forest Action Plan addressed fragmentation and parcelization more broadly, it offered numerous specific strategies and action steps that focused on invasive species including the development of a statewide Early Detection, Rapid Response (EDRR) program for forest invasive plants. Two specific projects relating to invasive species are highlighted below.

Invasive Species BMP Pilot Project

This was a two-year project that implemented the recommendation of the Indiana Invasive Species Council to assess and refine the Invasive Plant Advisory Committee's Invasive Species Best Management Practices (BMPs). It also provided demonstration and public outreach to encourage private landowner adoption of the new BMPs. The project directly addressed a main strategy of the 2010 Indiana Forest Action Plan: “Expand Best Management Practices with special attention to Invasive Species”. It was coordinated across 148,000 acres and engaged 22 professional foresters in invasive species monitoring, mapping, planning, treatment, inspection, education, documentation and other activities.

Next Steps in Early Detection, Rapid Response

This project specifically addressed the 2010 Forest Action Plan Strategy 3 component to “develop statewide Early Detection Rapid Response Program for forest invasive plants” and other action steps. It created a “Strike Team” to coordinate education and awareness, and to

conduct control efforts for EDRR species. This project built on an established and successful U.S. Forest Service Northeastern Area State & Private Forestry funded project in southern Illinois and expanded into the work detailed above by Southern Indiana Cooperative Invasives Management (SICM)

In addition to the projects above addressing this national priority, Indiana Division of Forestry provided training to loggers and forest industry professionals on an expanded suite of forest best management practices that includes invasive species, threatened and endangered species and other specialized situations.

National Priority 3: Enhance Public Benefits from Trees and Forests

The 2010 Indiana Forest Action Plan had many strategies and action steps that address this national priority. 2010 Forest Action Plan strategy 2, to "restore and connect forests, especially in riparian areas" was meant, in part to protect and enhance water quality and quantity (objective 3.1). 2010 Forest Action Plan strategy 5, to "maintain and expand markets for Indiana hardwoods, especially those that are sustainably certified" related to maintaining and enhancing the economic benefits and values of trees and forests (objective 3.4).

Other aspects of this national priority aligned with the 2010 Forest Action Plan, such as protect, conserve, and enhance wildlife and fish habitat (objective 3.5) and connecting people to trees and forests, and engage them in environmental stewardship activities (objective 3.6). 2010 Forest Action Plan Strategy 4, "coordinate education, training, and technical assistance, especially to develop strategic partnerships" broadly related to this national priority and focuses on working with partners to promote forestry knowledge and understanding, including the coordinated delivery of forest-related programing. The broad goals of the 2010 Forest Action Plan remain relatively unchanged. There is one success story that highlights contribution to this national priority listed below.

Hardwood Ecosystem Experiment

Since 2010, the Indiana Division of Forestry has continued to provide direct support to dozens of research projects investigating the ecological effects of forest management on State Forests. Most of the support went to researchers involved with the Hardwood Ecosystem Experiment (HEE), a long-term project based at Morgan-Monroe and Yellowwood State Forests (https://www.heeforeststudy.org/). The Division of Forestry provided support for long-term forest monitoring and to graduate/post-graduate researchers working on questions related to forest management and ecological impacts. These efforts have resulted in over 60 articles in peer-reviewed scientific journals and completed 29 master's theses and published dissertations since 2010. This long-term research is related to National Priority 3, the Indiana Forest Action Plan's strategy to promote forestry knowledge and understanding and multiple 2010 action steps.

Priority Areas, Forest Conditions, Trends, Threats and Priority Landscape Areas by Issue

Indiana's unique and high-quality forests are a part of the fabric of Midwestern wealth and development. The issues that are paramount in determining the sustainability of forest resources have far-ranging impacts on Hoosier jobs, health, and quality of life, among other things.

Landscape conservation and stewardship requires information and resources to facilitate the many shared goals of organizations and partners in the field. The following analysis should inform decision making related to forestry and land use, and it is presented so that specific issues, like water quality, economic development or public recreation can be considered separately and given a local priority weighting that may differ from any statewide priorities discussed herein. Partners are encouraged to analyze issue components independently where certain factors may be less relevant at more local scales or where initiatives have a more narrowly defined focus. Also, this section should have applications to the Indiana-relevant sections of broader-scale regional work that extends beyond the state's borders. Existing and potential multi-state priorities are discussed briefly in the following section.

Considered together, Indiana's forest issues represent an informed Hoosier perspective on forest threats, benefits and conservation priorities that are reflective of trends in the state. Forest benefits like recreation and biodiversity are recognized and evaluated in juxtaposition with threats to forests like wildfire and conversion. Indiana forest issues form the framework for the major analysis of the Assessment and are developed consistently with the priorities of Indiana forest stakeholders. Using Indiana's forest issues in this way, to prioritize forest importance, offers an analytical opportunity that mirrors the complexity and tradeoffs involved in all economic decision making.

Over the past 200 years, Indiana's forests have shown remarkable resilience and present a case study in forest resource resilience and sustainability. The lessons that were learned by society after the cutover that followed the European settling of this state, and the response guided by eminent Hoosier conservationists like Richard Lieber and Charles Deam, among others, are lessons that have application today as society responds to new forest threats and issues.

American ecologist Aldo Leopold wrote in *Round River* that "Conservation is a state of harmony between men and land". Such being the case, bringing harmony to society's relationship with forests has become exponentially more complicated as private individuals, who own 85% of Indiana's forests, have become more numerous and divided ownerships into smaller tracts.

Indiana's forests will never be the forests that existed at the time of European settlement. Major forest ecosystem components, like the passenger pigeon, have been erased forever and cannot be replaced. Similarly, land management practices of the past, like the free ranging of millions of hogs and widespread burning of large areas that were formative for Indiana's forests cannot be practiced on a similar scale today. Forest stewards and conservationists are key to helping society understand the history of Indiana's forests and their potential to provide benefits in the future.

According to the Northern Forest Futures Project https://www.nrs.fs.fed.us/futures/, Indiana's gains in forested acreage after the 20th century have peaked and are forecasted to decrease in coming years. It is of primary importance that forest stakeholders conserve and protect existing forests, working together to keep working forests on the landscape, and where possible attempt to make inroads against the projected loss.

Comprehensive analysis of all the important issues facing Indiana's forests is beyond the scope of this document.

Fragmentation

Fragmentation and/or conversion of forests to another land use is the most important threat to the sustainability of Indiana's forests.

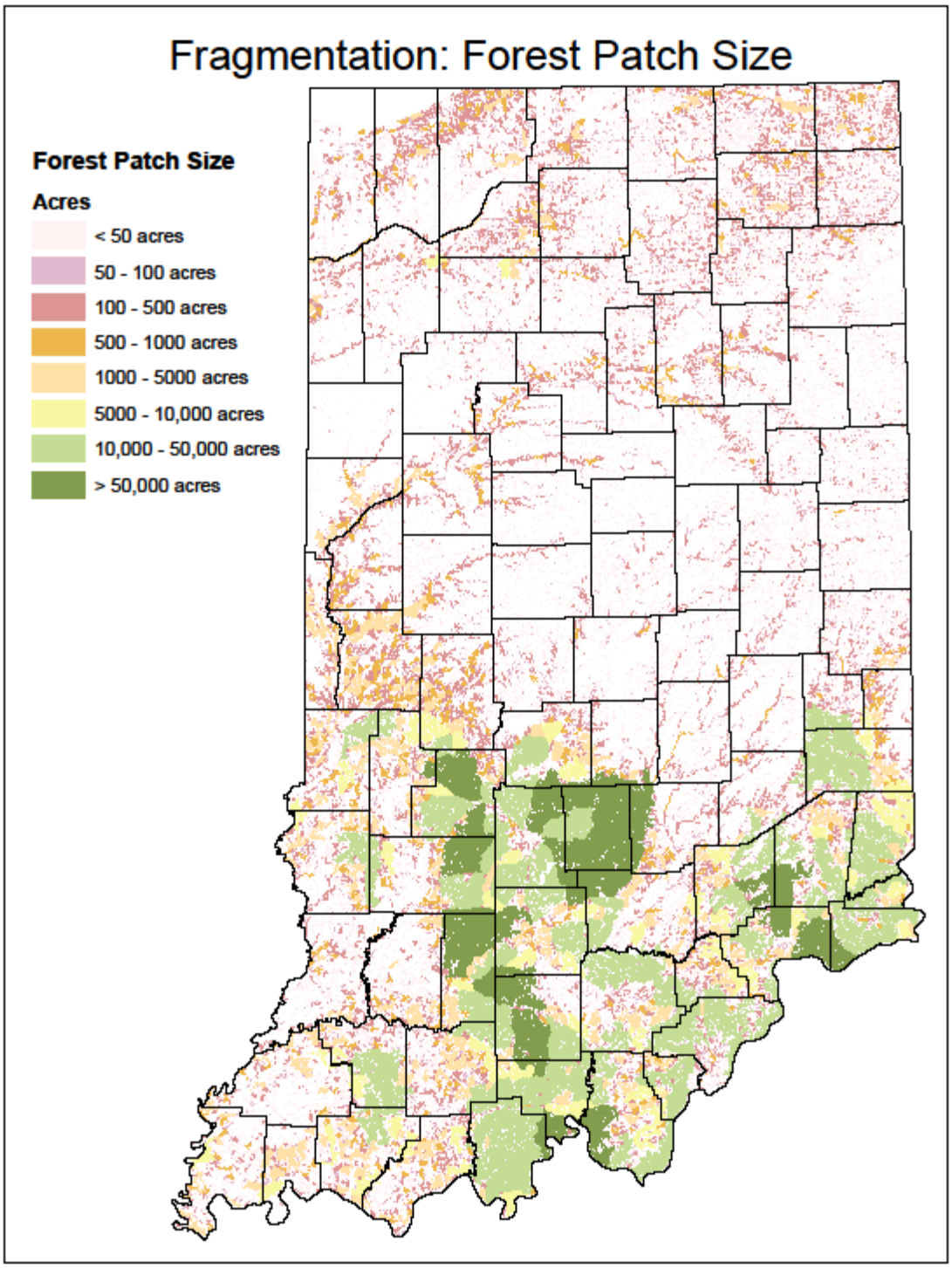
The broadly designated issue, hereafter referred to more simply as "fragmentation," can incorporate many different effects on forests. The effects of fragmentation from logging can be relatively short term and present certain ecological differentiation, whereas conversion of forestland to impervious surface presents wholly different and significantly more severe ecological effects. Likewise, the effects of a contiguous forest patch being converted to low density residential housing differ from those where conversion is to commodity agricultural production.

The long-term sustainability of forested ecosystems is affected by the ability of these systems to provide genetic response to stress, disease or disasters. Forest systems are complex and genetic transfer is influenced by a multitude of interacting forces from climate changes to fluctuations in wildlife population. Fragmentation inhibits this transfer and weakens the overall systems' ability to adapt and respond to environmental change.

This issue considers ecological aspects of fragmentation as well as economic aspects. It considers the growth in human population density and urban areas as well as associated leading indicators, namely roads and existing metropolitan areas. Just as extensive fragmentation can impair the ability of migratory birds to find suitable nesting sites; it can also impair the ability of woodland owners to market timber due to an insufficient product base from which to profitably deduct transportation and removal costs.

How parcels are divided and the rules and enforcement of tax assessment categories and zoning categories have important effect on the fragmentation of forests.

Map 2: 2018 Forest Patches by Size



Methodology: Forest patches were derived by converting the 2018 Forest Layer (Forest land in Indiana was derived from the 2018 National Agricultural Statistics Survey (NASS) satellite imagery. Classes 141 (Deciduous Forest), 142 (Evergreen Forest), 143 (Mixed Forest), 152 (Shrubland), and 190 (Woody Wetlands) were reclassified to forest. To remove mixed or misclassified pixels, all interstates, U.S. highways, and state highways were buffered by 15 meters per side and subtracted from the forest layer.)

Southern Indiana contains the majority of the largest forest patches. As the map above shows, there are no forest patches larger than 10,000 acres in Northern Indiana. These largest forest patches are the most able to provide forest genetic exchange requisite for healthy ecosystem functions.

Fragmentation for home building or other development is generally reliant on connection to local and non-local transportation networks. Roads also present major barriers for successful dispersal for some forest wildlife and plant species.

