Ohio's Statewide Forest Resource Assessment - 2010

Division of Forestry
Ohio Department of Natural Resources

June 2010

OHIO DEPARTMENT OF NATURAL RESOURCES

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Section 1 - Introduction

In 1983, the Ohio Department of Natural Resources (ODNR) Division of Forestry completed a statewide evaluation of Ohio's forest resources and developed the "Ohio Forest Resource Plan" (see Appendix for summary of report). While periodic reports by the USDA Forest Service Forest Inventory and Analysis (FIA) unit have provided valuable trend data for Ohio's forest resources (e.g., Griffith et al. 1993, Widmann et al. 2009), this document represents the first statewide, comprehensive forest resource assessment in Ohio since 1983. The findings of this Forest Resource Assessment will be integrated into the accompanying Forest Resource Strategy document. The Forest Resource Strategy also considers and complements other existing strategic plans including the Ohio Comprehensive Wildlife Conservation Strategy (released in 2005), the Statewide Comprehensive Outdoor Recreation Plan (SCORP 2008), and local Community Wildfire Protection Plans. The combined documents, called the Forest Resource Assessment and Strategy (FRAS), can be considered as a pilot for this integrated approach to evaluating and managing Ohio's forest resources. These documents will be living documents that will be amended and updated as new data become available, and they have an expected life expectancy of 5 years before the first major review/update.

Purpose

The purpose of the FRAS document is to provide a basis upon which future strategic directions and actions can be evaluated and selected. It is to be used by the Division of Forestry as well as existing and potential partners to marshal limited resources towards addressing identified forest issues and threats.

The Food, Conservation, and Energy Act of 2008 (the 2008 Federal Farm Bill) requires each state to complete a Statewide Forest Resource Assessment and Statewide Forest Resource Strategy to continue to receive funds under the Cooperative Forestry Assistance Act. The Assessment will help ensure that resources are being focused on important landscape areas with the greatest opportunity to address shared management priorities and achieve meaningful outcomes.

Scope

The Assessment will cover:

- An analysis of present and future forest conditions and trends on all ownerships in the state, including analysis of market and non-market forces.
- Identify threats to forest lands and resources in the state consistent with national priorities (listed below).
- Identify forest related benefits and services.
- Delineate priority forest landscape areas in the state across themes and programs, ownerships, and the urban to rural continuum, to be addressed by the Statewide Forest Resource Strategy.
- Delineate any multi-State areas that are a regional priority.

The USDA Forest Service has identified three national priorities that are to be addressed through an assessment process. These priorities are: 1) Conserve and Manage Working Forest Landscapes for Multiple Values and Uses, 2) Protect Forests from Threats, and 3) Enhance Public Benefits from Trees and Forests.

Methods

Through a comprehensive analysis of forest resource conditions and trends across Ohio, key issues and threats to Ohio's forest resources are identified, as well as the benefits and services that they provide. A framework of criteria and indicators (C & I) was used for this critical component of the assessment. This framework uses seven criteria and 18 indicators to assess Ohio's forest resources. It was adopted by the Northeastern Area Association of State Foresters (NAASF) as a method to assess the sustainable management of forests at both the state and regional levels. The adopted framework is a direct offshoot of an international effort referred to as the Montreal Process that uses seven criteria and 64 indicators. The C & I framework adopted by NAASF uses a subset of indicators that are appropriate at the state and regional scale as opposed to the global scale.

To supplement the results of the assessment of forest conditions and trends, a broad-based group of stakeholders were consulted to develop a draft list of key issues, threats, and opportunities. A public comment period for draft assessment and strategy documents also provided critical input. Key partner organizations and agencies, including all required stakeholder groups identified in the 2008 Federal Farm Bill, were consulted at various stages of the process, including the formal periods of stakeholder input and individual meetings. More details about stakeholder input are provided in Section 4 and in Appendix A of this assessment. Another critical component of the assessment process was the comprehensive geospatial analyses that were conducted to identify potential priority forests and priority landscapes across the state, using overlay analysis techniques with GIS software (ArcGIS versions 9.3). Results from these various assessment components are reported in this report. They form the foundation for developing a comprehensive Statewide Forest Resource Strategy.

Section 2 - Forest Conditions and Trends

Forest conditions and trends for the State of Ohio were assessed using a framework of criteria and indicators that was developed to assess the sustainability of forests in the northeastern United States. The criteria and indicators used in this assessment were developed from the Montreal Process, which is a larger system of criteria and indicators that assesses forest sustainability of temperate and boreal forests at the global scale (The Montreal Process 2009). The following criteria and indicators are used in this assessment.

Criterion 1. Conservation of Biological Diversity
- **Indicator**: 1. Area of total land, forest land, and reserved forest land
  2. Forest type, size class, age class, and successional stage
  3. Extent of forest land conversion, fragmentation, and parcelization
  4. Status of forest/woodland communities and associated species of concern

Criterion 2. Maintenance of Productive Capacity of Forest Ecosystems
- **Indicator:** 5. Area of timberland
  6. Annual removal of merchantable wood volume compared with net growth

Criterion 3. Maintenance of Forest Ecosystem Health and Vitality
- **Indicator**: 7. Area of forest land affected by potentially damaging agents

Criterion 4. Conservation and Maintenance of Soil and Water Resources
- **Indicator**: 8. Soil quality on forest land
  9. Area of forest land adjacent to surface water, and forest land by watershed
  10. Water quality in forested areas

Criterion 5. Maintenance of Forest Contribution to Global Carbon Cycles
- **Indicator:** 11. Forest ecosystem biomass and forest carbon pools

Criterion 6. Maintenance and Enhancement of Long-Term Multiple Socioeconomic Benefits to Meet the Needs of Societies
- **Indicator**: 12. Wood and wood products production, consumption, and trade
  13. Outdoor recreational participation and facilities
  14. Investments in forest health, management, research, and wood processing
  15. Forest ownership, land use, and specially designated areas
  16. Employment and wages in forest-related sectors

Criterion 7. Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management
- **Indicator:** 17. Forest management standards/guidelines
  18. Forest-related planning, assessment, policy, and law

In September 2009, the USDA Forest Service released its latest Forest Inventory and Analysis (FIA) report for the State of Ohio entitled *Ohio Forests: 2006* (Widmann et al. 2009). For many of the criteria and indicators included in this assessment, the *Ohio Forests: 2006* publication contains the most current relevant published data. Therefore, the assessment document will not reproduce all of the data reported in the FIA publication; the assessment will reference the FIA data, discuss it in the context of the assessment, and supplement it when appropriate. Accordingly, the *Ohio Forests: 2006* publication is an important reference to have as a complement to this assessment document. A copy of the FIA report can be requested from the USDA Forest Service or downloaded from the internet (http://www.nrs.fs.fed.us/pubs/rb/rb_nrs36.pdf).

Criterion 1: Conservation of Biological Diversity

Criterion 1 includes four Indicators that evaluate the structure and biological diversity of Ohio's forest ecosystems. The conservation of biological diversity is a critical component of sustainable forest management; diverse ecosystems are better able to respond to external influences, recover from disturbances, and maintain core ecological functions and services (USDA 2008).

Indicator 1 - Area of total land, forest land, and reserved forest land.

Forest Land Area

Based on FIA data, the total area of forest land in Ohio is 7.92 million acres, representing 30.2% of the State's land cover (2006 FIA data; Widmann et al. 2009). The USDA FIA Unit also reports "timberland" acreage, which totaled 7.7 million acres statewide or 97% of Ohio's total forest land area (Widmann et al. 2009). Prior to settlement, Ohio was estimated to be 95% forested. The State experienced a steady decline in forest cover from settlement until ~1940, when forest cover in the state reached a low point of 12% (Diller 1944). Successive surveys from the FIA reported a steady increase in forest land from the 1940s to the 1991 survey (Fig. 1a). However, the most recent survey (2006) found no statistical difference in forest land from 1991 to 2006, indicating a change in the trend of increasing forest land in Ohio. The primary driving force for the increase in forest land from 1940 to 1991 was the reversion of farmland to forest. That driver has all but ceased and any new forest land arising from reverting farmland is likely being offset by land being converted to non-forest land for development.

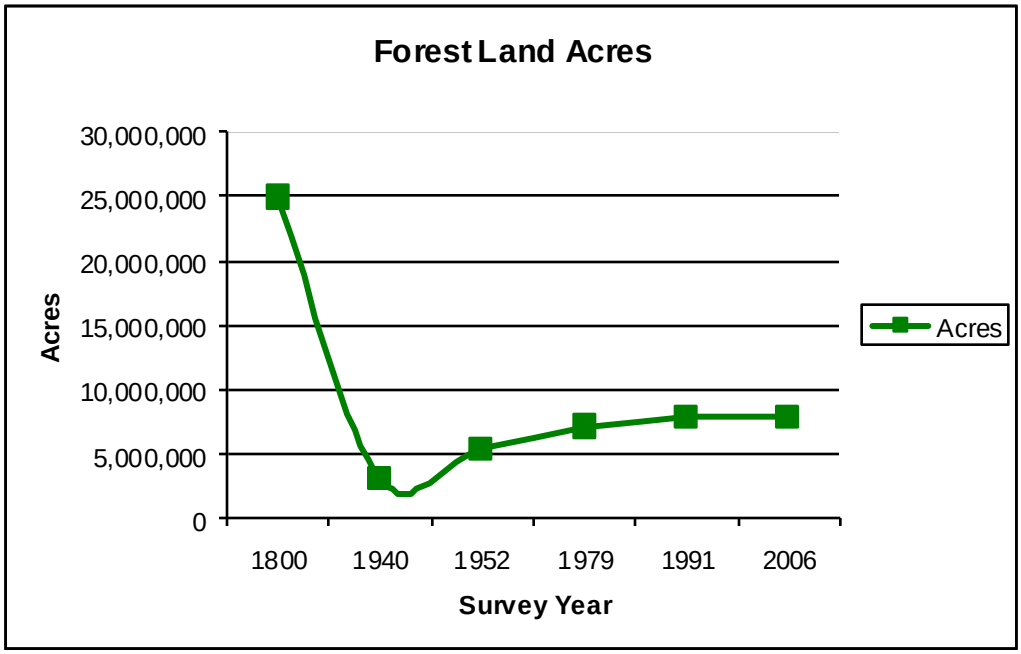


Figure 1a – The change in total forest land acres in Ohio over time (Data Source: Griffith et al. 1993, Widmann et al. 2009).

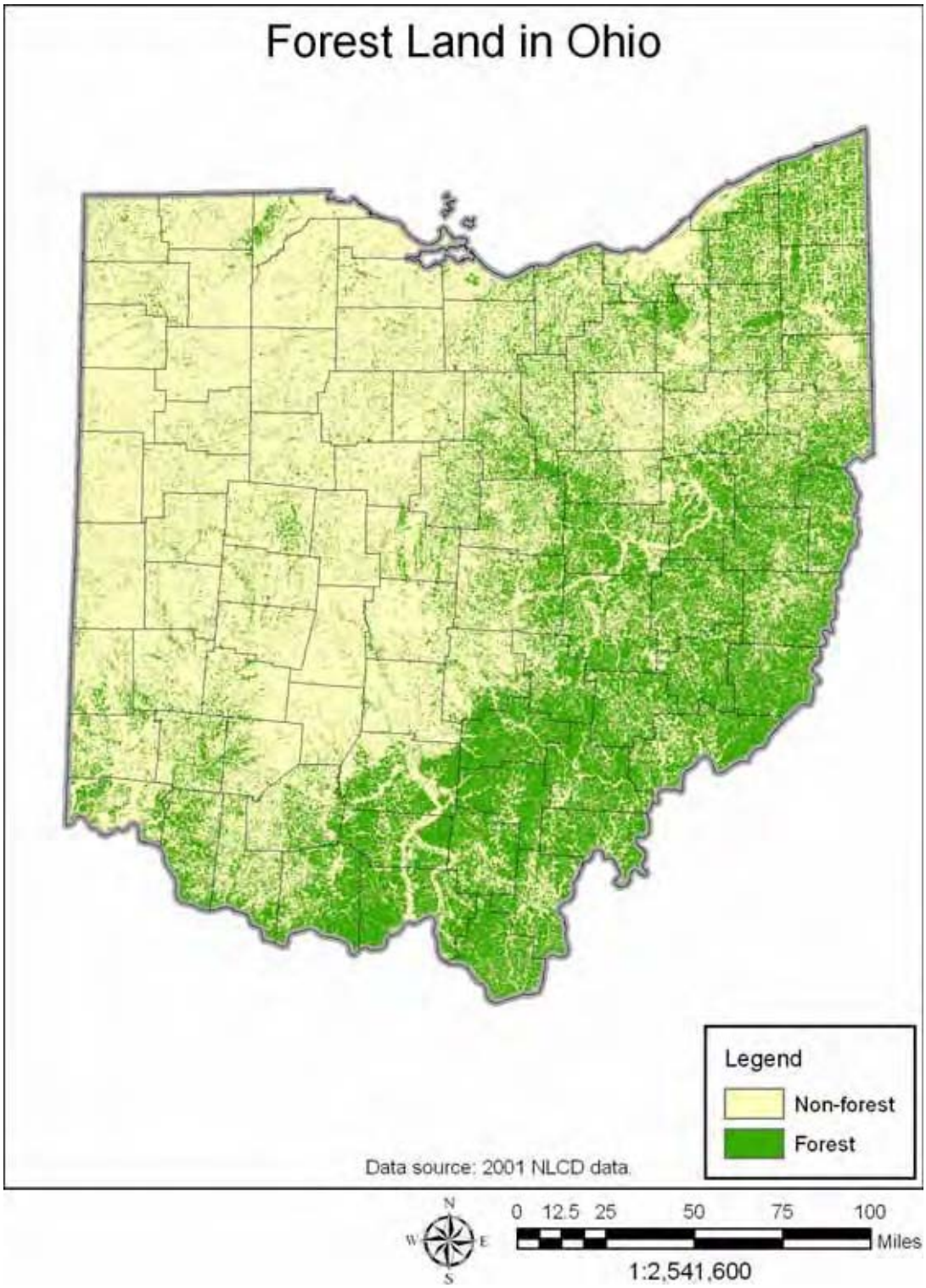


Figure 1b – Map of forest land cover in Ohio based on 2001 satellite imagery (Data: National Land Cover Data 2001).

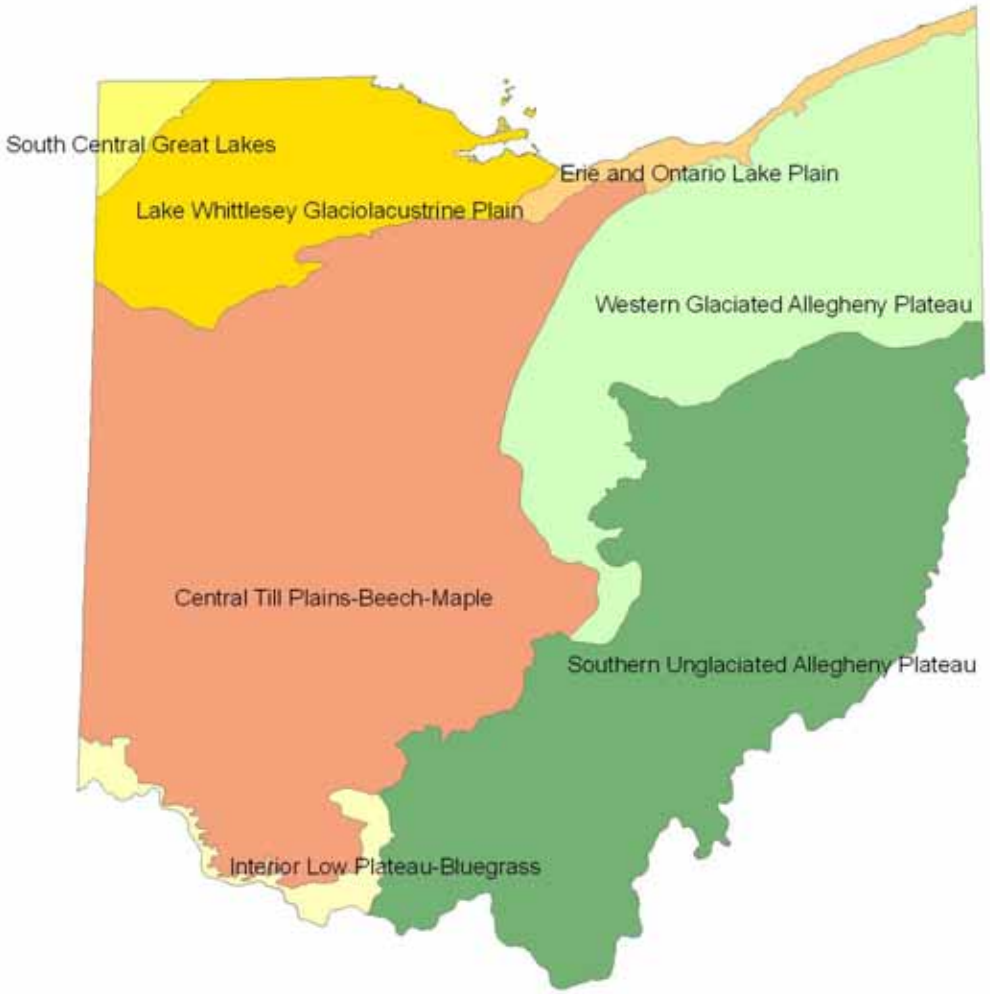


Figure 1c – Ecological Sections of Ohio from the USDA Forest Service's ECOMAP 2007 (USFS 2007).

Using 2001 satellite imagery, a nationwide land cover dataset was developed (Homer et al. 2004), and it will be referred to in this report as the National Land Cover Dataset (NLCD) 2001. A forest cover map for Ohio using NLCD 2001 data shows an uneven distribution of forest land across the State, with southeastern Ohio being the most heavily forested (Figure 1b). The total area of forest land in the state using NLCD 2001 data (all green areas on the Figure 1b map) is 8.55 million acres, or 633,132 acres more than the 7.92 million acres reported by FIA. A likely explanation for this discrepancy is the difference in the scale of measurement. FIA defines forest land as being a minimum of 1.0 acre in size, while NLCD classifies land cover down to the 30 x 30 meter pixel (0.22 acre) size. Therefore, NLCD includes small patches of forest cover (0.22 to 1.0 acre in size) that are excluded from FIA. By ecological sections (Fig. 1c), the unglaciated Allegheny Plateau in southeast Ohio is the most heavily forested, followed by the glaciated Allegheny plateau in northeast Ohio. Most counties in the unglaciated Allegheny plateau region have over 350 acres of forest land per square mile (Fig. 1d), which means the land is at least 55% forested (350 acres of forests per square mile equals 55% forested). Most counties in northwest Ohio have less than 100 acres of forest land per square mile and are less than 16% forested. The three most heavily forested counties in Ohio are Monroe, Hocking, and Lawrence, which are 81%, 80%, and 77% forested, respectively.

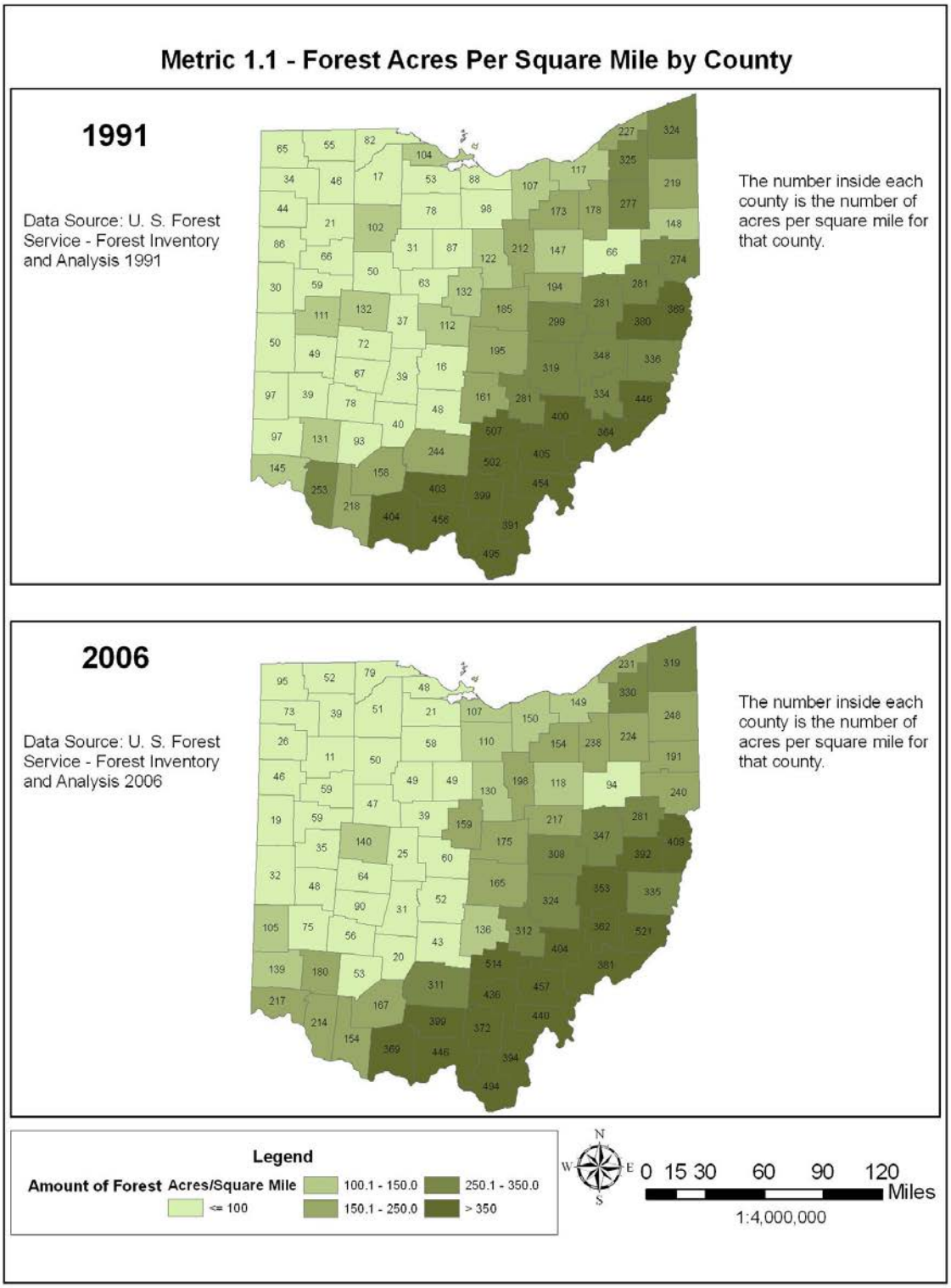


Figure 1d – The change in forest land acres per square mile by county from 1991 to 2006.

Forest Density

For this assessment, forest density is described using stocking levels, which indicate the degree to which an area is being utilized by trees. Stocking is often expressed as the percent of total tree density required to fully utilize the growth potential of the land (Widmann et al. 2009). FIA surveys use the following categories for percent stocking: non-stocked (0 to 9 percent); poorly stocked (10 to 59); moderately (medium) stocked (60 to 99); fully stocked (100 to 129); and overstocked (130 to 160) (Griffith et al. 1993). A comparison of stocking class distribution from the 1991 forest inventory to the 2006 inventory show a trend of increasing stocking levels on Ohio's forests. (Figure 1e). Statewide, most forests in Ohio are moderately or fully stocked. However, some mild regionality exists in forest stocking, with northwest Ohio having more forests in the overstocked category and fewer forests that are poorly stocked (Figure 1f).