Research shows that areas that have very low forest cover (e.g., <15%) had high nest loss at forest edges and within interiors; at moderate levels nest loss was high at edges but not interiors; and in unfragmented areas (>90% forest cover) nest loss was low at both edges and within interiors. (Donovan et al. 1997, Hartley and Hunter 1998, Thompson et al. 2002) The proportion of forest cover across a landscape in large part determines the distribution of wildlife, including forest amphibians, bats, and birds. The ecological effects of human population density on forested areas can be magnified when development is dispersed rather than concentrated in certain areas.

Areas at high risk for forest fragmentation, for example those with increased population density, often carry a higher economic cost, encompass a greater number of ownerships and carry greater inherent ecological denigration. Areas at low risk for forest fragmentation generally contain more intact forest habitats and a greater ability to effectuate landscape scale stewardship and conservation efforts at a lower cost. Thus, conservation efforts to protect against fragmentation should generally be directed to areas with low risk for fragmentation.

Lands with legal limits to conversion (easements, deed restrictions, and public ownership) are more effectively protected against conversion to another land use. Indiana forest lands in public ownership run the gamut from the federally owned Hoosier National Forest to small city parks. State owned forests exist in many capacities beyond State Forests managed by the Indiana Division of Forestry including: State Nature Preserves, State Fish & Wildlife Areas, State Department of Transportation medians, among others. There is less chance that these forests in public ownership will be converted to other land use than those in private ownership. Certain classes of public land have greater protections against conversion than others with State dedicated nature preserves having the most rigorous protections.

Indiana Division of Forestry administered Classified Forest & Wildlands Program includes 823,258 acres in 16,785 tracts as of November 2019. These enrollments offer tax incentives for owners and the classification goes with the property deed when ownership is transferred. There are fees associated with removing a property from the program but these costs are not sufficient to prevent Classified Forests from being converted to another land use where development pressure exists.

Income from working lands, farms or forests, provides economic value that is largely unable to compete with real estate values based on developed land use. As a result, even the most productive farm and forest lands is at risk of conversion to another land use when financial values are the only consideration and legal protections against conversion are not in place. Resources are available for land use planners to address this issue but they are not sufficient to address the full scope of the challenge.

Conservation easements are also used in Indiana to retain a forest land use. Indiana has about 24 land trusts that operate at local and regional scales to preserve land use through fee title purchase or conservation easements. According to estimates from the Land Protection Alliance, land trusts in Indiana are estimated to own or maintain easements on over 70,000 acres of mostly forest land.

The following table shows National Land Cover Database forested acre totals by county by survey year, total change from 2001 to 2016 and corresponding percentage change organized from highest percent increase to highest percent decrease in acre change. These data were provided by the Indiana Division of Forestry (J Flachskam) and show that Indiana's forest cover over the last 15 years where data is available has been relatively stable.

Indiana	NLCD Forest Acres					
County name	2001	2006	2011	2016	Change '01-'16	% change
Ohio	30,769	30,802	30,842	31,061	292	0.9%
Dearborn	110,823	110,442	110,603	111,121	298	0.3%
Switzerland	87,507	87,339	87,365	87,716	210	0.2%
Brown	173,768	173,682	173,679	173,843	75	0.0%
Franklin	128,318	128,121	127,765	128,356	38	0.0%
Henry	25,638	25,647	25,649	25,640	2	0.0%
Posey	37,403	37,361	37,202	37,388	-15	0.0%
Benton	2,235	2,233	2,233	2,234	-1	-0.1%
Shelby	19,450	19,448	19,443	19,435	-15	-0.1%
Newton	21,571	21,563	21,568	21,553	-18	-0.1%
Owen	155,497	154,846	154,794	155,363	-134	-0.1%
Noble	26,512	26,510	26,518	26,487	-24	-0.1%
Perry	175,320	174,928	174,559	175,116	-204	-0.1%
Miami	29,803	29,776	29,758	29,763	-40	-0.1%
Clinton	11,267	11,263	11,262	11,251	-16	-0.1%
Spencer	72,567	72,367	71,707	72,464	-103	-0.1%
Wabash	38,620	38,586	38,575	38,557	-63	-0.2%
Union	23,109	23,080	23,067	23,069	-40	-0.2%
Blackford	9,591	9,591	9,575	9,573	-18	-0.2%
Fountain	44,145	44,103	44,096	44,051	-94	-0.2%
Fayette	38,999	38,887	38,697	38,914	-85	-0.2%
Morgan	113,861	113,509	113,611	113,597	-264	-0.2%
Grant	22,115	22,093	22,076	22,063	-52	-0.2%
Montgomery	33,960	33,934	33,918	33,878	-83	-0.2%
Fulton	15,006	14,987	15,003	14,967	-39	-0.3%
Wayne	44,707	44,627	44,611	44,582	-125	-0.3%
Tipton	2,286	2,288	2,279	2,279	-7	-0.3%
Kosciusko	33,098	33,086	33,083	32,996	-102	-0.3%
Huntington	31,885	31,863	31,808	31,786	-100	-0.3%

Washington	150,144	149,717	149,656	149,673	-471	-0.3%
Starke	36,326	36,304	36,295	36,203	-123	-0.3%
Jackson	119,515	119,400	119,399	119,111	-405	-0.3%
Warren	34,811	34,778	34,772	34,693	-118	-0.3%
Parke	115,324	115,166	115,077	114,926	-399	-0.3%
Crawford	143,146	142,387	142,206	142,649	-497	-0.3%
Marshall	28,901	28,848	28,867	28,797	-104	-0.4%
Decatur	43,913	43,828	43,804	43,750	-163	-0.4%
Madison	18,095	18,084	18,066	18,027	-68	-0.4%
Whitley	23,722	23,698	23,681	23,626	-96	-0.4%
Delaware	21,143	21,131	21,098	21,057	-86	-0.4%
Jay	22,338	22,319	22,271	22,247	-91	-0.4%
Pulaski	29,753	29,756	29,742	29,629	-123	-0.4%
Howard	10,006	9,992	9,974	9,961	-44	-0.4%
Cass	31,917	31,895	31,876	31,771	-146	-0.5%
Wells	14,985	14,972	14,918	14,915	-70	-0.5%
White	15,790	15,794	15,769	15,713	-77	-0.5%
Jefferson	123,753	123,341	123,518	123,134	-618	-0.5%
Adams	12,455	12,457	12,399	12,391	-64	-0.5%
Ripley	128,164	127,357	127,560	127,487	-677	-0.5%
Martin	153,499	152,910	152,643	152,671	-828	-0.5%
Carroll	25,661	25,640	25,629	25,517	-144	-0.6%
Harrison	163,125	161,849	161,669	162,168	-957	-0.6%
Jasper	32,248	32,222	32,175	32,053	-195	-0.6%
DeKalb	23,176	23,148	23,108	23,032	-143	-0.6%
Randolph	19,879	19,839	19,772	19,755	-125	-0.6%
Orange	153,675	152,663	152,701	152,702	-973	-0.6%
Greene	163,056	162,299	162,140	162,011	-1,045	-0.6%
Warrick	88,728	88,368	88,654	88,082	-646	-0.7%
LaPorte	48,854	48,685	48,651	48,498	-356	-0.7%
Putnam	111,109	110,748	110,502	110,291	-818	-0.7%
Rush	16,374	16,275	16,227	16,245	-129	-0.8%
LaGrange	8,500	8,503	8,451	8,432	-68	-0.8%
Scott	56,308	55,879	55,895	55,854	-453	-0.8%
Dubois	104,181	103,525	103,418	103,341	-840	-0.8%
Lawrence	151,154	149,918	149,956	149,907	-1,247	-0.8%
Steuben	11,781	11,750	11,741	11,675	-107	-0.9%
Jennings	113,684	113,210	113,139	112,610	-1,074	-0.9%
Hancock	11,984	11,945	11,909	11,871	-114	-0.9%
Monroe	172,071	170,859	170,662	170,403	-1,668	-1.0%
Clay	70,656	70,209	70,126	69,959	-697	-1.0%
Vermillion	39,867	39,383	39,258	39,441	-427	-1.1%
Tippecanoe	39,771	39,525	39,471	39,314	-456	-1.1%

Boone	14,451	14,362	14,300	14,279	-171	-1.2%
Bartholomew	76,833	76,049	76,007	75,796	-1,038	-1.4%
St_Joseph	31,095	30,759	30,733	30,670	-425	-1.4%
Knox	35,470	35,165	35,126	34,952	-518	-1.5%
Floyd	49,515	48,936	48,744	48,672	-843	-1.7%
Vanderburgh	34,211	33,693	33,566	33,615	-596	-1.7%
Johnson	34,197	33,841	33,742	33,583	-614	-1.8%
Sullivan	77,081	76,396	75,844	75,450	-1,632	-2.1%
Pike	95,597	93,335	91,664	93,551	-2,045	-2.1%
Elkhart	17,655	17,473	17,386	17,271	-384	-2.2%
Clark	113,305	111,604	111,204	110,754	-2,550	-2.3%
Hendricks	27,758	27,278	27,167	27,076	-682	-2.5%
Daviess	48,541	47,387	47,236	47,224	-1,318	-2.7%
Allen	36,265	35,511	35,366	35,099	-1,166	-3.2%
Vigo	75,455	74,597	74,177	72,979	-2,476	-3.3%
Gibson	42,735	41,876	41,385	41,016	-1,719	-4.0%
Porter	33,848	33,261	32,719	32,473	-1,375	-4.1%
Marion	18,034	17,451	17,289	17,270	-765	-4.2%
Hamilton	16,449	15,956	15,753	15,653	-796	-4.8%
Lake	25,142	24,244	23,464	23,195	-1,947	-7.7%
Total	5,367,011	5,336,709	5,327,063	5,325,278	-41,734	-0.8%

Soil & Water

Conservation and maintenance of soil and water resources, and the conservation of forests that protect drinking-water supplies ("soil & water") are important issues to Indiana forest stakeholders. Only seven of the 1,292 respondents to the original stakeholder survey were "not concerned" about these issues, and depending on how their importance measures are tallied, it is arguably of equal or greater importance than fragmentation.

Maintaining a forested buffer around perennial watercourses improves water quality, wildlife habitat and protects soil resources. Undisturbed forests are unsurpassed in their ability to preserve and enhance soil resources and water quality. Forest cover, especially around creek and river bottoms, and along drainages or riparian areas, acts as a buffer for surrounding exposed soil or agricultural applications and reduce soil or other pollutants from reaching streams. Forested riparian areas are important for the maintenance of soil and water quality and play an important role in regulating stream and river temperatures requisite for aquatic life. Because these areas are prone to flooding and less amenable to row crop agriculture, they are generally less developed and therefore heavily relied upon as wildlife dispersal corridors.

Forest cover alone cannot ensure water quality in larger watersheds. Inadequately managed point-source and non-point (pollution, roadway and impervious surface runoff, sewage overflows, manure, and pesticide and herbicide applications) can negatively impact stream water quality.

Best management practices ("BMPs") that protect soil and water quality during and after timber harvest are required on forestland managed by the DNR and USDA Forest Service. In general, BMPS are not mandatory of private forest although use is encouraged. Lands enrolled in the Classified Forest & Wildlands must prevent "excessive erosion" and BMPs are a tool to meet that requirement.

Public drinking water is particularly important because it is something that Hoosiers cannot live without and there are specific health implications where drinking water contains contaminants or toxic elements. Maintaining forests in these areas can lessen the need for expensive water treatment facilities.

Karst regions are particularly susceptible to water-quality issues due to the fragility of subterranean ecosystems and the abrupt entry of surface water into underground watercourses through sink holes, caves, etc. These areas are also important for the federally endangered Indiana Bat.

Toxic and hazardous materials deposited on or associated with roadways and impervious surfaces enter waterways more quickly during rains and floods because they are not filtered or slowed by soil, root, and plant dynamics.

Impervious surface areas are removed from natural ecosystem service functions and comparatively bereft of ecologically beneficial habitat for trees and wildlife. These areas can affect their own climate and create heat islands that further differentiate local ecosystems.

Purdue University maintains a State of Indiana Waters website (https://www.agry.purdue.edu/indiana-water/) that is easy to navigate and locate information but it is unfortunately only related to the quantity and distribution of Indiana ground and surface waters and does not include information on water quality.

Invasives

The spread and control of invasive species is an important forest issue in Indiana. According to the 2010 Forest Action Plan stakeholder survey, this is a top issue for forest stakeholders in Indiana. Invasive plants threaten forest sustainability in Indiana. Invasions can cause great harm to native ecosystems, economies, human health, and aesthetics.