The significant increase in forests that are fully stocked over the past couple decades indicates that Ohio's forests are getting denser, more shaded, and generally maturing. However, Ohio's forests are still relatively young, with overstory trees averaging less than 60 years of age on 63 percent of timberland (Widmann et al. 2009). The increasing stocking levels also suggest a decline in open, early-successional forest habitat, and that trend will be discussed later in this assessment (see pages 18-21). Finally, the approximately 2.3 million acres of fully stocked or overstocked timberland in the State provides opportunities for timber management without diminishing forest growth (Widmann et al. 2009).

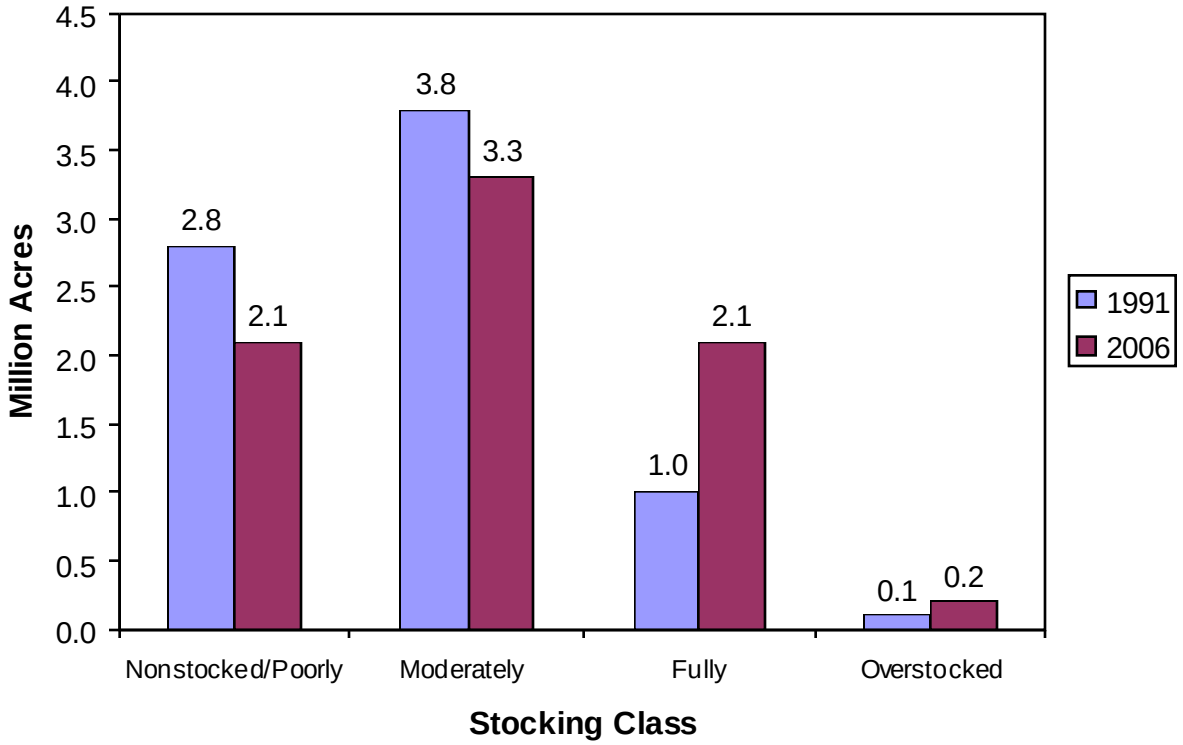


Figure 1e – Area of timberland by stocking class of growing-stock trees in Ohio, 1991 and 2006. Modified from *Ohio Forests: 2006* (Widmann et al. 2009).

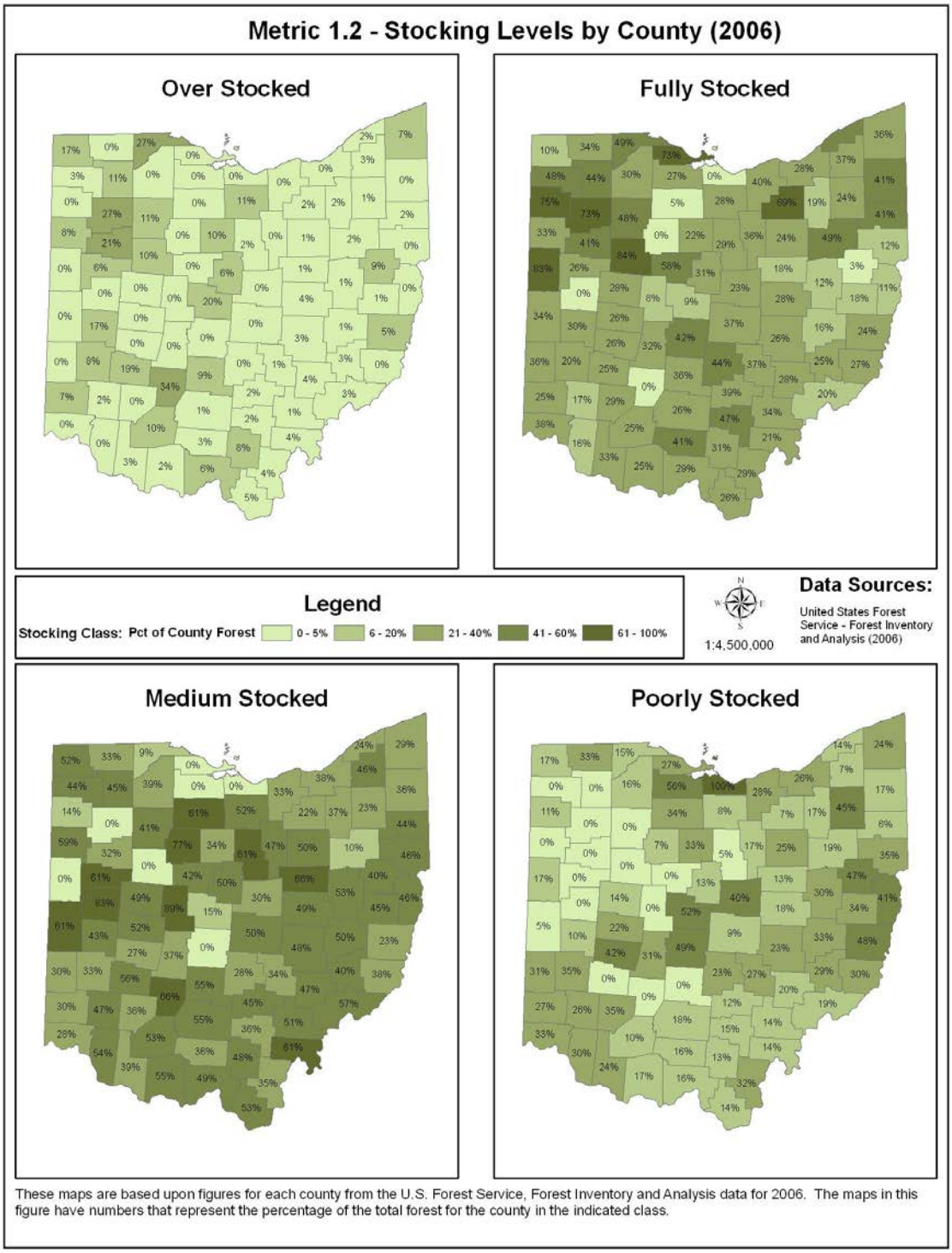


Figure 1f – Forest stocking by county and stocking class using 2006 FIA data (Data source: USDA Forest Service FIA unit)

Forest Land and Population

Currently there are 7,918,900 acres of forest land (2006 FIA data) for the 11,353,140 people (2000 Census) in Ohio. This represents 0.7 acres of forest land per person. Similar to total forest land in the State, the trend was an increasing amount of forest land per person as forest land grew from 1940 to 1991. However, with the stabilization of forest land (no growth from 1991 to 2006) and the continued population growth (Figure 1g), the per capita forest acreage declined this past decade (Figures 1h). The map in Figure 1i shows the distribution of major metropolitan areas across the state, and Figure 1j shows the change in per capita forest land by county between 1991 and 2006.

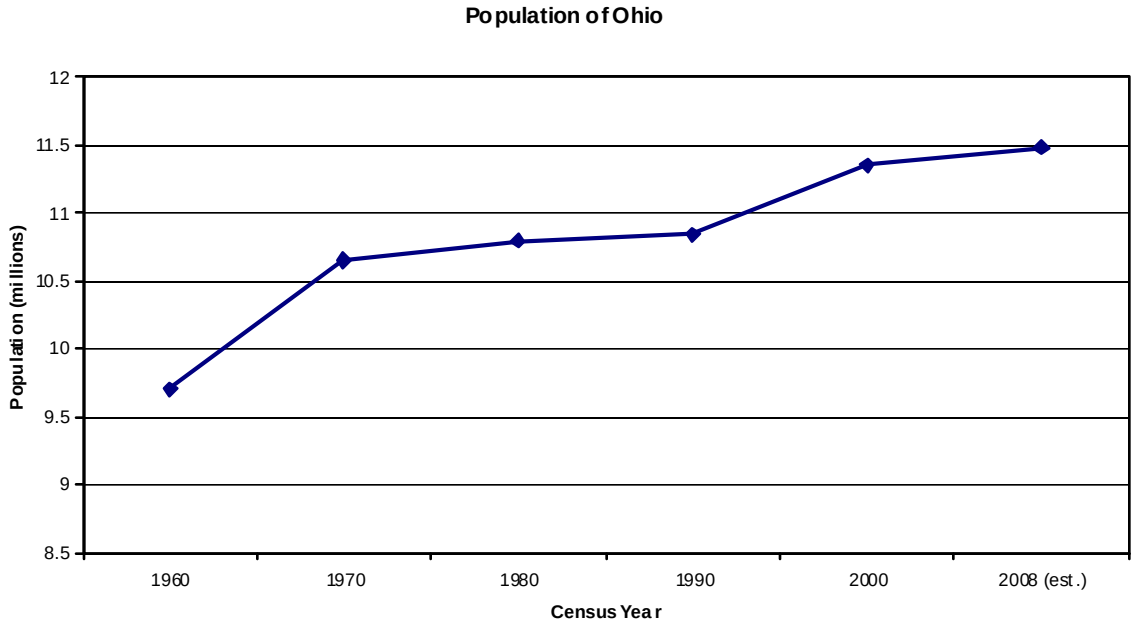


Figure 1g – Human population of Ohio from 1960 to 2008 (Data source: U.S. Census Bureau).

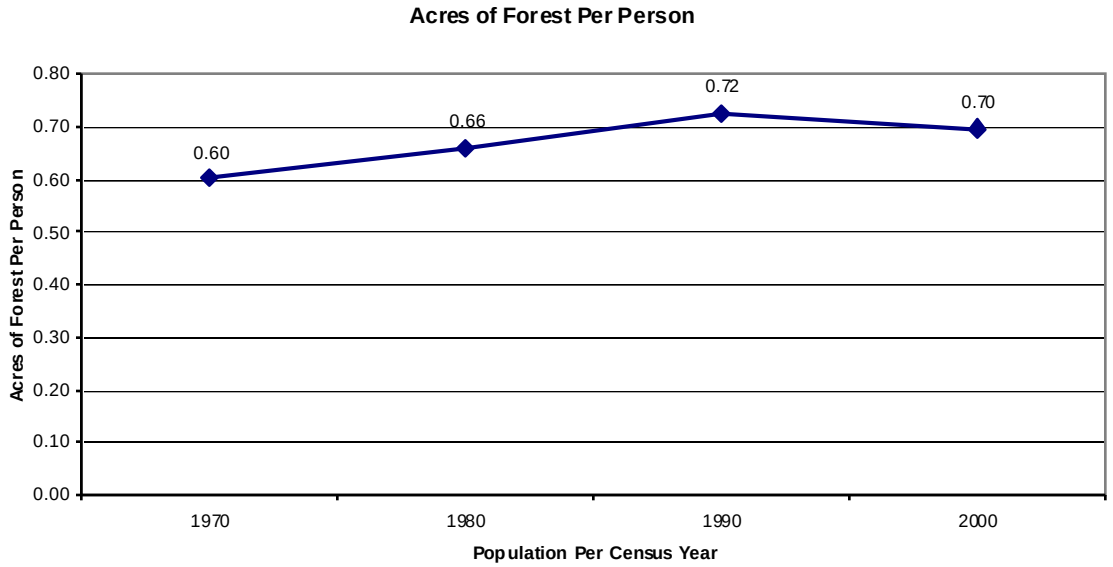


Figure 1h – Change in the acres of forest per person over time (Data source: USDA Forest Service FIA and U.S. Census Bureau). Note: 1968 FIA data are presented with 1970 Census data, 1979 FIA data with 1980 Census, 1991 FIA data with 1990 Census, and 2006 FIA data with 2000 Census.

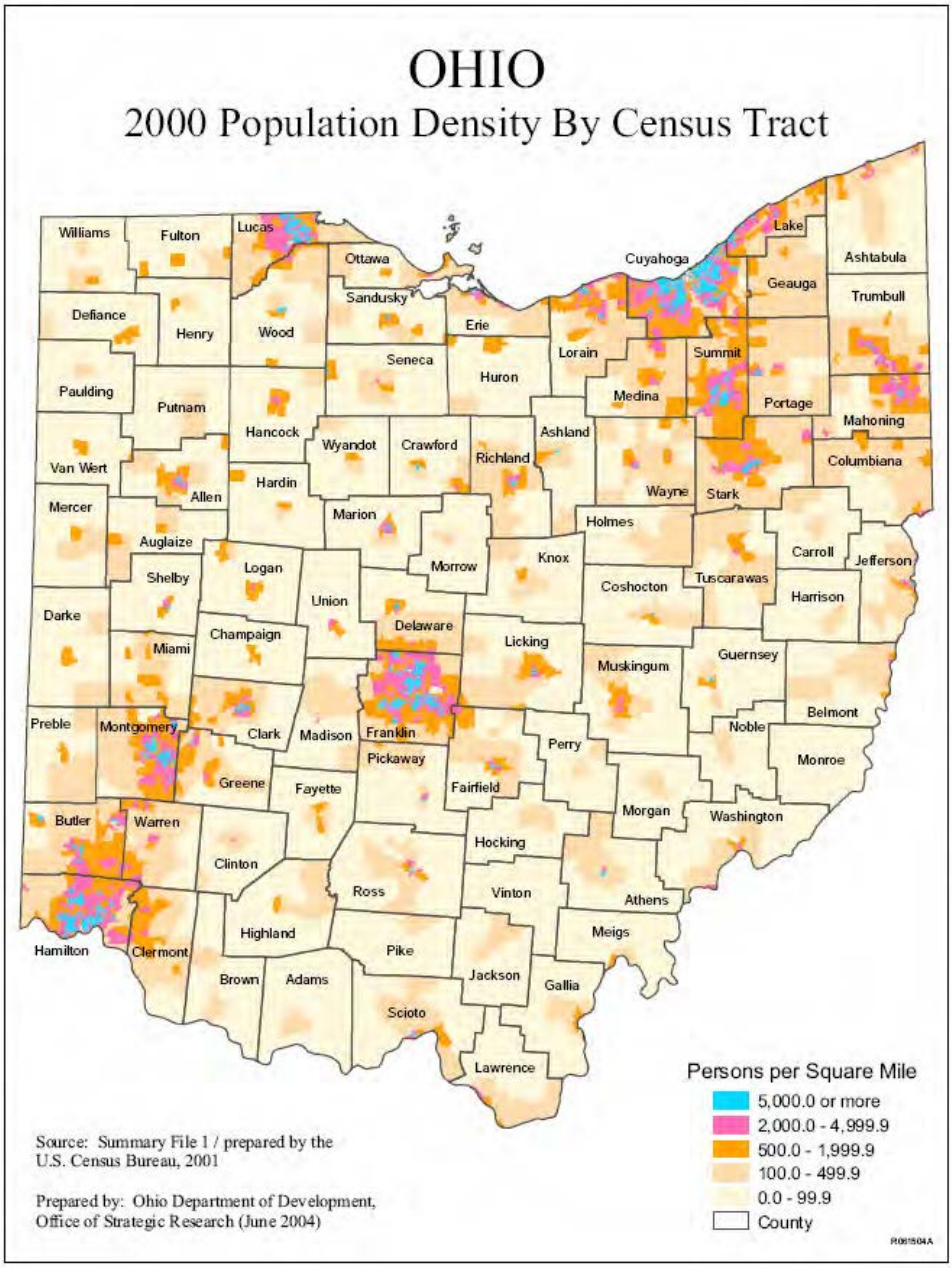


Figure 1i – Population density in the year 2000 by census tract for Ohio. Map prepared by Ohio Department of Development using data from the U.S. Census Bureau, 2001.

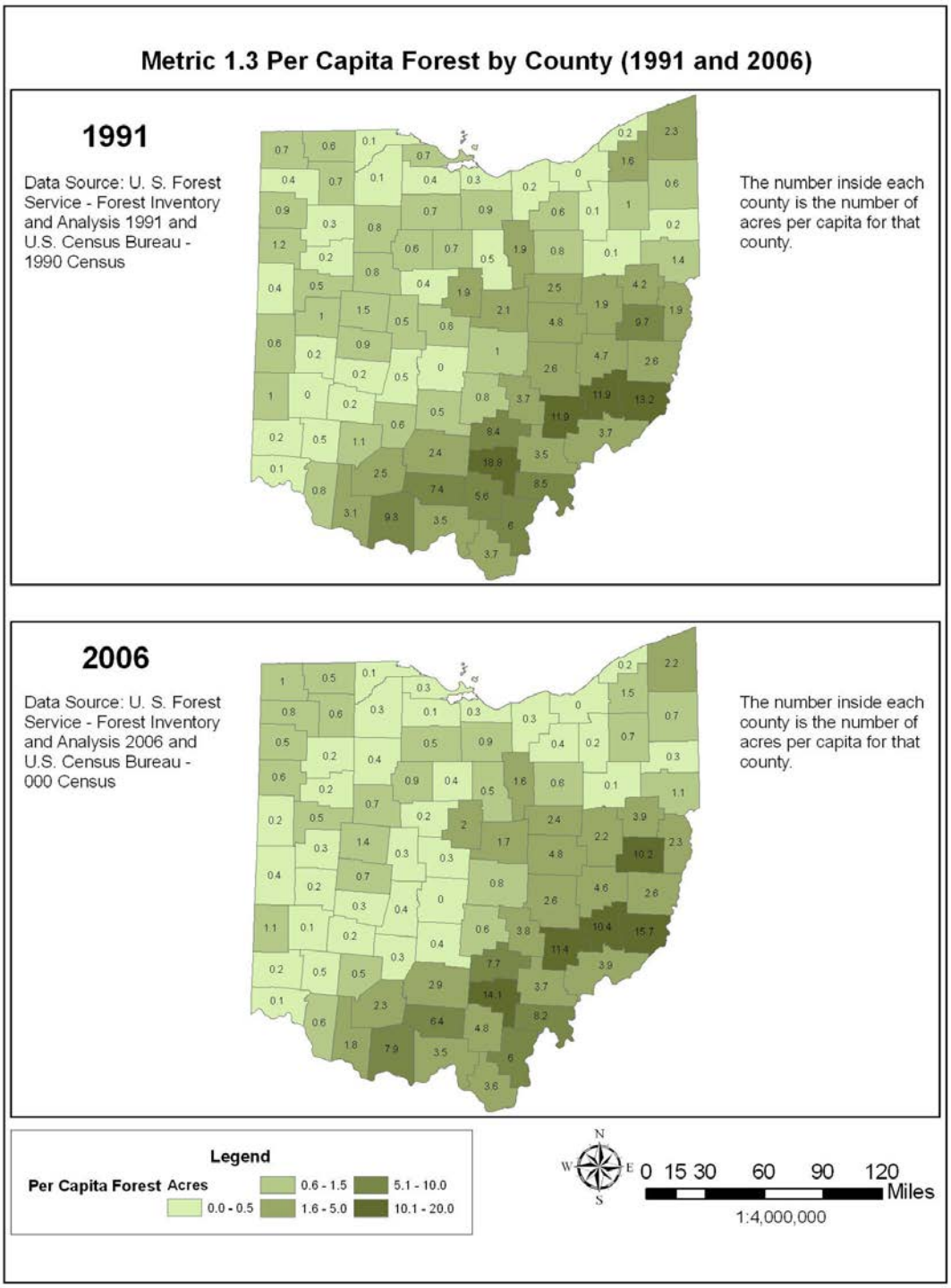


Figure 1j – Change in per capita forest acres by county from 1991 to 2006 (Data source: USDA Forest Service FIA and U.S. Census Bureau).

Reserved Forest Land

Reserved forest land includes forests that meet the FIA criteria for timber land, but have statutes or administrative constraints that preclude timber utilization. This land potentially includes forests with conservation easements that prohibit timber harvest/utilization and parklands that prohibit such management. In 2006, the reserved productive forest land was 203,900 acres. This represents 2.6% of the total forest land. The general trend is an increasing number of acres in the reserved productive forest land category (Figure 1k). The trend is also for an increasing proportion of the total forest to be in this category increasing from about 1.2% in 1968 to the current 2.6%. All of the reserved forest land reported by the FIA is on public land, with the State holding the largest acreage (Figure 1l). However, some private, non-governmental organizations, such as land trusts, may own private forest lands or hold conservation easements on private lands that meet the definition of reserved forests (i.e., prohibit timber utilization). Data on private reserved forest land are not currently available.

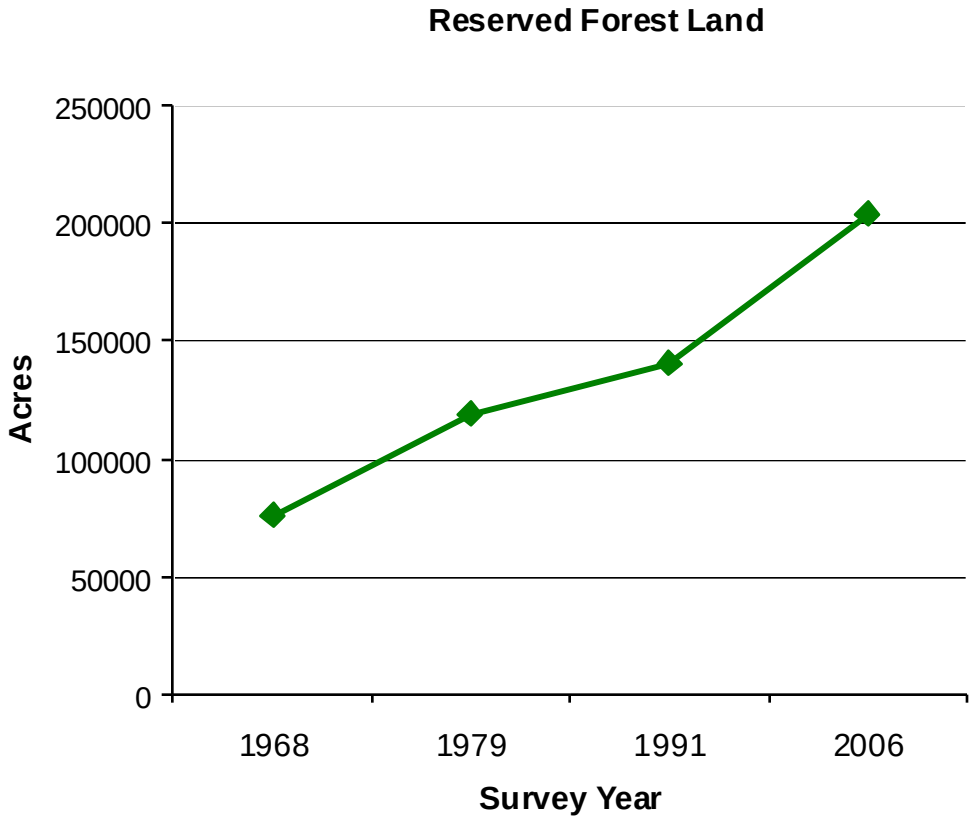


Figure 1k – Change in reserved forest land over time, as reported in U.S. Forest Service Forest Inventory and Analysis reports of 1968, 1979, 1991 and 2006.