Indiana's distinction as a hub of transportation and commerce also creates pathways and corridors that accentuate invasive-species problems. Humans play a large part in accelerating the introduction and spread of invasive plants in forested communities through the direct planting or seeding of non-native nursery stock. Forest management practices that are conducted without regard for invasive plants or application of BMPs can cause explosive expansions of invasive species like Japanese stiltgrass.

There are a wide variety of plant species able to invade forests. Some, like Japanese stiltgrass and garlic mustard, are shade tolerant and able to establish and spread under undisturbed forest canopies. Others, like Japanese honeysuckle and autumn olive are shade intolerant but can establish in the understory and abide until the canopy is disturbed and light reaches them, enabling their rapid spread.

Control and risk of spread is difficult precisely for these reasons. The public generally becomes aware of an invasive species' inroads only when it may be too late to eradicate it. Statewide invasive species mapping is provided through EDDMapS, Early Detection & Distribution Mapping System, Report IN website available at eddmaps.org.

Different areas of Indiana will face different pressures from invasive species due to differing forest composition, climates and surrounding environments, and directional spread, among other factors. Beyond those plant species listed earlier, there are other plant species like bush honeysuckle and multiflora rose that affect large areas of Indiana's forestland.

The Indiana Invasive Species Council, according to their website https://www.entm.purdue.edu/iisc/, "was established by the state legislature to enhance the ability of government agencies to detect, prevent, monitor and manage new and long established invasions, as well as increase public awareness about invasive species." Their Invasive Plant Advisory Committee (IPAC) was instrumental in developing and maintaining the "Official IISC invasive Plant List" and working through the scientific evaluation of plants to determine their invasive nature and status which is the supporting document to the aquatic and terrestrial plant rules (Indiana Administrative Code - 312 IAC 18-3-23 and 18-3-25).

Most divisions of the Indiana Department of Natural Resources are concerned with invasive species, certainly landholding divisions, but the Division of Entomology and Plant Pathology is the only statutory representative of the agency on the Indiana Invasive Species Council. It makes sense that certain invasives issues, like feral hogs being handled by DNR Division of Fish & Wildlife, are more appropriately handled by different divisions. There is no invasive species coordinator at the Agency or statewide level. Similarly, various USDA agencies have leadership on certain issues within the broader invasive species category such as: Animal and Plant Health Inspection Service (APHIS) and US Fish & Wildlife Service.

Invasive species that are impacting Indiana forests include not just plants but also animals, like feral hog mentioned above, insects - Gypsy Moth and Emerald Ash Borer and diseases - Oak Wilt, Chestnut Blight, Dutch Elm Disease and Butternut Canker. Since, 2010 the Emerald Ash Borer has moved through Indiana, Indiana specific quarantines on ash material movement have been removed and according to the DNR Forest Health Specialist, USDA Animal Plant Health Inspection Service (APHIS) is expected to remove the federal quarantine in early 2020.

The list of insects and diseases not present but a future threat to Indiana forests include - Thousand Cankers of Walnut, Beech Bark Disease, Beech Leaf Disease, Sudden Oak Death, Laurel Wilt, Asian Longhorned Beetle, Hemlock Woolly Adelgid and Spotted Lantern Fly. Of these, three diseases and one insect have greatly removed tree species from Indiana forests impacting their value to all forest resources and the forest industry.

Biodiversity

"To keep every cog and wheel is the first precaution of intelligent tinkering." - Aldo Leopold

Biologic diversity is perhaps the most important overall measure of ecosystem health and well-being. Forest stakeholders respond strongly to this issue because it is also a measure of our

own health and the well-being of society as a whole. Remarkable genetic similarities between humans and other life indicate that the environmental stresses that threaten the existence of certain species affect us as well.

Biodiversity includes all plant and animal species, species of special concern and common species, and it exists upon a similar diversity of habitat types at various states of succession. This vast complexity is difficult to represent spatially.

Statewide survey information relating to stand age and forest type does not exist at a relevant scale to be useful for focused landscape scale initiatives. This continues to be a major data gap that will hopefully be addressed in the near future with technological advances in the area of forestry remote sensing.

Without these data it is difficult to address certain other identified issues that have specific relation to forest biodiversity. One example is sustainable regeneration of oak woodlands. Oak species are a great determinant of diversity in certain areas because of the large number of insect and animal species that depend upon them. Beyond the more generally recognized large game species like deer and wild turkey that depend on oak mast, research shows that the *Quercus* genus supports the greatest number of butterfly and moth species whose larvae are the most important source of protein for Neotropical migratory birds like the forest-dependent and Indiana Species of Greatest Conservation Need, cerulean warbler. (Tallamy, 2008)

The need for high-resolution stand-age class and forest-type data across the state can be highlighted by considering two statistics from the USDA Forest Service. Their Forest Inventory and Analysis program shows that the oak-hickory forest type (72%) dominates all other forest cover type groups in Indiana. FIA also shows that over 80% of stand age classes fall between 21 and 100 years (FIA, 2013). These data point toward unsustainable characteristics that necessitate further research and understanding.

Indiana's oak-hickory component developed largely from existing seed sources maintained by Native American burning practices, regeneration and succession in full-sun, open-canopy conditions and in the general absence of deer herbivory (extirpated from Indiana by 1900). These conditions do not and cannot exist today as they did in the past and there is question whether shade-intolerant species like oaks, black walnut and black cherry, among others, will have a place in Indiana's forests of the future without a defined effort to maintain them in the mid- and under-stories of forests.

The following figures show species distribution by size class across two different ownerships and at a statewide scale.