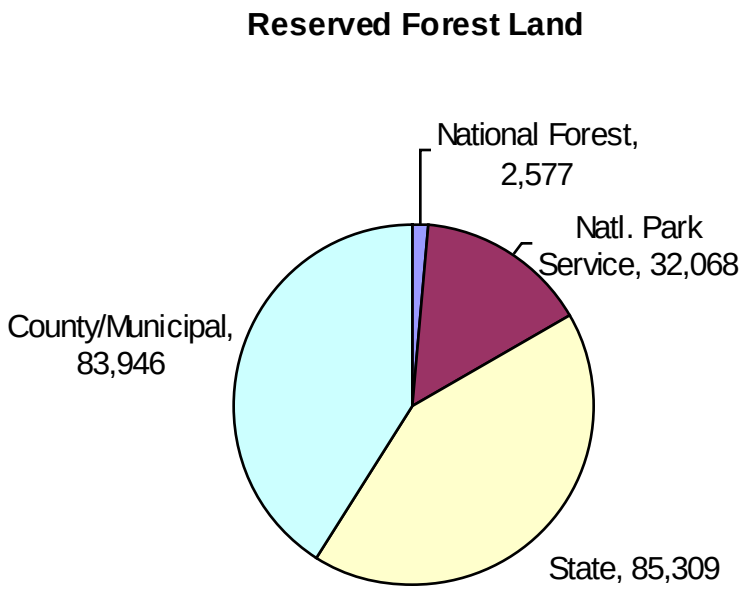


Figure 1l – Ownership of reserved forest land in Ohio, 2006. Data source: USDA Forest Service FIA (accessed online from EVALIDator at: http://fiatools.fs.fed.us/Evalidator401/tmattribute.jsp)

Urban Forest

Urban land in Ohio covers 9.7 percent of the total land area, and it is expected to increase to 22.9 percent by 2050 (Nowak and Greenfield 2010). The amount of forest cover within urban areas is an important aspect of the overall quality of life and the environmental services potential. Urban trees offer multiple services, including runoff mitigation, pollutant uptake, and thermal mitigation. Trees on urban and community land in Ohio annually remove 840,000 metric tons of carbon and 21,930 metric tons of air pollution (Nowak and Greenfield 2010). Trees also are a key component of urban livability, as they have a positive influence on recreational opportunities and property values. Detailed, comprehensive urban tree canopy data are lacking for most Ohio communities, but a recently published report by the USDA Forest Service (Nowak and Greenfield 2010) provides good summary statistics about Ohio's urban and community forests. Statewide, the average tree canopy cover in Ohio in 2000 was 28.7 %, and in urban areas, it was 19.8 % (Nowak and Greenfield 2010). Percent tree canopy cover varies significantly across the State with a high correlation with forest land cover as identified in the NLCD 2001 dataset (Figure 1c). To better evaluate the extent and quality of urban forests in Ohio at the local level, better mapping data on urban tree canopy are required.

Some municipalities have completed more comprehensive analyses of their urban forests. For example, the Cincinnati Park Board conducted an urban canopy study that was used to develop their 2004-2024 Management Plan. According to their 2000 Urban Tree Canopy Study, Cincinnati's tree canopy cover is currently at 37 % (Figure 1m). The city's forest revitalization program over the past 20 years has helped the city achieve this relatively high tree canopy cover by planting 40,000 street trees, 30,000 highway trees, and thousands of park trees during that time. The 2004-2024 Plan calls for additional tree plantings to help the city reach its goal of 40 % tree canopy in residential areas, 25 % in mixed commercial/residential, and 10 % in the central business districts (Cincinnati Park Board 2004).

Figure 1m – Cincinnati's Urban Tree Canopy Cover Map (Cincinnati Park Board 2004).

The USDA Forest Service evaluates the extent of urban forestry management in communities using different indicators of management programs, such as the existence of tree ordinances, urban forestry staff, and/or urban forestry management plans. Data from 2009 indicate that 43 % of Ohio's population lives in communities that are managing programs to plant, protect, and maintain their urban and community trees and forests. An additional 41 % of the population lives in communities that are developing such programs. Figure 1n shows the distribution of those communities on a state map.

A special issue impacting urban forests in Ohio is the emerald ash borer. This exotic pest is impacting all forests in the state, urban and rural, but in urban areas, it presents some unique challenges. One significant challenge that municipalities are facing is the removal of dead and dying ash trees, and their subsequent replacement. This is a safety issue in urban forests, especially for street trees. To proactively address this economic and environmental burden, many Ohio communities are developing emerald ash borer management plans. To date, at least 62 of these plans have been completed statewide.

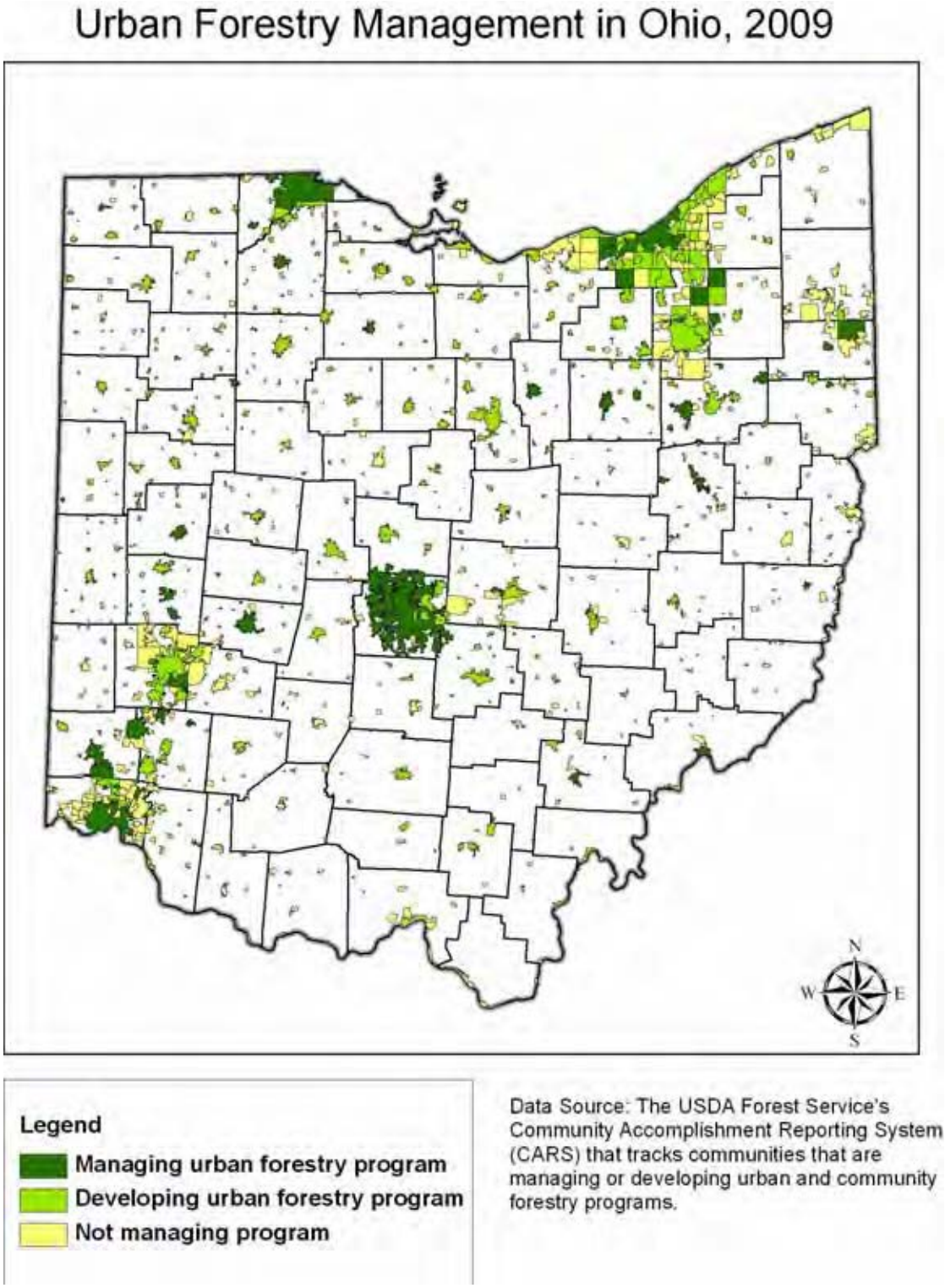


Figure 1n – Distribution of urban and community forestry programs in Ohio, 2009, according to the Community Accomplishments Reporting System (CARS) for the U.S. Forest Service Urban & Community Forestry Program.

Indicator 2 – Forest type, size class, age class, and successional stage.

This indicator shows the general distribution of forests by type, size, age, and successional stage. An evaluation of these forest characteristics provides useful information about the current structure of the forests and the benefits they provide (e.g., wildlife habitat), as well as insight about how Ohio's future forests will look. A detailed evaluation of these forest attributes can be found in the USDA Forest Service report *Ohio Forests: 2006* (Widmann et al. 2009). This document will highlight data from that report that illustrate overall trends for Ohio's forests, as well as those with direct applicability to the metrics under this indicator.

Ohio Forests: 2006 reports little change in the broad forest-type groups from 1991 to 2006, with the two dominant groups, oak/hickory and Northern hardwoods, covering 85% of Ohio's timberland (Widmann et al. 2009; Figure 1o). However, more significant changes were detected when evaluating individual species trends. Oaks remain a dominant species in Ohio's forests, but their relative dominance has been steadily declining since 1968. During that same time period, the relative dominance of species like maples and yellow poplar steadily increased (Figure 1p). An evaluation of individual species by size class suggests that this shift from oaks to maples will continue into the future, as oaks are lacking in the small diameter size classes (saplings), while maples are prominent (Figure 1q).

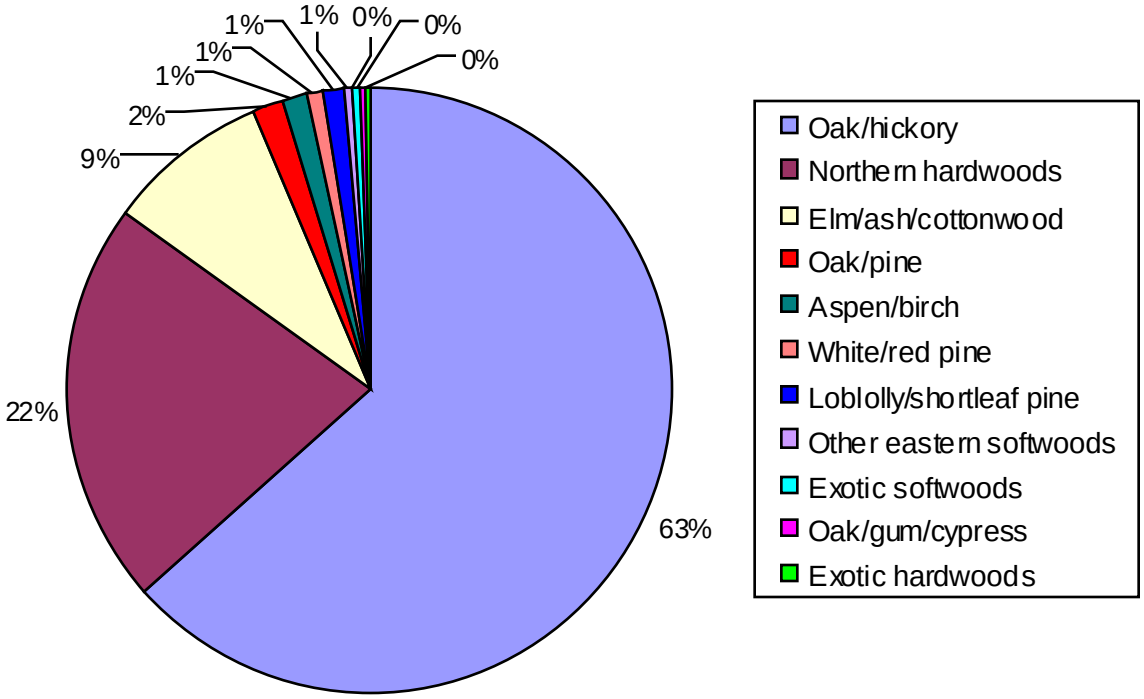


Figure 1o – Percentage of timberland area by forest type group in Ohio, 2006 (FIA 2006). Note: the *Northern hardwoods* group includes the *maple/beech/birch group* and *other hardwoods group*.