Chart #: Trees on Indiana State Forests in 2018

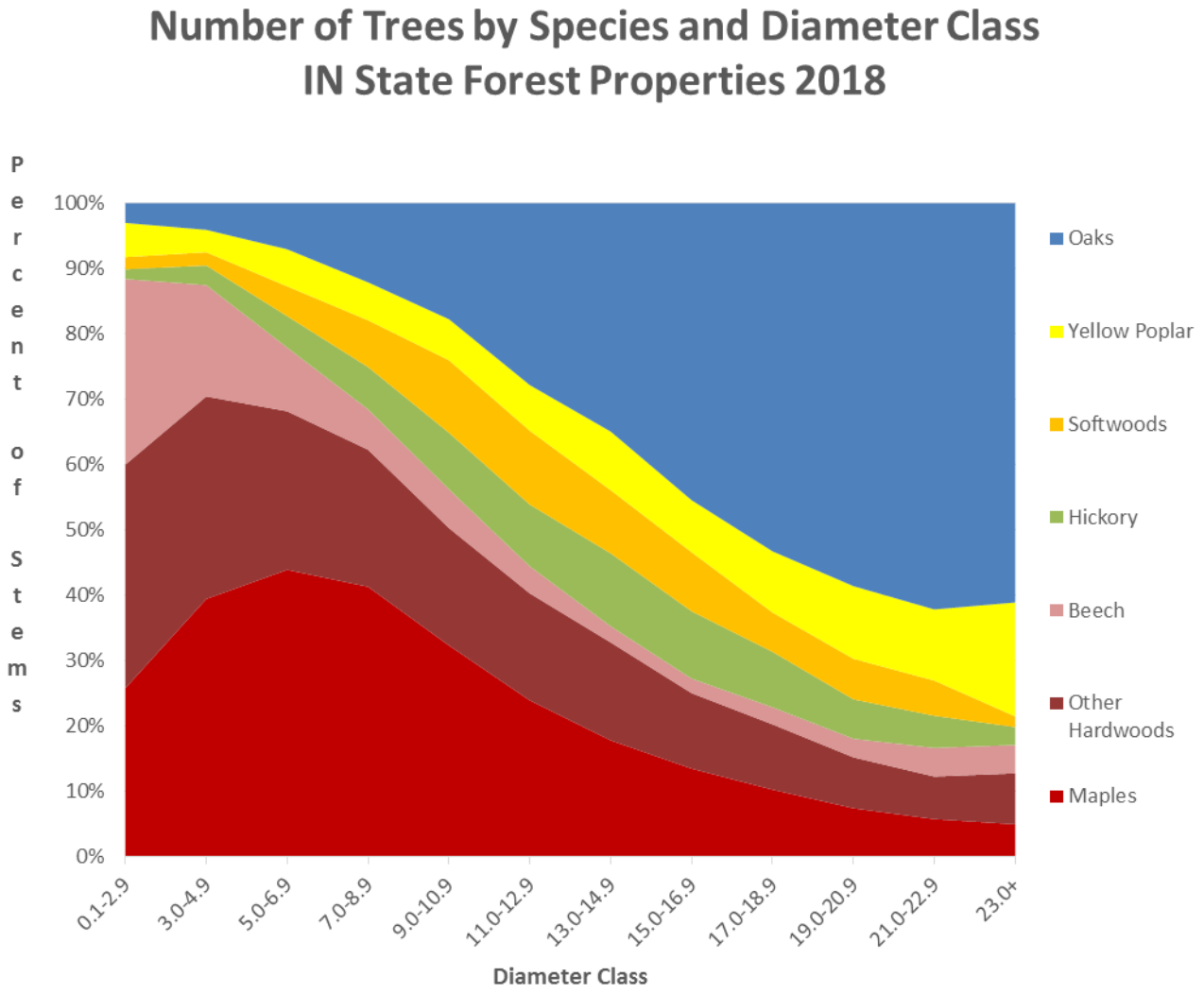


Chart #: Trees on Classified Forests in 2018

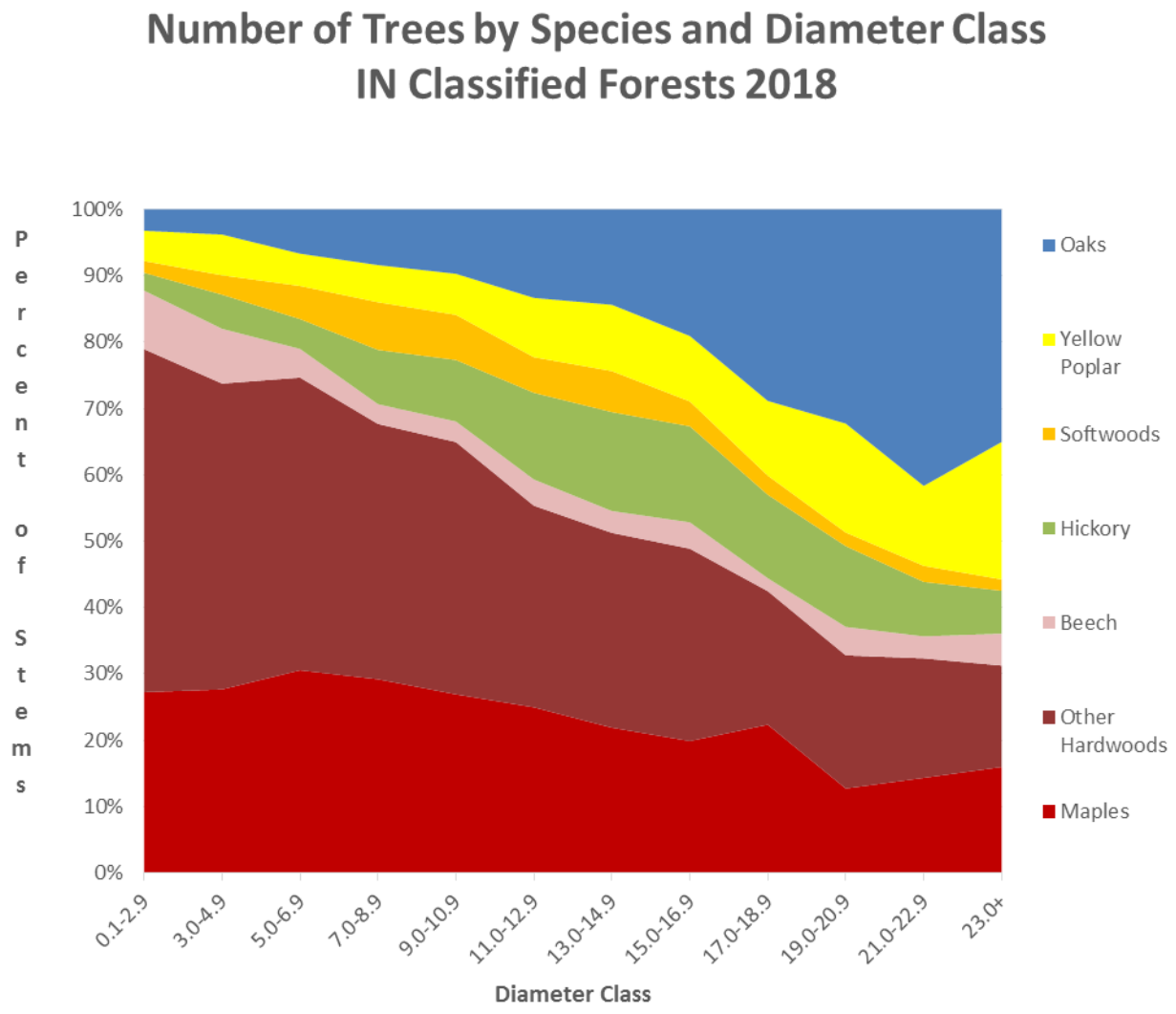
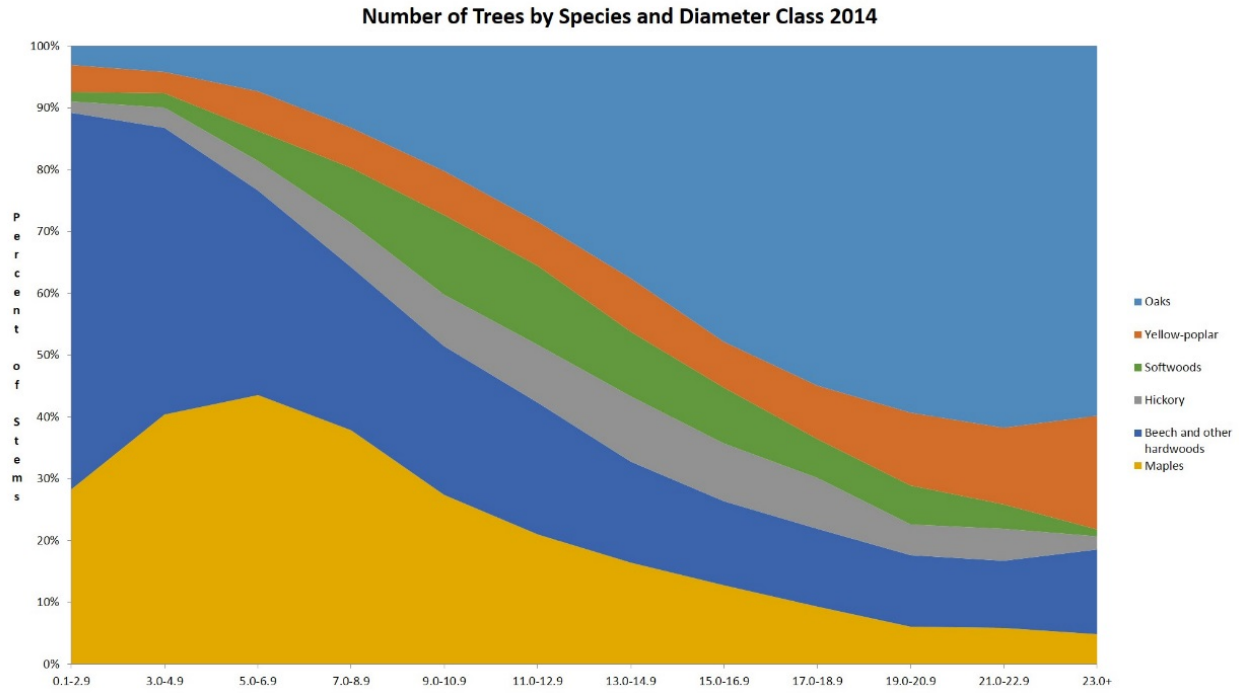


Chart #: Trees statewide in 2014



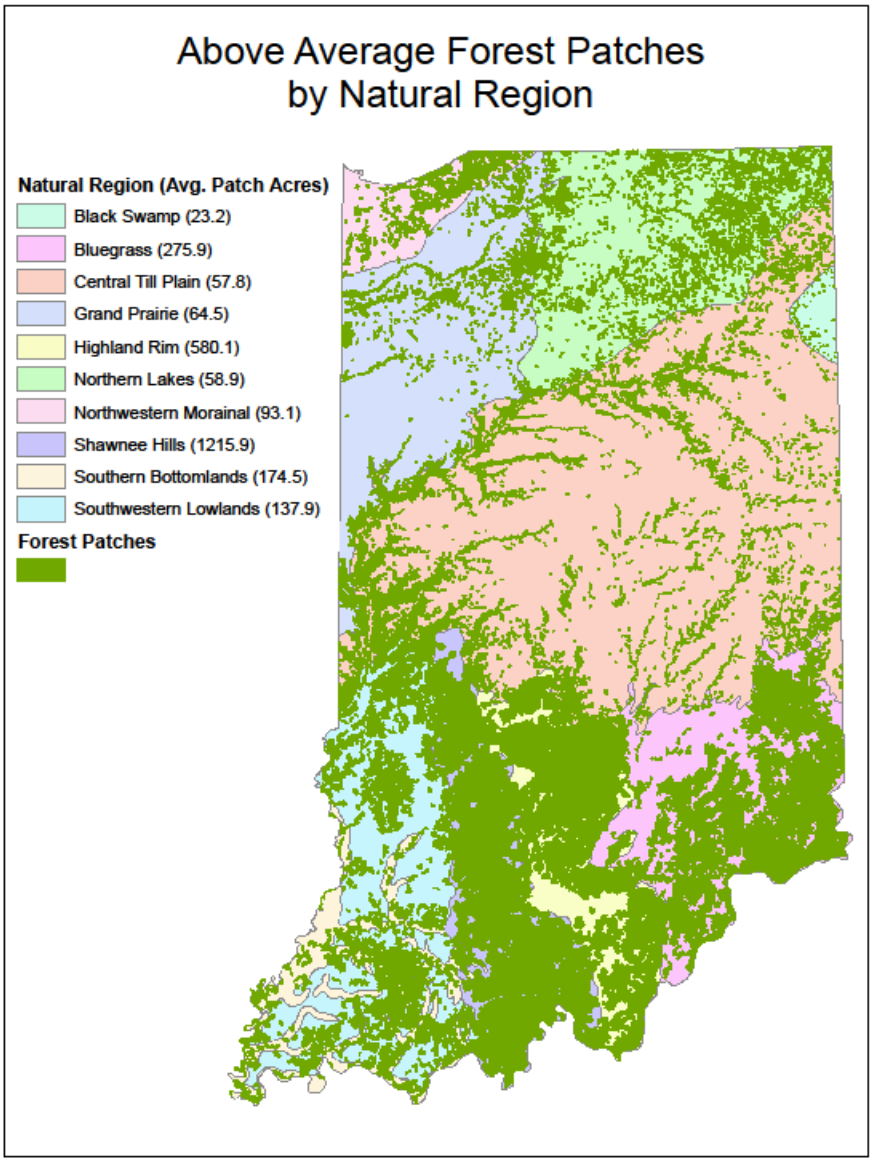
There are some differences according to ownership, but still without significant management changes Indiana is going to lose its oak-hickory to shade-tolerant species mix at the canopy level. Few oak and hickory seedlings are available to maintain forest composition. Without direct intervention and more intensive management, forest composition will shift to shade tolerant species like maples and beech that can thrive in closed-canopy forest. The majority of canopy level trees in today's forests are oaks and hickories. Loss of oak and hickory forests will present sweeping changes to forest biological diversity and in general a significant loss of productive capacity for the greatest number of fauna.

The extreme dominance of age classes between 20 and 99 years threatens ecological simplification. The loss of species diversity, especially among those species traditionally found in Indiana after the forest recovery, like ruffed grouse, depend on early successional habitat.

The Natural Regions of Indiana were developed by Michael A. Homoya of the Indiana DNR Division of Nature Preserves. These regions represent an ecologically unique partitioning of the state based on natural geologic or climactic factors. A region's biological diversity will be reflective of these inherent elements shaping the surrounding ecosystem. Thus, each natural region can be expected to present unique characteristics that suit particular organisms and forested habitats.

This map shows above-average-size forest patches for all of Homoya's Natural Regions. Average patch size for each natural region is shown next to its name in the map legend. By this method, natural variations should capture unique attributes that might be overlooked with a focus only on species richness. It is assumed that larger forest patches generally offer more suitable habitat for biological diversity and present a greater capacity to exist into the future.

Map: 2019 Above Average Forest Patches by Natural Region (DNR: J. Flachskam)



A link to the Indiana Natural Regions map without forest patches is located in the appendix.

The data results presented in this map has changed since 2009. Most natural regions have seen their average forest patch size increase. Natural Regions showing average patch size growth by increases: Shawnee Hills (26%), Highland Rim (20%), Bluegrass (14%), Southwestern Lowlands (14%), Southern Bottomlands (13%) and Northern Lakes (9%). Natural Regions showing average patch size decrease: Northwestern Morainal (-9%), Grand Prairie (-5%), Black Swamp (-2%) and Central Till Pain (-1%).

Generally, researchers have found that increases in the proportion of forest cover around wetlands correlates to increases in forest species richness and diversity. For instance, areas with higher proportions of forest canopy within 1 km of forested wetlands often have higher species richness of forest amphibian species (Knutson et al. 1999, Herrmann 2005).

Large forest patches within low forested areas can be considered refugia for species that remain and highly important to dispersal, migration and other ecologic functions. Connectivity and dispersal corridors are of major importance for sustainable biological diversity.

Birds are indicators of the environment and that is why Partners in Flight Landbird Conservation Plan (2016) https://partnersinflight.org/resources/the-plan/ states that: "Forest landowners often implement management practices for biodiversity conservation such as retention of snags, downed wood, and trees with wildlife benefits. Additional practices, including vegetation buffers for water quality protection, also benefit birds. Regular forest management practices, such as clearcutting, thinning, natural regeneration and replanting, often create forest conditions that mimic natural disturbance and forest succession and support many declining species."

Oak regeneration and lack of age class diversity (specifically older and younger forests) were stressed by partners and members of the Indiana Forest Stewardship Coordinating Committee at their 2017 and 2018 meetings as having increased importance since the 2010 Forest Action Plan.

Recreation

The availability of land for public recreation is an important issue for Indiana's forest stakeholders. Recreation, similar to the wood products industry described below, is a significant driver of conservation, research and federal monies dedicated to forests. Both issues offer an opportunity to link economically to the values and benefits that woodlands provide.

Inherent in recreation is the opportunity to address other important and identified forest issues: inadequate public education about forests, overpopulation of white-tailed deer and inadequate youth education about forests. Public and youth education about forests is enhanced and made relevant with increased outdoor experiences. Hunting is a major component of recreation that offers perhaps the only viable method to control deer populations.

In correspondence to contribute to the Forest Action Plan, Backcountry Hunter's & Anglers provide the following information: "As fishing and hunting number continue to decline and the population of Indiana become more urban, there will be a greater demand from the public for recreation and a greater need for State Forests to use recreation to create public support. Indiana (especially the Southern regions) has a great potential for providing recreation that will improve the quality of life for Hoosiers and drive economic development through tourism."

"With approximately 4% of Indiana's land base in public ownership, we are a state that is critically conservation challenged, a factor that contributes to our consistently low national quality of life ratings relative to the nation at large. The Conservancy and our partners will address the issue by significantly increasing the protection of ecologically important land and waters to enhance ecological services and recreational opportunities to Hoosiers across the state. We will lead by example relative to threats to public and private conservation lands."

Wood products

Sustaining Indiana's forest products industry is an issue that stakeholders are concerned about. This section is generally concerned with assessing the importance of forestlands in relation to the provision of a specific ecosystem service, timber production.

Because society demands wood and wood products for a multitude of uses, economic value is assigned to the standing timber that provides the raw material. For Indiana's forests, this is arguably the most important link to an economic system within which forests accrue annual costs of management, oversight and property taxes. Until additional markets for ecosystem services, like the provision of clean water or carbon sequestration, are developed, the harvest and sale of timber will likely continue to be the main contributor to the economic value of forestland, along with other practices like maple sugaring and hunting leases.

Speculative investment in forests for associated development land values that are based on the future parcelization and conversion to another land use are not assessed in this document.

Forestry and wood product manufacturing is a $10 billion industry that employs more than 70,000 Hoosiers, and Indiana has developed a global reputation for excellence in hardwood tree production and product manufacturing; however, growing increasing substitution by plastics and other imitation products as well as competition from wood product manufacturers in Asia, Latin America and elsewhere threatens the viability of Indiana's hardwood industry.

Seeking to differentiate Indiana's environmentally sound, high-quality and legally-sourced wood products has resulted in a branding effort called "Premium Indiana Forest Products." Also some Indiana companies have embraced third-party certification of forest products through groups like Programme for the Endorsement of Forest Certification (PEFC), Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC). Third-party certified sustainable forests represent a significant but decreasing share of the managed forests in Indiana, mostly through the state-sponsored FSC certification under the group umbrella for Indiana Classified Forest & Wildlands. This decrease is largely due to the generally accepted legality and sustainability of US hardwoods (Seneca Creek Study) and a lack of consumer demand for and premium price for certified hardwood products.

Indiana has ranked first nationwide in recent years in the production of wood office furniture, wood kitchen cabinets, and hardwood veneer, along with several other products. As small family-owned businesses, wood products companies average fewer than 50 employees and play an important role in rural communities. The Division of Forestry has fostered efforts to connect disparate groups by creating and maintaining a forest commerce website, The Indiana Forestry Exchange: www.inforestryx.com

Distance to sawmills, primary and secondary manufacturers who are the major purchasers of standing timber and delivered logs for processing is an important component of this issue. Transportation costs for timber production and marketing and 30-90 mile radius is often used in the industry to assess costs.

Biomass can be a relative indicator of potential timber and other industrial use but is not necessarily related to an area's productive capacity. The measure of an area's productive capacity (site index) is not accurately and consistently available on a statewide basis.

Public lands are important because their larger overall areas offer greater opportunity for landscape scale continuity in management and relative economies with respect to harvesting practices.

The Classified Forest and Wildlands program, initiated in 1921 by the State of Indiana encourages timber production, watershed protection, and wildlife habitat management on private lands in Indiana. Program landowners receive a property tax reduction in return for following a professionally written management plan. The program remains open to enrollment year round by contacting a local State District Forester.

There are currently about 823,000 acres enrolled as Classified Forests and Wildlands, representing approximately 16.4% of forests in Indiana. These private properties reflect a commitment to the retention of forestland and the maintenance of sustainable working woodlands. These properties are a supplier of timber for the state's wood product needs. The Indiana DNR estimates that these properties annually harvest 30-35 million board feet of timber.

Lt. Governor Suzanne Crouch unveiled a new economic development strategy to grow the state's hardwoods industry on February 5, 2019. The strategy was commissioned by the Indiana Department of Natural Resources, the Indiana Hardwood Lumbermen's Association and the Indiana State Department of Agriculture, and was completed by DJ Case & Associates, Purdue Center for Regional Development, Purdue University Department of Forestry and Natural Resources, and Purdue Extension.

To grow the state's hardwoods industry, the strategy identified three key focus areas: business development, education and marketing.

Some of the specific initiatives under these areas include strengthening Indiana's existing hardwoods industry by expanding current processing, attracting new companies to the state, educating consumers and businesses on the sustainability of the hardwoods industry, reducing leakages and developing an ongoing campaign to promote the value of hardwoods.

The Indiana Hardwood Strategy also created an Indiana Hardwood Interactive Map that was developed by the Purdue Center for Regional Development, this interactive map of nearly 4,500 businesses in the hardwoods and forest products sectors. Establishments are shown as dots of varying sizes dependent on the number of jobs in the business. The usual mapping features of zoom-in, zoom-out, linear distance measurement, and exporting into various image types are available. A click on any dot (business establishment) produces a pop-up feature with various details about the establishment including name, physical and web address, line of business, industry type, and more. Link to the map is provided in the Appendix.

High cost of forest ownership and low incentives to retain

Costs of forest ownership can be substantial, especially when owners are faced with management costs associated with invasive species. Forest establishment, seedling purchase, weed management, boundary marking, timber stand improvement, invasive control, access-road installation, harvest costs, property tax, severance tax and estate tax can all play a part

among other things and, depending on the condition of the forest land considered, in determining the cash outflow relating to forest property ownership.

As discussed in the Wood Products section above, in Indiana the main and most significant economic value associated with woodland ownership is derived from the management and harvest of timber. Currently, there are a number of other potential revenue streams associated with forestland, like maple syrup production, forest herbs and fruit, and hunting leases, but overall across the state none of these is as substantial an economic opportunity compared with potential long-term timber values.

Demographic patterns in forest ownership can have particular influence when there are transfers of ownership. Often, properties are divided at this time and estate tax assessments influence the remaining property structure, goals and forest quality.

There are a few counties in Indiana that require additional government paperwork, fees and permits prior to timber harvest and limit harvests in urban/suburban areas. Ordinances of this type can be burdensome to landowners and are sometimes barriers that prevent recommended management from occurring. Regulations of this type may also prevent reforestation efforts or tree planting projects from occurring as suburban sprawl may occur adjacent to plantations that require 85 plus years to reach maturity.

Overpopulation of White-tailed deer

The overpopulation of White-tailed deer is an important issue for many forest stakeholders. The overriding concern is the preservation and maintenance of a diverse and healthy native understory of trees and vegetation that will in succeeding generations determine the composition of the dominant canopy. An overpopulation of deer will limit the biological diversity of an area, denude the understory of choice forage, like oak seedlings, and favor a population of generally unpalatable exotic invasives.

Deer are also a particular concern for those landowners planting and establishing seedlings in forest regeneration or orchard settings. Next to weed pressure, deer browse can be the major factor determining success or failure in these efforts. White-tailed deer are managed by the Indiana DNR, and their populations are controlled mainly by seasonal hunting. Records and locations of deer collisions are recorded by State Police and influence the general cost of automobile insurance in the state.

As described by the Backcountry Hunters & Angers in correspondence contributing to the Forest Action Plan: “Participating in hunting has steadily declined in Indiana for at least 10 years. In 2006, more than 550,000 hunting licenses were sold in the state. That number was down to less than 440,000 in 2016. This presents a major issue as hunting license sales fund a large portion of conservation efforts through the Indiana DNR.” It also means that there are less people to manage an increasing deer population and that younger generations are increasingly not being exposed to the traditions as they were in the past.

Urban Forests

About 80% of Hoosiers live in an urban area. Urban forests include city parks, street and yard trees. Canopy cover is an important component of the urban forest. Leaf surface area directly correlates with the benefits of street trees. The greater the leaf surface area exhibited by a tree, the greater the benefits a particular tree is likely to provide to a community. Trees with large leaves and spreading canopies tend to produce the most benefits.

Street trees and urban forests provide ecological services that include 1) reduced air pollution, 2) storm-water control, 3) carbon storage, 4) improved water quality, and 5) reduced energy consumption. Other, harder-to-quantify benefits include increased job satisfaction, faster recovery time for hospital patients, and improved child development, among other things. Also, aesthetic values associated with increased urban canopy contribute to higher property values. (Kane, 2009)

Statewide urban forest analysis has found that the state has a large number vacant street tree planting spaces and a lack of overall street tree diversity, the vast majority being maple. Street trees and urban forests were highly impacted by the loss of ash to the emerald ash borer. Three of the 11 most common urban tree species are not native to Indiana. Urban forests also are significantly impacted by invasive species.

According to Purdue Forestry & Natural Resources (FNR), the most recent statewide Indiana urban forest inventory showed a high percentage of maple species (35- 42%). 58% of all trees were in good functional condition. This survey was done prior to the majority of Emerald Ash Borer impact and ash were about 15% of canopy. Total urban tree canopy was about 20% of possible urban areas and nearly all urban forests inventoried were mature to over-mature.

The following information provided by Purdue FNR to the Forest Stewardship Coordinating Committee for their 2017 meeting, describes further the importance of urban forests: “High intensity land use patterns and increasing pressure on water resources demands creative stormwater management. Trees dissipate the energy of falling raindrops to help prevent erosion and buffer intense rainfalls. Urban tree roots have the potential to penetrate compacted soils and increase infiltration rates in open space areas, stormwater basins and subsurface stormwater storage (structured soil). Uptake of water from trees limits the volume of runoff discharged downstream, and their canopies offer interception of rainfall and shading (cooling) in an urban environment. Trees also absorb nutrients that could otherwise run off to local receiving waters.

Incentives for implementing trees for stormwater management can include providing stormwater management credit in development or redevelopment rules. Some metro watershed districts are considering allowing credit for the interception of rainfall by trees.

In addition to regulatory tools and design detail modifications for development and redevelopment, financial incentives can encourage private landowners to plant trees on their property. These incentives can take many forms, ranging from free or low cost seedlings or other native tree stock to financial rebates or reduced fees offered by utilities or local governments. Tree seedling giveaways may be coupled with educational programs and may also coincide with nationally recognized days such as Arbor Day. Various utilities across the country offer incentives to preserve or plant trees in certain areas of the yard to maximize their cooling benefits.”

The Indiana Urban Forest Council was dissolved since the last the Forest Action Plan but the Indiana urban forestry community has made efforts to reorganize its collective voice. They hosted an Urban Forest Symposium in September 2019.

Climate Change

Climate change is increasingly impacting Indiana and resulting in wetter winters where the ground does not freeze solid for long periods, longer summer droughts and increasing numbers of days that are over 90 degrees. It is also resulting in some warmer winters that enable certain insect populations to have increased numbers of breeding cycles such as occurred with, tulip tree scale in the 2010s. Forests thus face challenges such as the tulip tree scale epidemic that was followed by a significant summer drought during 2012, severely impacting Indiana's state tree populations in the south central area of the State.

At the wider scale, forests play an important role in the carbon cycle and store carbon in their biomass. According to the Center for International Forestry Research website https://www.cifor.org/forests-and-climate-change/, forests are also "important for reducing [climate change's] current and future effects on people. For example, forest goods tend to be more climate-resilient than traditional agriculture crops and so when disasters strike or crops fail, forests act as safety nets protecting communities from losing all sources of food and income. They also regulate waterways, protect soil, cool cities and entire regions, and more."

A publication by Purdue University, *Indiana's Future Forests: A Report from the Indiana Climate Change Impacts Assessment*, details how Indiana forests will respond to climate change over the next century. According to its summary materials, "expected changes include shifts in the distributions and abundances of trees, understory plants and wildlife, as well as changes in the environmental, economic and cultural benefits these forests provide." A link to the full report is provided in the Appendix below.

Continued Public Disconnect from Forests and Forestry

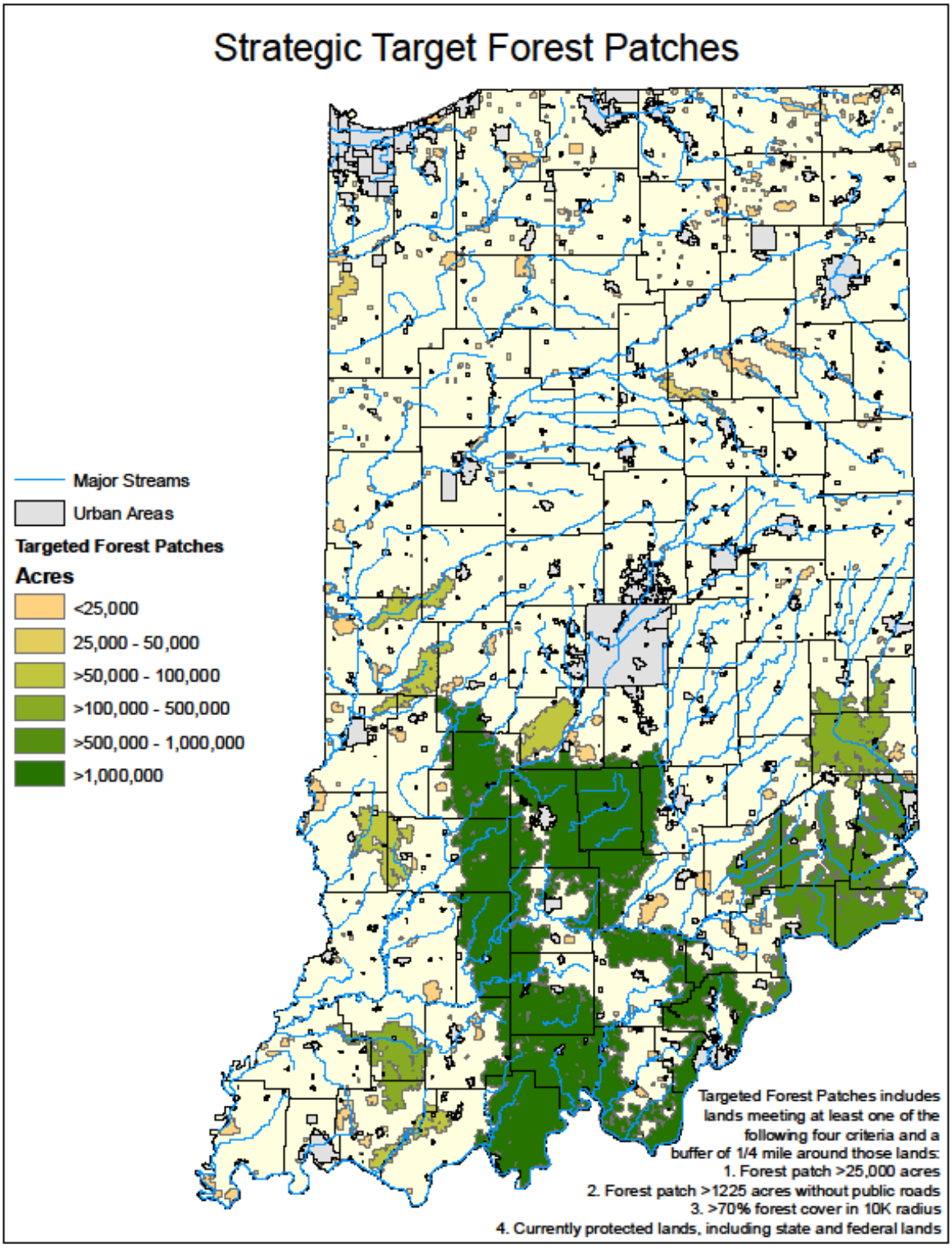
The general public is increasingly urban and suburban in population. Direct understanding of forests through exposure and interaction are decreasing. This trend is increasing among younger generations. People continue to value trees and forests but are not intimately connected with them in the ways that previous generations were: collecting firewood, milling their own lumber, harvesting hickory nuts and butternuts in the fall, etc. A large number of Hoosier adults have grown up in areas outside cities and have seen suburban landscapes of strip malls and single family housing divisions consume the more rural aspects of the areas where they grew up. These Hoosiers are rightly concerned with protecting forests but because of the generations of disconnect they can become convinced that forest management is a problem. Indiana forests do not need protection from forest management at all compared to how much they need protection from conversion to another land use. In fact, we know based on experience that even the most abused forests are able to recover and transition to healthy stands as over 80% of our 5 million acres of forests have done in the last century.