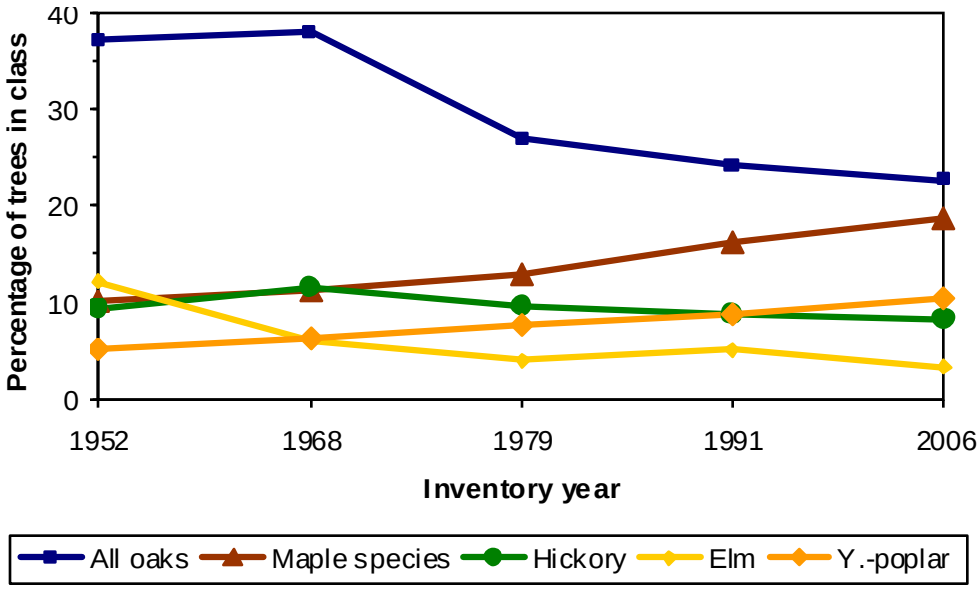


Figure 1p – Change in select species from 1952 to 2006, as percentage of growing stock. From: *Ohio Forests: 2006* (Widmann et al. 2009).

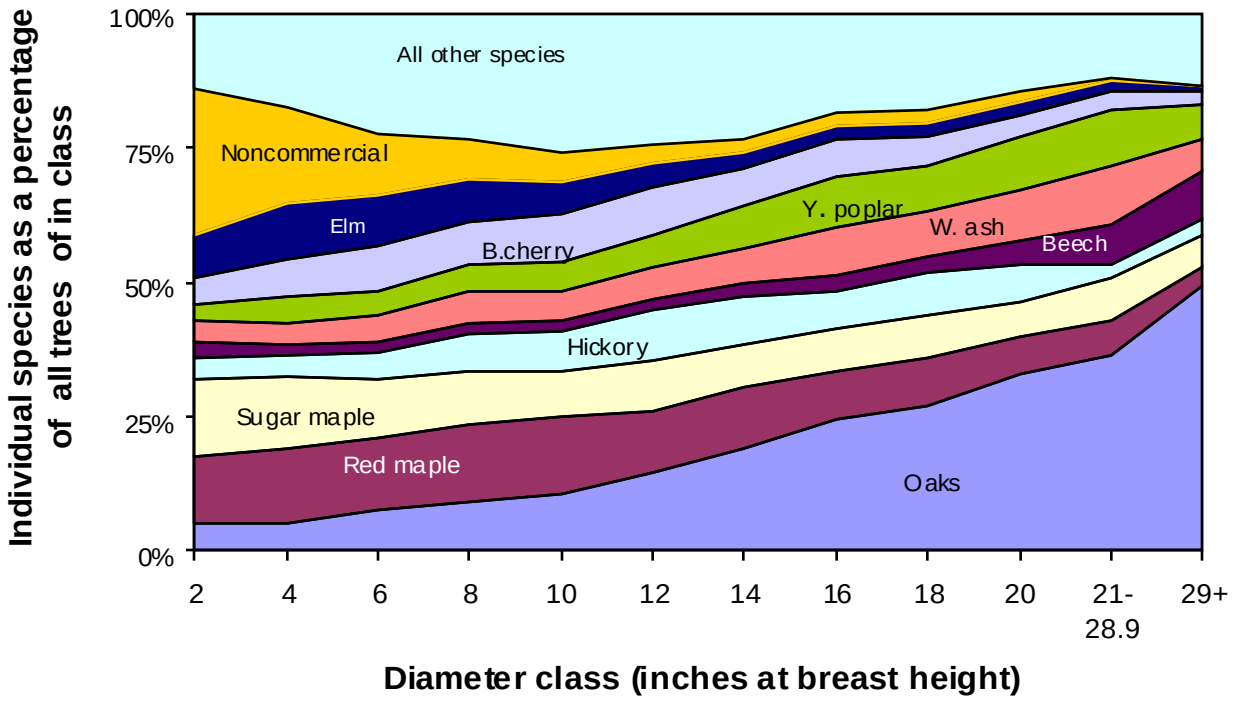


Figure 1q – Species composition by diameter class in 2006. From: *Ohio Forests: 2006* (Widmann et al. 2009).

Stand Structure: Size & Age Class

Over the past four decades, the structure in Ohio's forest stands has changed dramatically. During that time, the percentage of timberland that is sawtimber-sized has more than doubled, while the percentage of stands that are sapling/seedling-size has gone from 56 to 12 (Figure 1r). Sawtimber trees have a diameter at breast height (d.b.h.) greater than 11.0 inches; poletimber trees are 5.0 to

11.0 inches in d.b.h., and sapling/seedlings are less than 5.0 inches in d.b.h. A closer examination of pole and sawtimber-size trees, based on 2-inch diameter classes, further demonstrates growth in the large diameter trees and a reduction in the small diameter trees (Figure 1s). Currently, 60% of Ohio's forests are between 40 and 80 years old and 88% are between 20 and 100 years old (Figure 1t). Young forests (less than 20 years old) and old forests (greater than 100 years old) are under-represented, at 8.3% and 3.3%, respectively. Trends in age class could not be developed as the field methods for that measurement changed; in the 1991 inventory, 40 percent of forests were classified in the "mixed age" class but the most recent inventory does not include that category as an option. Overall, these data support the conclusion that Ohio's forests are maturing, although the vast majority of forests are still less than 100 years old.

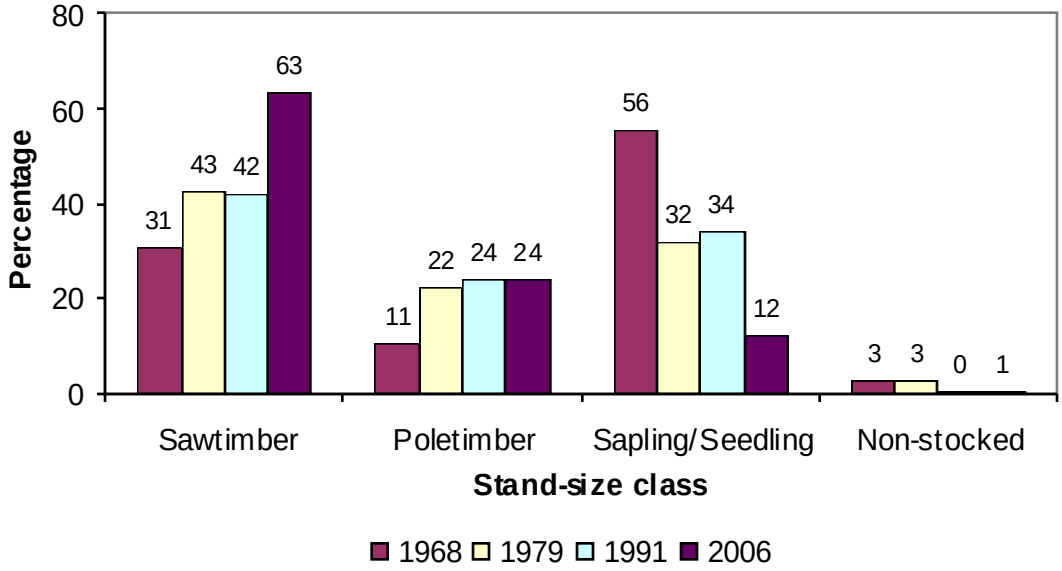


Figure 1r – Percentage of timberland by stand-size classes in Ohio from1968 to 2006. From: *Ohio Forests: 2006* (Widmann et al. 2009).

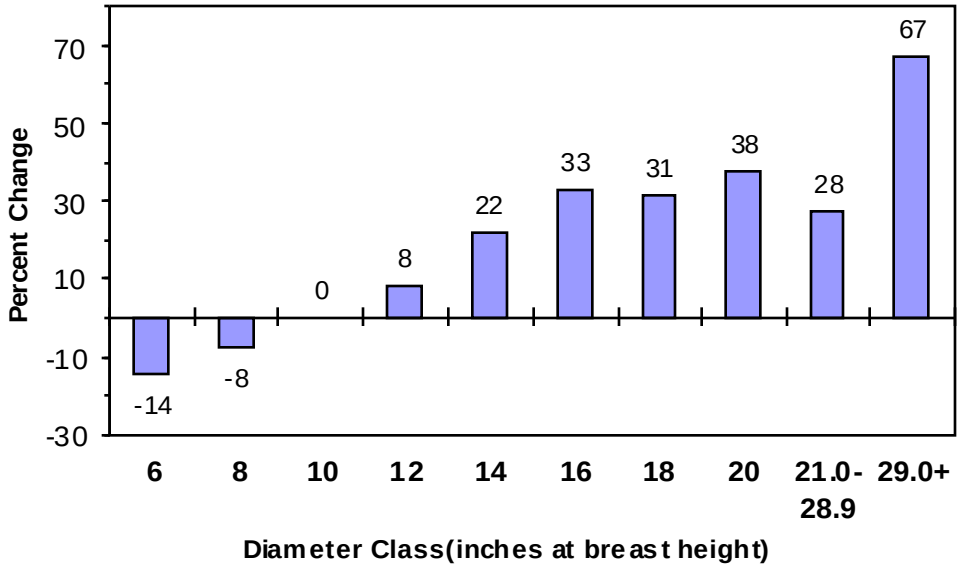


Figure 1s – Percent change in the number of trees by diameter class in Ohio from 1991 to 2006. From *Ohio's Forests: 2006* (Widmann et al. 2009).