A number of partners and stakeholders expressed concern with declining public support and funding for natural resources agencies. The Indiana Division of Forestry's budget around the time of the last Forest Action Plan was about $12 million per year. It has decreased by about 27% since then. The most recently passed budget allocates about $8.7 million per year. The Division of Forestry has lost positions since 2010 and currently has 17 open staff positions which represents staffing levels at about 86%.

Priority & Multi-state Areas

Strategic Target Forests

Prioritization is important for this cooperative effort. The Indiana Strategic Target Forest Patches are areas or regions of the state that are a priority for conservation and stewardship. They remain unchanged from 2010 Forest Action Plan.



Strategic Target Forest Patches were developed from the Indiana Statewide Forest Assessment's Composite Priority Landscape Areas map that was the result of a geospatial analysis compiling multiple maps or data layers together for forest issues to form an a series of "issue maps." Further information explaining this process can be found in the 2010 Indiana Statewide Forest Assessment https://www.IN.gov/dnr/forestry/files/fo-Assessment_6_2010.pdf.

Multi-state

There are many existing and potential multi-state forestry related conservation efforts and partnerships that involve Indiana. The following list identifies certain areas and issues for existing and potential multi-state efforts.

"Multi-state areas of concern to HEC primarily include waterways that cross or form state boundaries, and the value of protecting/restoring riparian buffers which can reduce the pollutant loads reaching these waterways, such as the Kankakee River, Maumee River, Wabash River, Ohio River, and Indiana tributaries of Lake Michigan."

- Central Hardwoods Region
- White Oak Initiative
- Young Forest Initiative
- Moraine Forests in Northern Indiana
- Bird Conservation Region 22: Eastern Tallgrass Prairie
- Bird Conservation Region 23: Prairie Hardwood Transition
- Bird Conservation Region 24: Central Hardwoods
- Great Lakes Regional Collaboration
- Ohio River Corridor Initiative
- Big Rivers Fire Compact
- Karst Areas
- Chicago/Gary, Chicago Wilderness
- Wabash River Valley
- Invasive Plants, Cooperative Weed Management Areas
- Invasive Insects and Diseases: Gypsy Moth, Emerald Ash Borer, Oak Wilt and others
- Oak Regeneration
- Upper Midwest and Great Lakes Landscape Conservation Cooperative
- Bird Conservation Joint Ventures, Central Hardwoods Joint Venture
- Call Before You Cut

Long-term strategies to address threats to forest resources in Indiana

This Forest Action Plan is the result of input from natural-resource professionals, landowners, conservationists, land stewards and forest stakeholders. It updates the *2010 Indiana Statewide Forest Assessment & Strategy* and addresses the most important issues that increasingly threaten the sustainability and ecological capacity of Indiana's forests to provide the benefits of clean air, carbon sequestration, soil protection, wildlife habitat, wood products and other values, goods and services to all Hoosier citizens. None of these issues are new and the Indiana forestry community's response continues to evolve. There are current programs in place and efforts underway that are making progress on each of these issues. It is hoped that the Forest Action Plan provides further direction and support as well as greater coordination for these

efforts underway and facilitates partnerships and cooperative effort towards what is most pressing.

The strategies and action steps below are consistent with the USDA Forest Service National Priorities: conserve and manage working-forest landscapes for multiple values and uses, protect forests from threats and enhance public benefits from trees and forests.

The Forest Action Plan should be considered a living document. Further effort will be needed to prioritize, assign responsibility and determine timeframe and measurement criteria for various Action Steps in order to effectively implement. Adaptation and evolution of the Forest Action Plan are considered required and appropriate responses to changing conditions described in the forest issues and trends section above. The Forest Stewardship Coordinating Committee shall be a leader in implementing the below strategies but individual partner organizations are encouraged to take actions on their own if possible and notify the committee of the effort towards our common goals. These strategies and action steps are meant as guidance and not intended to be fixed or inflexible. Their accomplishment will be the result of the Indiana forestry community's shared effort.

These strategies do not necessarily represent the opinions of the Indiana Division of Forestry and or the Indiana Department of Natural Resources (DNR). The DNR and Division of Forestry recognize the leadership that the Forest Stewardship Coordinating Committee has provided in developing this plan and the importance of a strong community of forest stakeholders in Indiana. DNR supports the overall intent of this Forest Action Plan and the vast majority of the action steps detailed below.

The overarching goals of the strategy are:

- Conserve, manage and protect existing forests, especially large forest patches, with increased emphasis on oak regeneration
- Restore, expand and connect forests, especially in riparian areas
- Connect people to forests, especially children and land-use decision makers, and coordinate education training and technical assistance
- Maintain and expand markets for Indiana hardwoods, with special focus on secondary processors and promoting the environmental benefits of wood products to local communities and school groups
- Double the size of Indiana's urban forest canopy with a focus on native species diversity and community and youth stewardship

The following action steps are a prioritized means of achieving the above goals and a future desired forest condition: diverse, healthy and resilient forests that will continue to provide the ecosystem services we currently value for future generations.

Strategy 1: Conserve, manage and protect existing forests, especially large forest patches, with increased emphasis on oak regeneration

Action Steps

1.1 Increase funding for and promotion of programs that provide financial incentives for forest conservation

- Increase State Division of Forestry funding to administer programs, especially increase district forester staff levels
- Increase funding for forestry management activities under federal cost share program (CRP, EQIP, etc.)
- Give preferential access to cost share incentives for CFW enrolled lands

1.2 Work with counties, cities, planners and developers to promote retention of working forests and encourage development in areas that are already developed/incentivize density in development and the use of existing infrastructure corridors. This includes the use of forests as urban green infrastructure.

1.3 Promote working forest conservation easements and cooperate with and or leverage any farmland preservation efforts where interests align, consider expanding or adopting practices used in Harrison County Land Conservation Program https://harrisoncounty.IN.gov/index.php/residents/environment/harrison-county-indiana-land-conservation-program. Collaborate with land trust community to conserve forestland with working forest conservation agreements.

1.4 Increase use of disturbance on the forest landscape in conjunction with other efforts to facilitate oak regeneration and recruitment

- Increase use of fire in forest management
    - Develop cooperative prescribed fire groups (Indiana Prescribed Fire Councils) for private landowners
- Increase the use of shelter-wood harvest, group selection openings and clear cuts where possible
- Supplement natural regeneration with plantings of bare root seedlings and use deer protection where possible
- Increase coordination with The White Oak Initiative https://www.whiteoakinitiative.org/

1.5 Increase young forests and early successional habitat across landscape

- Expand and develop Southern Indiana Young Forest Initiative
- Partner more closely with other regional Young Forest Initiatives

1.6 Maintain rigorous and vigilant survey and monitoring efforts as well as slow the spread and awareness campaigns to protect trees from insect and disease outbreaks including: gypsy moth, oak wilt, Beech Bark Disease, Beech Leaf Disease, Laurel Wilt, Hemlock Woolly Adelgid, Asian long horned beetle, spotted lanternfly, thousand cankers disease, sudden oak death and others

- Increase use of artificial intelligence and remote sensing where possible to leverage technological advances in early detection and rapid response
- Continue the Gypsy Moth Slow The Spread Program
- Increase the capacity of Indiana Division of Forestry's Forest Health Section to provide information, education, survey, and management assistance to the public and private sectors

1.7 Develop, modify and promote programs that use property tax incentives to discourage parcelization of forests

- Strengthen requirements for Classified Forests & Wildlands Program (CFW) enrollments to follow management plan
- Reevaluate the financial penalty for withdrawal or carve outs from CFW
- Incentivize CFW enrollments to more permanently protect their working forestlands by creating working forest conservation easements

1.8 Increase ability to pass forests to next generation without parcelization by providing successional planning information, training and resources to landowners to facilitate a smooth and sustainable transition of property to the next generation
1.9 Develop effective and efficient techniques to support and assist small acreage landowners (<10 acres of forest)
1.10 Increase the percentage of forests in the age class of <19 and >100 years old

- For <19 year old age class, follow action steps above for young forests and early successional habitat across landscape
- For >100 years old, increase recognition of public lands where forests are unmanaged or managed for their late successional, climax forest attributes, such as nature preserves and in State parks and encourage private sector to develop recognition program for old forests on private forestlands

1.11 Secure permanent and significant annual funding to an Indiana Woodland Restoration program and Forest Restoration Fund. Funds should provide cash incentives for timber stand improvement, afforestation/reforestation, forest erosion control and best management practices (BMPs) including invasive plant control and other forest restoration activities.
1.12 Engage university to develop detailed Indiana land use study in that highlights forests most under threat for conversion to another land use and provides guidance and methods to ensure their conservation and an increase of working forests on the landscape

Strategy 2: Restore, expand and connect forests, especially in riparian areas

Action Steps
2.1 Increase forest cover as a land use by 1,000,000 acres over the next 10 years

- Encourage counties to set local targets for expanding forest cover, increase 20% by 2030
    - Provide county planners, local level economic development offices and other resources and tools to assist in identifying, retaining and expanding working forests
    - Develop recognition programs for county success
- Increase forest land in public ownership
    - Develop and promote programs that encourage and or provide incentives for private landowners to beneficiary deed ownership to public agencies, especially for adjacent landowners or in-holdings
    - Expand funding from the general assembly for the President Benjamin Harrison Conservation Trust and or support efforts that create new sources of funding through governments that are dedicated to spending on and investing in conservation
    - Increase efforts that provide a third party (oftentimes a land trust) funding and eventual transfer to public ownership
- Provide increased targeted incentives to convert marginal or unproductive farm ground to forest cover
- Provide incentives for landowners to convert mowed areas to planted trees, especially species that do not successfully establish through natural succession (i.e. plant bottom land oaks, not sycamore and cottonwood)
- Increase number of trees available through the State Nursery System
    - Develop and effectuate plan to ensure acquisition of required amount of local seed even in years where seed production is affected by regional disturbance such as a late frost with efforts to ensure that seed sources are of the highest quality or

improved selections. Make effort to provide seedlings for every prospective sale and not sell out of species early in order season
    - Develop smaller count bundles (with appropriate pricing) for sale at State Tree Nursery and to target tree planting in residential and urban areas
- Actively develop and increase private sector participation/partnership