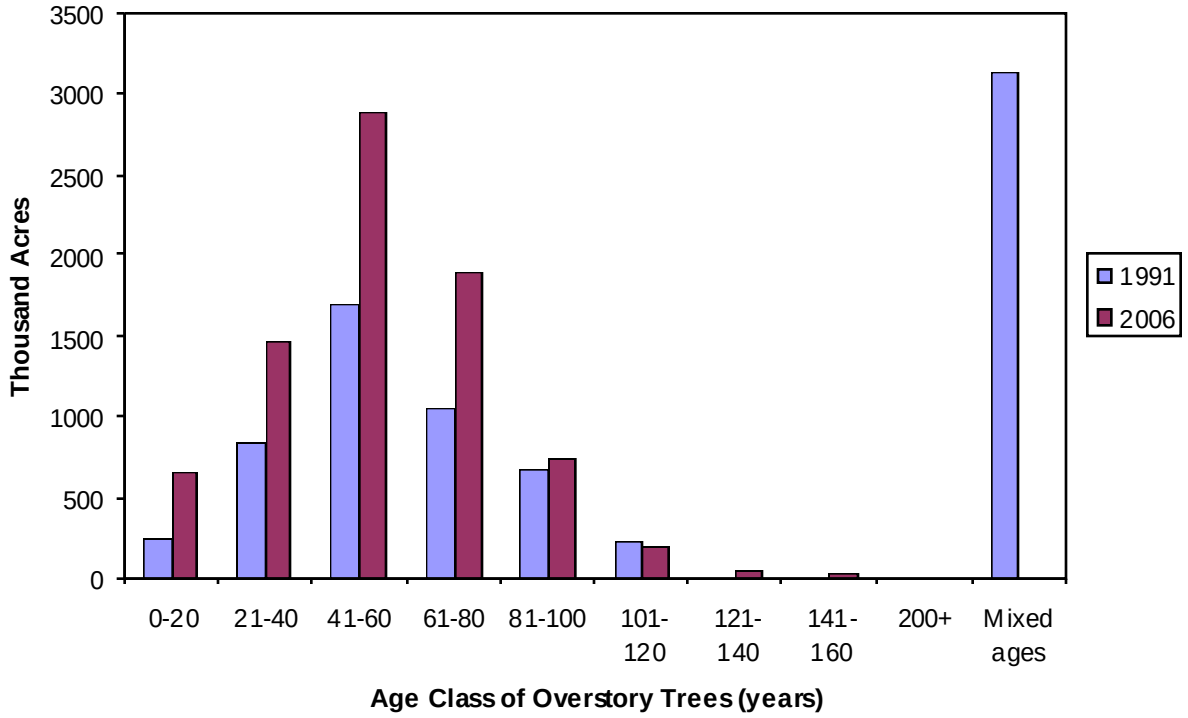


Figure 1t – Age classes of Ohio's forests in 1991 and 2006 (FIA 1991, 2006). Note: 1991 FIA data include a "Mixed ages" category that was excluded from 2006 inventory and 1991 inventory grouped all ages greater than 100 years into one category (100+ years).

Successional Stage

Succession is defined as, "the gradual supplanting of one community of plants by another" (Helms 1998). The successional stage of forests is important to biological diversity, as each stage provides unique habitats for some plants and animals. The successional stages of forests are sometimes characterized using the following three broad categories: early-successional, mid-successional, and late-successional (sometimes called "mature"). Another approach to characterizing forest succession, often used by forest ecologists and silviculturalists, uses different milestones in forest development like "stem exclusion" and "canopy closure." To maximize biological diversity at a large scale, a range of different successional stages is desirable (ODOW 2005). On a more localized scale or when considering a single species or species group, a single successional stage may be desired (e.g., late successional or mature forest for Kentucky warblers).

The general maturing of Ohio's forests that was described previously (i.e., Figure 1r) suggests a shift towards later successional stages. The ODNR Division of Wildlife notes this shift in their *Comprehensive Wildlife Conservation Strategy* (ODOW 2005):

> "If the trend toward increasing forest maturity continues, populations of forest wildlife species dependent on young woodlands will likely decline in the future. Research is needed to evaluate the habitat requirements for survival and reproductive success of forest wildlife in Ohio in relation to forest patch size, isolation and age class."

Additional data reflecting the impact of fewer early-successional forests on individual bird species are presented later in this report (pages 38-42).

Indicator 3 – Extent of forest land conversion, fragmentation, and parcelization.

For a 50-year period from 1940 to 1990, Ohio experienced the steady expansion of forestland and the single largest source of new forest land was old field reversion (abandoned agricultural land reverting back to forests). Ohio has now entered an era where the conversion to forestland is being offset by the conversion of forest land to other uses. Much of this conversion of forest land is being driven by the parcelization of large contiguous tracts of forest land for home sites or other land development, which leads to fragmentation of the forest.

Forest fragmentation is, "the process by which a landscape is broken into small islands of forest within a mosaic of other forms of land use or ownership" (Helms 1998). The area where a forest transitions to nonforestland (e.g., backyards, fields, pastures, or roads) is called forest edge, and the area occupied by one continuous forest block is referred to as forest patch size. As forests are fragmented and forest patch sizes decrease, the amount of forest edge increases. Therefore, forest edge is a good measure of fragmentation in forests. In the glaciated parts of Ohio, over 75 % of the forest land is within 90 m (295 feet) of the forest edge. However, in the unglaciated hills of Ohio, over 40 % of the forest area is greater than 90 m from the forest edge and classified as forest interior (Widmann et al. 2009, Figure 1u). An analysis of forest patch size further demonstrates the degree of fragmentation of Ohio's forests and shows that southeastern Ohio (mostly in unglaciated areas) has the largest continuous forest patches or blocks (Figure 1v).

Forest fragmentation is often linked to human activities, including road construction, residential development, and land conversion for agricultural use (e.g., clearing forests for crop fields). Proximity to human population can be a good predictor of fragmentation in forested landscapes. The expansion of urban populations into rural, undeveloped natural areas (sometimes called wildlands) results in a suite of unique natural resource issues, including but not limited to forest fragmentation. Such areas are often referred to as the wildland-urban interface (WUI). While comprehensive data do not exist to quantify the extent of forest land conversion or fragmentation in urban-interface areas in Ohio, data collected for a college course on land use history at Ohio University provide some insight on the topic. The data compare land use in the 1980s to the 2000s, and they relate primarily to rapidly expanding suburban areas around major cities in Ohio (for details on the methodology, see Matlack and McEwan 2008). Results of data analysis show a significant loss of forest cover over the twenty-year period; mean forest cover declined from 27.3% in the 1980s to 21.8% in the 2000s. In the study areas, urban/suburban development is the key driver of forest loss, and the areas impacted the most are those that originally (i.e., in the 1980s) had little urban or suburban land cover (Matlack unpublished).

Several national maps of the WUI have been developed, including the University of Wisconsin's "WUI 1990" and "WUI 2000" maps, which were recently updated (Figure 1w); however, maps specific to Ohio should be developed in the future to more accurately identify WUI areas. An analysis of projected housing change from the year 2000 to 2030 on forest land shows where future forest fragmentation and expansion of the WUI is likely to occur in Ohio (Figure 1x).

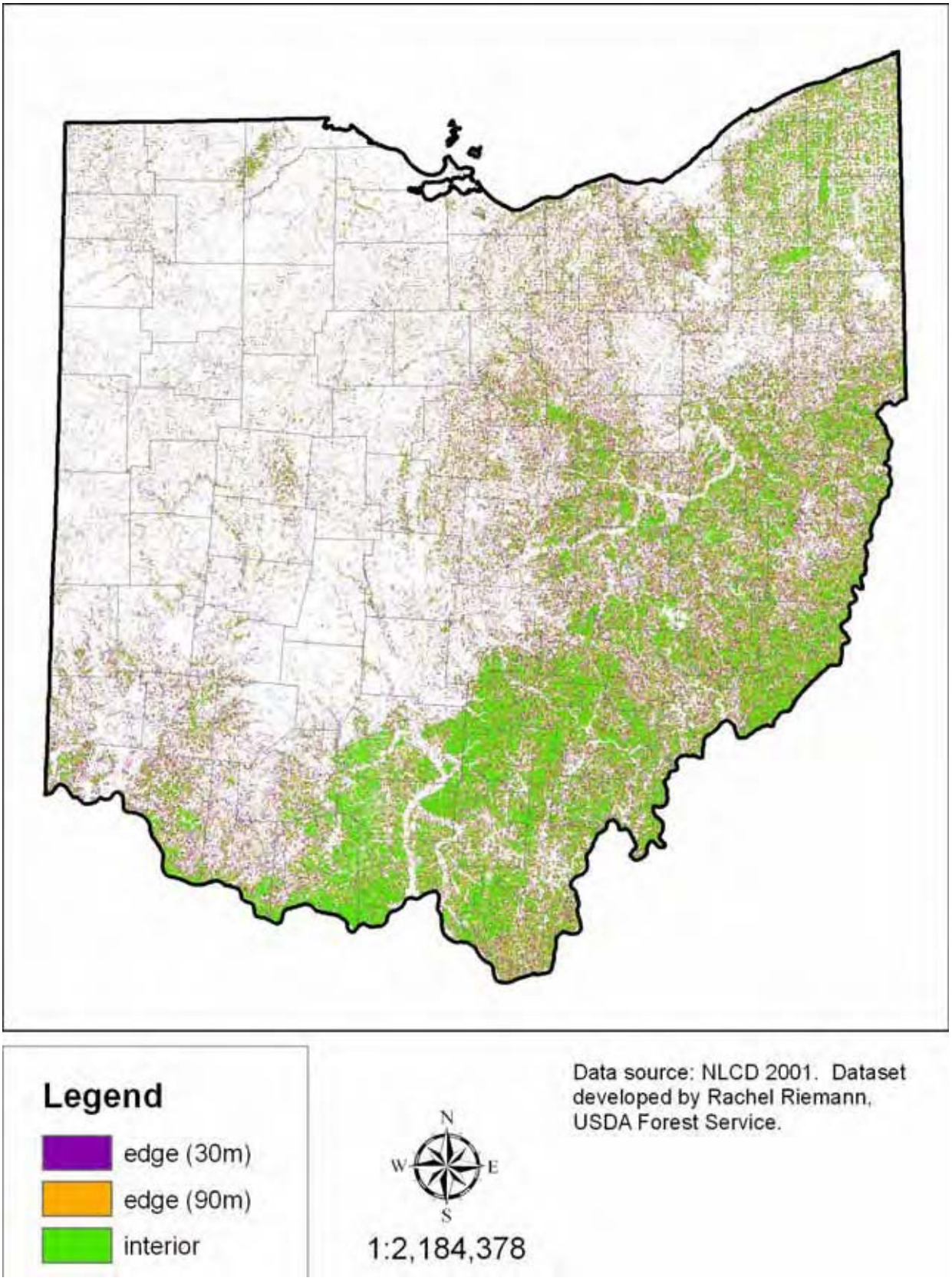


Figure 1u – Forest land in Ohio by distance to forest edge and forest interior.