2.2 Reduce the impact and spread of invasive species

- Increase coordination of invasive species efforts at the state level among DNR divisions, Board of Animal Health, Indiana Department of Transportation and other agencies to ensure that control practices are prioritized, targeted and effective
- Ensure coordination between State-level (above), Invasive Species Council, Federal and other partners involved in invasive species regulation, management and funding
- Develop or expand promotional campaigns on the negative consequences of those invasive species in the nursery trade (like Callery Pear and Burning Bush) that did not make the Terrestrial Plant Rule (312 IAC 18-3-25) because of their importance as a revenue source to the nursery trade and or modify or increase the rule to include those species.
- Promote and expand efforts to develop county-level invasives groups (CISMAs – Cooperative Invasive Species Management Areas) that are self-sustaining, locally led
- Increase the use of Invasive Species BMPs prior to and in conjunction with timber harvest
    - Add the Invasive Species BMPs to future printings of the Forestry BMP field guides

2.3 Support, develop and increase efforts to restore species historically more abundant in Indiana forests like American chestnut, butternut and ash

- Begin immediate propagation program through grafting of lingering ash trees
- Partner with SUNY ESF American Chestnut Project to introduce plantings of their blight-tolerant American chestnut trees
- Support efforts at the Hardwood Tree Improvement & Regeneration Center to develop propagation strategies for these and other important species to the Central Hardwoods Region
- Increase work in Ash species resistance/tolerance to Emerald Ash Borer through location of Lingering Ash trees, develop in tree improvement program, conduct progeny test of resistant/tolerant species, collect seed from lingering ash trees, develop seed orchards, treat forest ash trees to maintain a seed source in state parks, state forests, and nature preserves with goal to develop resistant/tolerant ash species for rural and urban forest restoration

2.4 Advocate for reduced deer populations

2.5 Develop a new program or cooperative effort with DNR Fish & Wildlife to ensure that forest landowners (especially those with detailed forest management plan) seeking to restore oaks in their forest understory or open plantings are able to protect plantings and young seedlings from deer with l lethal force and without undue processes for approval

2.6 Targeting watersheds that drain excess agricultural nutrients, create special and permanent incentives to buffer riparian corridors with forests to filter agricultural chemicals, nutrients and sediment before entering river systems

2.7 Encourage farmers to use install and maintain native hedgerows along field margins, including through hedgerow practices in the Environmental Quality Incentives Program

2.8 Develop study that focuses on forest conservation in Northern Indiana and provides special guidance and strategies to conservation partners operating in that unique area

2.9 Increase promotion of federal programs for planting trees in agricultural areas that frequently flood while also promoting tree species for planting projects that do not readily establish themselves (as mentioned in other action steps)
2.10 Discourage the planting of species that readily establish themselves in federal funded and private sector tree planting programs

Strategy 3: Connect people to forests, especially children and land-use decision makers, and coordinate education training and technical assistance

Action Steps
3.1 Increase enrollment and expand the Indiana Natural Resources Teacher Institute Program
3.2 Promote the creation of and use of outdoor labs at schools throughout Indiana
3.3 Develop student or school tree identification initiatives and provide awards and recognitions for school accomplishments on getting past the "green wall", a term that means all plant life looks the same and is recognized as similarly beneficial or without unique attributes
3.4 Develop program that gets professional foresters into Indiana elementary and high school programs to deliver engaging program and includes outdoor experiences with trees around school grounds without the need for bussing/field trip
3.5 Develop specific outreach programs about forestry and forest management for birders
3.6 Expand the use of Project Learning Tree in Indiana schools, provide dedicated full time employee to concentrate solely on this effort
3.7 Partner directly or through other partners with the Indianapolis Zoo, Ag education programs and National FFA Organization to engage students and teachers
3.8 Improve access to forestry knowledge and technical information by continuing to utilize an expanded series of "demonstration forests" in cooperation with private landowners, conservation organizations, community forests and others to serve as examples of good forest management.
3.9 Continue to support the publication of the Woodland Steward magazine, expanding its distribution and improving its web accessibility
3.10 Develop or expand programs that encourage forest natural resources education tied to state curricula that occur outdoors on forests at State DNR properties or partner properties. Consider pilot program with at least 1 full time school bus with dedicated educator that can be reserved by schools at no cost that can serve Indianapolis and doughnut county region
3.11 Use effective and proven tools to conduct landowner outreach, like TELE – Tools for Engaging Landowners Effectively
3.12 Expand and promote Educational grant program at Indiana Forestry Educational Foundation, seek pass through funding from national public and private sector sources
3.13 Develop an Indiana Center for Agroforestry to promote, develop and leverage agroforestry solutions for Indiana farmers and landowners, use University of Missouri's center as a model
3.14 Make special effort to develop corporate and business partnerships in the implementation of these strategies and action steps but especially in this strategy, connecting people to forests, consider programs like Walmart Acres for America and approach Indiana based manufacturers for support
3.15 Provide incentives or free logger education for Cutter Training all levels and Indiana Forestry BMPs
3.16 Continue to support the Hardwood Ecosystem Experiment (https://www.heeforeststudy.org/)
3.17 Make special effort to engage women and minorities in Forest Action Plan strategies and to develop more diversity among natural resource professionals in Indiana, especially seek to encourage connection to forests and trees among the most urban aspects of Indiana society

3.18 Coordinate with Invasive Species Council on management of forest related species management and awareness
3.19 Increase tours of forest management areas, harvest sites, to promote recognition that forests do not disappear with management, land use does not change, they are not turned into parking lots
3.20 Complete Knobstone Trail and establish sustainable, long-term support for the resource as a national-class trail and hiking destination that fosters strong connections to all forest age classes and the diverse forest types in Southern Indiana
3.21 Support the creation of "food forests" in Indiana, especially those that use primarily native species and connect large numbers of people to trees and forests. A food forest is defined by Wikipedia as "a low-maintenance, sustainable, plant-based food production and agroforestry system based on woodland ecosystems"
3.22 Work with recreation groups to expand promotion of forest based recreational opportunities like mountain biking, photography, mushroom hunting, hiking and new or non-traditional uses like forest bathing and foraging
3.23 Encourage foresters to participate in the Project Learning Tree and Society of American Foresters online short course – Teaching Youth and Communities About Forests – to help strengthen outreach and education efforts to youth and adults
3.24 Connect communities and young people to forests and sustainable forestry through mobile educational unit that can visit schools, festivals and other community events (also see "Wood Bus" action step)
3.25 Promote the National Arbor Day Foundation's Tree Campus USA for colleges and universities and Tree Campus K-12 programs
3.26 Provide opportunities to have positive forest experiences in communities where people live
3.27 Promote the physical and mental health benefits of immersive forest activities
3.28 Promote playgrounds made with hardwoods or natural products over products made from non-renewable resources (nature play spaces)

Strategy 4: Maintain and expand markets for Indiana hardwoods, with special focus on secondary processors and promoting the environmental benefits of wood products to local communities and school groups

Action Steps
4.1 Develop and implement an Indiana "Wood Bus" similar to the Pennsylvania WoodMobile https://www.agriculture.pa.gov/Business_Industry/HardwoodDevelopmentCouncil/Woodmobile/Pages/default.aspx that is a traveling exhibit providing information on the Indiana's forest resource and the state's forest products industry as well as educational materials on forest management and sustainability
4.2 Support and promote bringing the "Forests Forever" museum exhibit to the Indiana State Fair
4.3 Highlight the vibrant forest products Industry and sustainable forestry and logging community in Indiana by hosting a Wood Pro Expo or some similar event in Indiana biannually, developing on ideas and lessons learned at the 2019 Hoosier Hardwood Expo in Cloverdale
4.4 Provide increased programs on marketing hardwood logs and trees for landowners, work in cooperation with Indiana Tree Farm and primary industry groups to provide information on forest management and log utilization, pricing, etc.
4.5 Ensure secondary processors are provided with a robust supply of local raw materials by connecting landowners and primary wood processors with secondary processors using online tools, database and mapping applications

4.6 Promote Indiana hardwoods at domestic trade shows, actively recruit companies to locate in Indiana and tout Indiana hardwoods as the "green material" of the 21st century, healthy for homes, etc.
4.7 Consider developing state-level certification scheme similar to Programme for the Endorsement of Forest Certification (PEFC) in France that provides certainty of a wood product's legality and sustainability
4.8 Increase the development of new products from hardwoods and their by-products and promote new uses of hardwoods like in cross laminated timber applications and through thermal modification
4.9 Promote the use of Indiana hardwood with local architects and builders
4.10 Encourage the public institutions and State government of Indiana and the organizations to which it provides funding to use Indiana hardwoods wherever possible in renovations or new construction, Indiana hardwoods should be given increased credit in competitive projects due to their environmental sustainability over fossil fuel based products.
4.11 Promote and implement the Indiana Hardwood Strategy
4.12 Engage Indiana's forest products industry to take a more active role in forest land conservation efforts
4.13 Provide sufficient funding for phytosanitary inspections in the forest products industry so that invasive pests and diseases are not spread through soil or other contaminants
4.14 Encourage the "tall wood buildings" movement and encourage the construction of demonstration in Indiana using cross laminated timber (CLT) and or hardwood cross laminated timber HCLT
4.15 Seek out or develop new markets for mill residues (primarily chips) as less paper is being used worldwide
4.16 Develop programs and initiatives to foster employee recruitment and retention in the forestry and wood products industry

Strategy 5: Double the size of Indiana's urban forest canopy with a focus on native species diversity and community and youth stewardship

Action Steps
5.1 Provide assistance to communities to accurately analyze and interpret their forest Urban Tree Canopy (UTC) Cover data, develop and implement increased forest canopy goals

- Provide incentives for communities to set canopy cover goals and coordinated plans to achieve those goals
- Coordinate with local universities, established non-profits to
    - predict outcomes of specific goal setting steps
    - measure progress based on community efforts
    - quantify community benefits based on canopy efforts that are applicable across municipal management and planning programs
- Increase private sector participation/partnership in urban canopy retention/growth

5.2 Develop community programs that engage young people in tree planting, care and maintenance
5.3 Incentivize urban tree plantings that reduce areas of mowed turf grass and replace with appropriate native tree species
5.4 Incentivize projects that preserve/ retain/ enhance existing urban tree cover and urban woodlots.
5.5 Facilitate training programs for municipalities to increase awareness of benefits, changes in practice and overall management of their urban forests
5.6 Support partnerships and innovative ideas that lead to enhanced urban forest management

5.7 Increase support for the DNR Community and Urban Forestry Program to provide communities with access to professional urban forestry technical assistance and promote awareness of urban forestry issues
5.8 Support professional and volunteer education and engagement activities to improve practice and safety in urban forest management.
5.9 Expand the Indianan Community Tree Steward training Program for volunteers
5.10 Support professional development of commercial arborists and arboriculture as a skilled trade
5.11 Promote species diversity in urban canopies to reduce susceptibility to forest pests and increase climate change and overall urban forest resilience
5.13 Promote the use of trees and urban forests in reducing carbon dioxide emissions, mitigating existing Co2, and meeting Co2/air quality goals where municipalities have set them
5.14 Promote the human mental and physical health benefits of increased tree canopy cover
5.15 Promote the importance of post-planting care and maintenance in growing healthy urban forest canopies
5.16 Promote the benefits of native large canopy tree planting in meeting community tree canopy cover goals and supporting wildlife
5.17 Work with Indiana Association of Counties, Indiana Chapter of the American Planning Association, Indiana Association of Cities and Towns (AIM), INDOT, Indiana Silver Jackets, Indiana Arborist Association, Soil & Water Conservation Districts, and the Northwest Indiana Regional Planning Commission in achieving these and other action steps
5.18 Promote/ Partner with the National Arbor Day Foundation and its affiliated recognition programs Tree City, USA Tree Campus USA, Tree Line USA Tree Campus k-12 and Tree Campus Healthcare programs in promoting tree planting and urban forest management in communities

Necessary resources

This section provides description of resources necessary for the State Forester to address state-wide strategies contained in the Forest Action Plan.

There will be significant resources necessary for the implementation of the Forest Action Plan beyond the approximately $8.7 million annual budget of the Indiana Division of Forestry which is down over 25% since the 2010 Forest Assessment and Strategy. Cooperative partner resources expand capacity for achievement. The USDA Forest Service State and Private Forestry has traditionally supplemented Division of Forestry's operating budget with about $1.5 million in grants and matched funds for cooperative programs and competitive projects. USDA funding levels for consolidated programs are changing annually, and shifting more and more to competitive, targeted project grants. The Division of Forestry, strategic partners and collaborative efforts intend to actively pursue and apply for grants from Federal agencies and from Federal, community and private foundations that can provide additional funding for this Strategy.

Coordination with Groups and Other Plans

This section details the efforts to develop the Forest Action Plan, coordinate with stakeholder groups and individuals and encourage stakeholder participation.

The Division of Forestry and the Indiana Forest Stewardship Coordinating Committee ("FSCC" or "Stewardship Committee") have conducted open meetings with key stakeholders to ensure that the Forest Action Plan (1) integrates, builds upon, and complements other state natural-resource assessments and plans, and (2) identifies opportunities for program coordination and integration. Notes and presentations from these meetings are available here: https://www.IN.gov/dnr/forestry/6252.htm

A first step in the development of the Forest Action Plan was the review of relevant literature. Documents were identified and reviewed for incorporation through consultation with the Stewardship Committee and posted the Division of Forestry webpage relating to the Forest Action Plan to facilitate stakeholder involvement and exchange.

Many of the Forest Action Plan's strategic recommendations and related priority forest areas, were developed from information in the Indiana Wildlife Action Plan. The Indiana Wildlife Action Plan contains a wealth of information on Indiana forest species and their habitat needs. It is accessible online through the Indiana Division of Fish & Wildlife's webpage and also linked below in the appendix.

Stakeholder Involvement

The Forest Stewardship Coordinating Committee, an established group representing a broad range of forestry interests in the state, has participated in the stakeholder process to develop this document along with Indiana DNR Divisions, USDA Natural Resource Conservation Service, Ecological Services Office for the US Fish & Wildlife Department, Hoosier National Forest and other federal land management representatives and technical committee members.

A diverse group of stakeholders and individuals who have an identified interest in forestry or forestland use was invited to participate in strategy sessions and meetings to update this document in 2017-2018. Records of those meetings are available here: https://www.IN.gov/dnr/forestry/6252.htm. More than 50 stakeholder organizations had members participate in this process to refine important forest issues and contribute their thoughts on strategic actions. Meetings attempted to refine and clarify the most pressing issues faced by Indiana's private, public and urban forests. Stakeholders also contributed their visions of a desired future forest condition and discussed the implications of priority landscape areas.

The Indiana Forest Stewardship Coordinating Committee has been a successful organizing body and platform to engage a wide range of forestry interests and enable sharing of concerns for the condition and future of diverse Indiana woodlands.

A detailed list of the groups that participated in the 2017-2018 meetings of Forest Stewardship Coordinating Committee can be found on that committee's webpage maintained by the Division of Forestry.

Document Review Process

A draft of the Forest Action Plan 2020 Update was available for public review for 8 weeks over the winter 2019-2020. The document was available online and also links or PDF files were sent via email to forest stakeholders who had requested to review a copy via stakeholder outreach

webpage. These were also e-mailed to an open list of stakeholder groups and individuals assembled for this process and including the Forest Stewardship Coordinating Committee. The Division of Forestry received [update] written responses through the document review process and incorporated suggestions where possible to improve the content. Names of the individuals that submitted written comments on the draft Forest Action Plan are included in the appendices. Review comments will be made available on the Division of Forestry's Forest Action Plan webpage.

Appendix A: References

Donovan, T. M., P. W. Jones, E. M. Annand, and F. R. Thompson, III. 1997. Variation in local-scale effects: mechanisms and landscape context. Ecology: 78(7): 2064-2075.

Duchamp, J. E., and R. K. Swihart. 2008. Shifts in bat community structure related to evolved traits and features of human-altered landscapes. Landscape Ecology, 23:849-860.

Hartley, M. J., and M. L. Hunter. 1998. A meta-analysis of forest cover, edge effects, and artificial nest predation rates. Conservation Biology, 12(2):465-469.

Hermann, H. L., K. J. Babbitt, M. J. Baber, and R. G. Congalton. 2005. Effects of landscape characteristics on amphibian distribution in a forest-dominated landscape. Biological Conservation, 123:139-149.

Knutson, M. G., J. R. Sauer, D. A. Olsen, M. J. Mossman, L. M. Hemesath, and M. J. Lannoo. 1999. Effects of landscape composition and wetland fragmentation on frog and toad abundance and species richness in Iowa and Wisconsin. Conservation Biology, 13(6):1437-1446.

Thompson, F. R., III, T. M. Donovan, R. M. DeGraaf, J. Faaborg, and S. K. Robinson. 2002. A multi-scale perspective of the effects of forest fragmentation on birds in eastern forests. Pages 8-19 *in* T. L. George and D. S. Dobkin, eds., Effects of habitat fragmentation on birds in western landscapes: contrasts with paradigms from the eastern United States. Studies in Avian Biology, 25.

Trzcinski, M. K., L. Fahrig, and G. Merriam. 1999. Independent effects of forest cover and fragmentation on the distribution of forest breeding birds. Ecological Applications, 9(2):586-593.

Appendix B: Links to contributing information and information resources

The Forest Action Plan focuses on the most important issues facing Indiana's forests. In an effort to provide additional information on topics that are not addressed in this Assessment or supplement the text, this section is provided with text and relevant links to other statewide plans, documents and organization websites. The information contained in this Appendix has contributed to the creation of this Assessment. These websites were last accessed in November of 2019.

Emerald Ash Borer Information Network
http://www.emeraldashborer.info/

Indiana Natural Regions Map (DNR – Homoya)
https://indiananativeplants.org/wp-content/uploads/Natural-Regions-Map2.pdf

Forever Forest Exhibit
https://northamericanforestfoundation.org/forever-forest-exhibit/

Indiana Natural Resources Teacher Institute
https://www.IN.gov/dnr/forestry/files/fo-NRTI_Information.pdf

Walmart's Acres for America
https://www.nfwf.org/acresforamerica/Pages/home.aspx

The Center for Agroforestry at the University of Missouri
http://www.centerforagroforestry.org/

Harrison County Land Conservation Program (HCC)
https://harrisoncounty.IN.gov/index.php/residents/environment/harrison-county-indiana-land-conservation-program

The White Oak Initiative
https://www.whiteoakinitiative.org/

Tools for Engaging Landowners Effectively (TELE): A Complete Guide to Designing Programs and Communications
www.engaginglandowners.org/guide

Indiana's Future Forests: A Report from the Indiana Climate Change Impacts Assessment
https://ag.purdue.edu/indianaclimate/forest-ecosystems-report/

Indiana Wildlife Action Plan (DNR)
https://www.IN.gov/dnr/fishwild/7580.htm

Hardwood Tree Improvement and Regeneration Center
https://htirc.org/

Indiana Division of Forestry
https://www.IN.gov/dnr/forestry/

The Woodland Steward newsletter
http://www.inwoodlands.org/

USDA Natural Resources Conservation Service
https://www.nrcs.usda.gov/wps/portal/nrcs/in/home/

Purdue Plant Pest Diagnostic Lab
https://ag.purdue.edu/btny/ppdl/Pages/default.aspx

Indiana Forestry BMPs (DNR)
https://www.IN.gov/dnr/forestry/2871.htm

Indiana Hardwood Strategy (ISDA, 2019)
https://www.IN.gov/isda/hardwoods.htm

Statewide Comprehensive Outdoor Recreation Plan (DNR)
https://www.IN.gov/dnr/outdoor/4201.htm

Future forests of the northern United States (USFS)
https://www.nrs.fs.fed.us/pubs/50448

National Woodland Owner Survey (USFS)
https://www.fia.fs.fed.us/nwos/

Indiana's Future Forests: Climate Change Impacts Assessment (Purdue University)
https://ag.purdue.edu/indianaclimate/forest-ecosystems-report/

Forests of Indiana, 2017 (USFS)
https://www.nrs.fs.fed.us/pubs/56667

Forests of Indiana, 2013 (USFS)
https://www.IN.gov/dnr/forestry/files/fo-IN_Forests_2013.pdf

Indiana DNR Classified Forests Report of Continuous Forest Inventory (DNR)
https://www.IN.gov/dnr/forestry/files/fo-Continuous_Forest_Inventory_Classified_Report_2013_2017.pdf

Hardwood Ecosystem Experiment publications (HEE)
https://heeforeststudy.org/publications/

Indiana Natural Heritage Database
https://www.IN.gov/dnr/naturepreserve/4746.htm

Lepidopteran Use of Native & Alien Ornamental Plants (Tallamy)
http://www.bringingnaturehome.net/

Hoosier National Forest Land Resource Management Plans
https://www.fs.usda.gov/main/hoosier/landmanagement/planning

DNR – Indiana Department of Natural Resources
http://www.IN.gov/dnr/

DNR Division of Forestry Strategic Direction 2015-2019
https://www.IN.gov/dnr/forestry/files/fo-State_Forest_Strategic_Plan_2015_2019.pdf

Indiana State Department of Agriculture – Strategic Plan
https://www.IN.gov/isda/3547.htm

Invasive Species Council
https://www.entm.purdue.edu/iisc/

Southern Indiana Cooperative Invasives Management
http://www.sicim.info/

Indiana Land Resources Council
https://www.IN.gov/isda/2357.htm

NRCS –Natural Resource Conservation Service
http://www.IN.nrcs.usda.gov/

Indiana Association of Soil & Water Conservation Districts
http://iaswcd.org/

S&PF – State and Private Forestry, section of United States Forest Service
http://www.fs.fed.us/spf/

Indiana Forest Stewardship Coordinating Committee
https://www.IN.gov/dnr/forestry/6252.htm

2010 Statewide Forest Assessment & Strategy
http://www.IN.gov/dnr/forestry/5436.htm

DNR – Community & Urban Forestry
https://www.IN.gov/dnr/forestry/2854.htm

USFS – United States Forest Service
http://www.fs.fed.us/

Hoosier National Forest
http://www.fs.fed.us/r9/hoosier/

National Priorities – State & Private Forestry
https://www.fs.usda.gov/about-agency/state-private-forestry

Indiana's Hardwood Industry: Its Economic Impact
http://www.IN.gov/dnr/forestry/files/fo-IHI_economic-impact.pdf

Sustainable Forestry Initiative (SFI)
http://www.sfiprogram.org/

Forest Stewardship Council (FSC)
http://www.fsc.org/

Programme for the Endorsement of Forest Certification (PEFC)
https://www.pefc.org/

U.S. urban forest statistics, values and projections
https://www.fs.fed.us/nrs/pubs/jrnl/2018/nrs_2018_Nowak_003.pdf

Indiana Trails Plan
https://www.IN.gov/dnr/outdoor/files/trailsplan2006.pdf

Indiana Monarch Conservation Plan
https://www.indianawildlife.org/lib/uploads/files/Indiana%20Monarch%20Conservation%20Plan_8-10-18.pdf

Indiana Conservation Partnership Reports
https://www.IN.gov/isda/icpreports/

Indiana Fluvial Erosion Hazard Program and Mitigation Manual
https://feh.iupui.edu/

USFS Northern Forest Futures Project
https://www.nrs.fs.fed.us/futures/

Upper Mississippi River/Great Lakes Joint Venture BCR Plans for Indiana
https://umgljv.org/planning/state-by-bcr-plans/

Partners in Flight Continental Landbird Conservation Plan (2016)
http://www.partnersinflight.org/wp-content/uploads/2016/08/pif-continental-plan-final-spread-single.pdf

Community Planning for Agriculture and Natural Resources: A Guide for Local Government
https://www.cdext.purdue.edu/wp-content/uploads/2019/06/guidebook.pdf

Indiana Land Resources Council
https://www.IN.gov/isda/2357.htm

The Purdue University Land Use Team
https://cdext.purdue.edu/collaborative-projects/land-use/

Indiana Conservation Alliance (INCA)
http://indianaconservationalliance.org/

Indiana Hardwood Interactive Map
https://pcrd.maps.arcgis.com/apps/webappviewer/index.html?id=86ab79e192e94e348b638e8870844f79

Appendix C: Forest Legacy Program Requirements

A separate Forest Legacy Assessment of Need (AON) document meeting federal Forest Legacy requirements is included here by reference to the online version:
https://www.IN.gov/dnr/forestry/files/fo-IN_AON-Revised.pdf

This revised AON document has been previously approved by the FS Region, Area, or IITF Forest Legacy Program staff. Documentation of FS approval is available upon request to the Indiana Forest Legacy Program Coordinator. Review by the Indiana Forest Stewardship Coordinating Committee was conducted through the Forest Action Plan's online partner coordination, at meetings of Indiana Forest Stewardship Coordinating Committee and as part of the Forest Action Plan draft review process.

Due to the 142 page length of the document it is not included in full here. A copy of the Forest Action Plan including the full revised AON can be requested.

Appendix D: Summary of Review Comments & Names of Reviewers