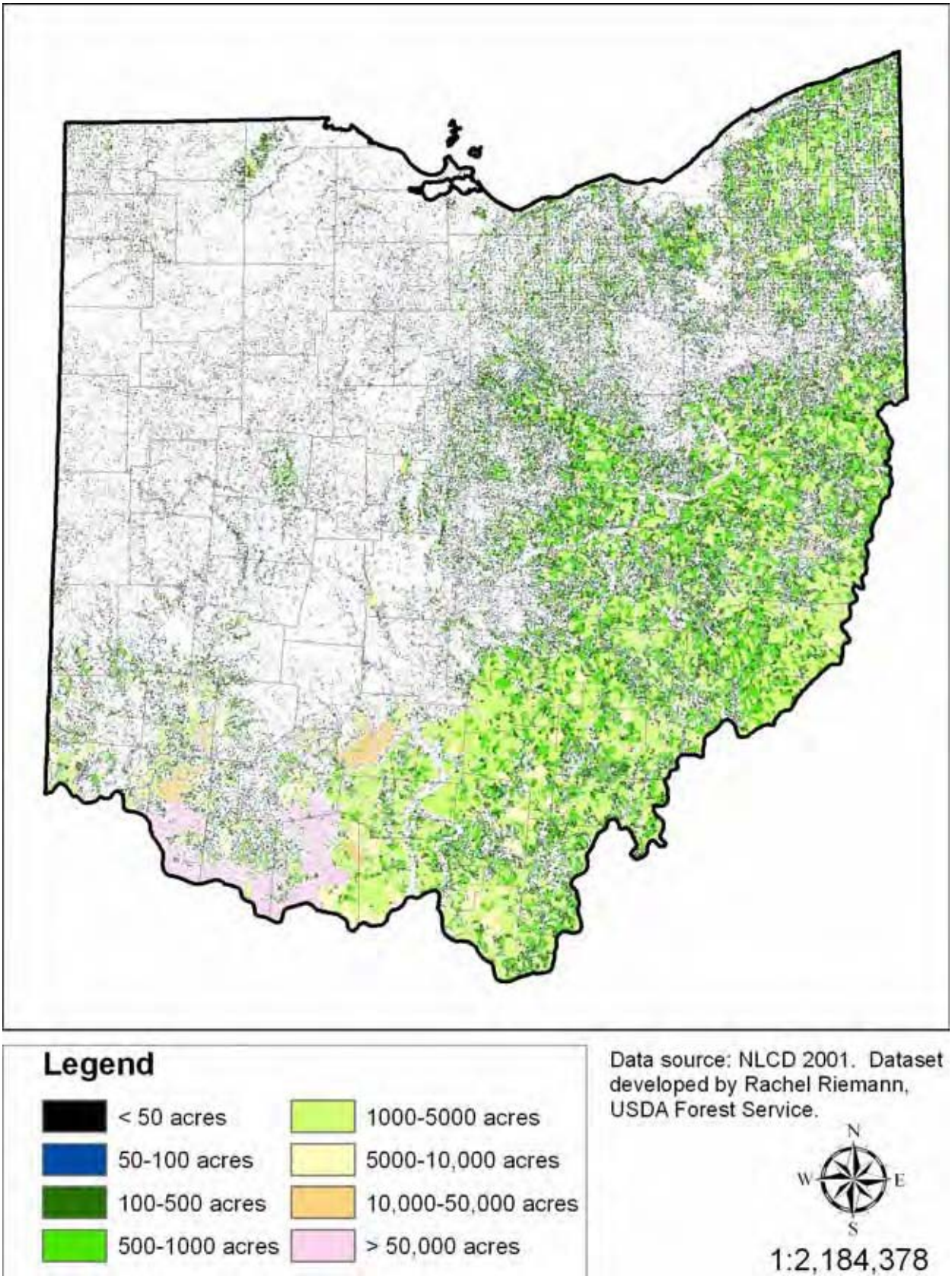


Figure 1v – Forest land in Ohio by patch size.

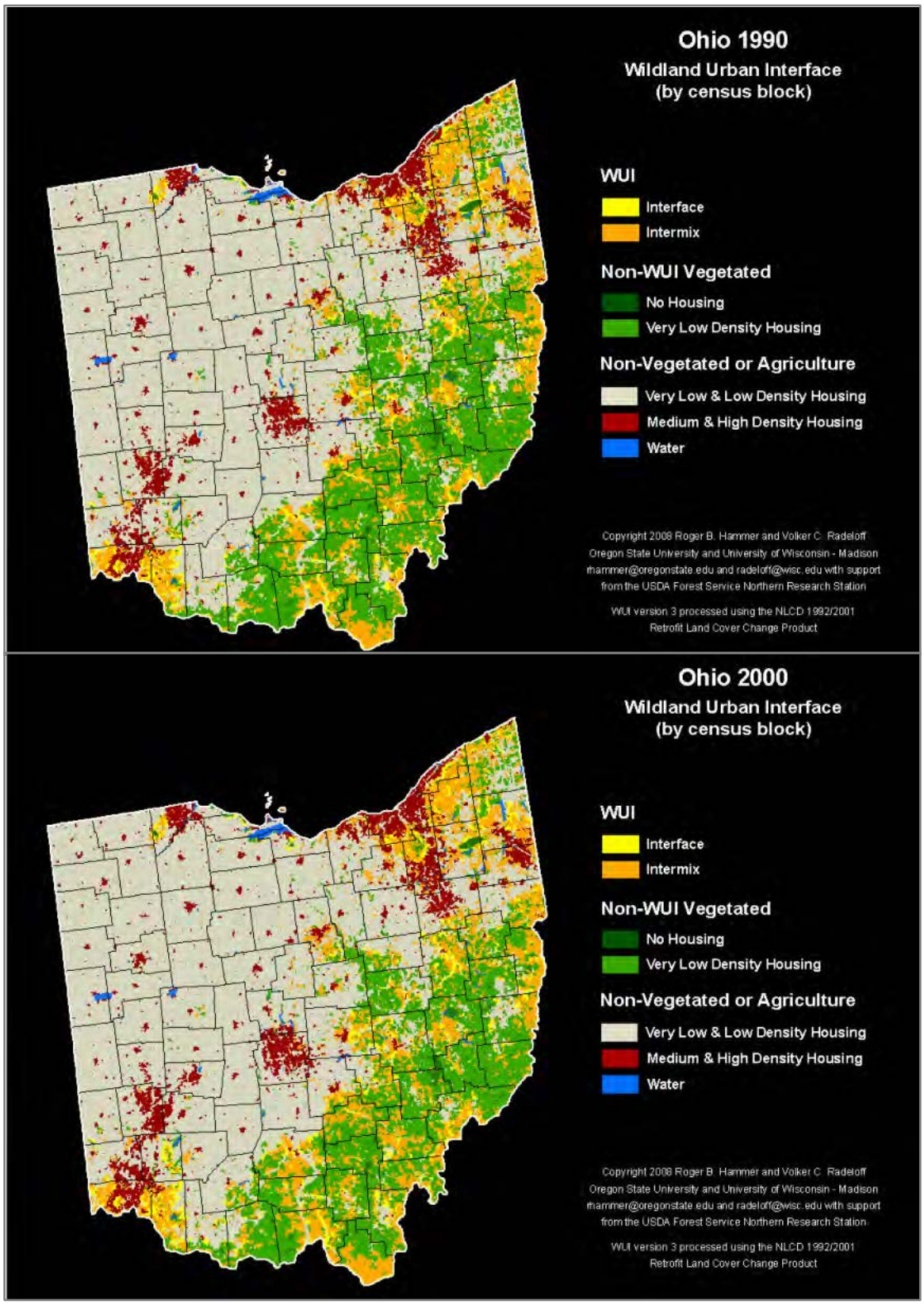


Figure 1w – The wildland-urban interface in Ohio in 1990 and 2000. Map produced by Roger Hammer of Oregon State University and Volker Radeloff of the University of Wisconsin, using NCLD 1992/2001 Retrofit Land Cover Change data.

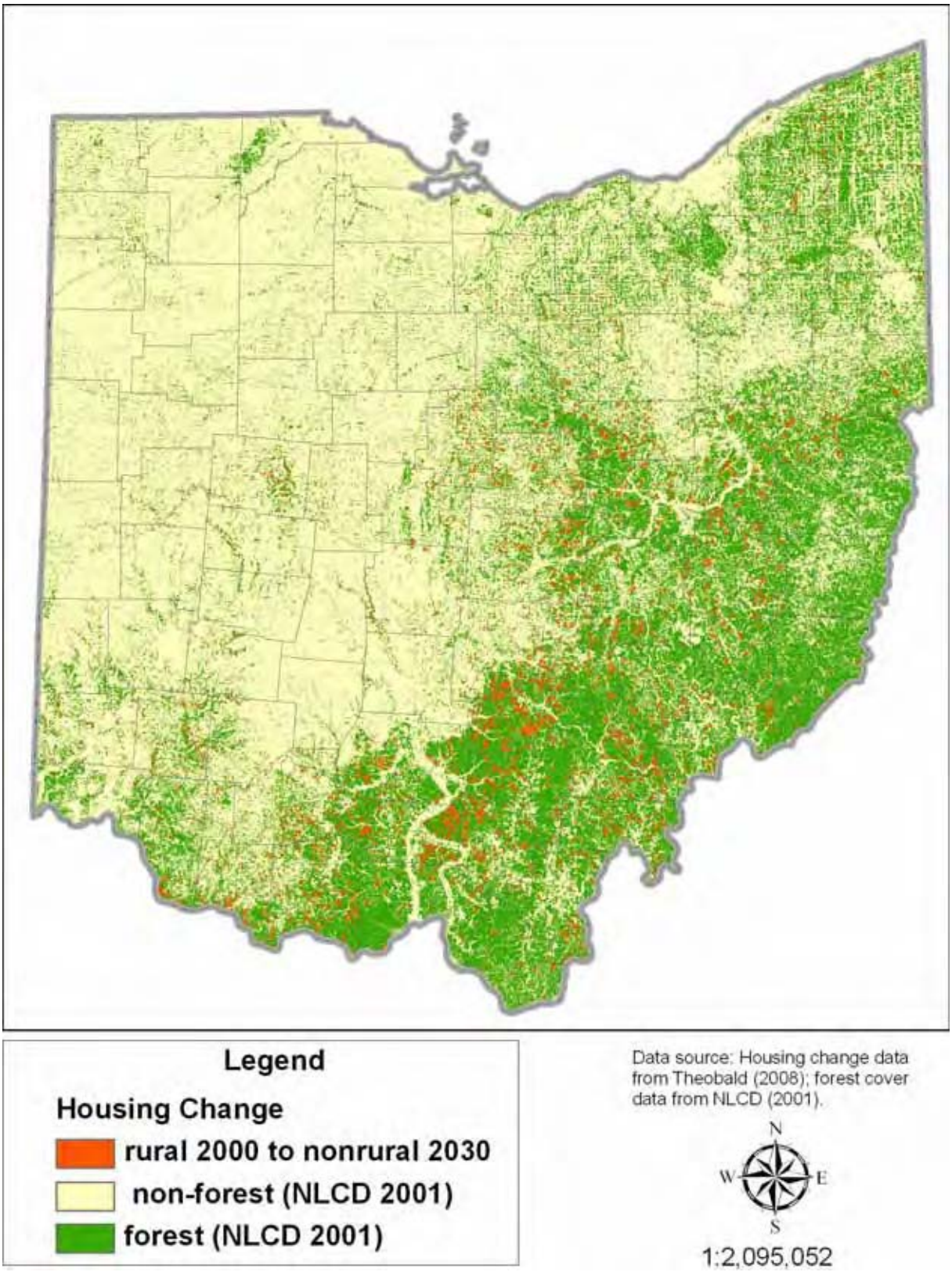


Figure 1x – Projected housing change from 2000 to 2030 on forest land in Ohio. The orange areas on the map represent forest land (from NLCD 2001) that are projected to change from rural to non-rural from the year 2000 to 2030 (Theobald unpublished).

Forest land development and parcelization

Of the 160 million cubic feet of removals in Ohio's growing-stock volume from 1991 to 2006, 32% was due to land use change to nonforest use (Widmann et al. 2009). A significant portion of that land use change likely results from the development of forest land; however, the exact amount is unknown. The vast majority of forest land development occurs on private lands. In Ohio, 88 % of forest land is privately owned, and the largest ownership category is "family forest," which represents 73 % of Ohio's forest land. Ninety-three percent of family forest landowners own forests that are less than 50 acres in size (Figure 1y), and the relative number of owners in this category has been growing. Fifty-five percent of family forest land is less than 50 acres in size. The number and acreage of family forests less than 50 acres in size increased by 10 and 6 percent, respectively, since 1991 (Widmann et al. 2009). The average parcel size of private woodland owners went from 19.0 acres per owner in 1991 to 17.3 acres per owner in 2006 (Birch 1996, Butler et al. 2010). This shift in forest ownership towards smaller size class of holdings reflects the increasing parcelization of Ohio's forests.

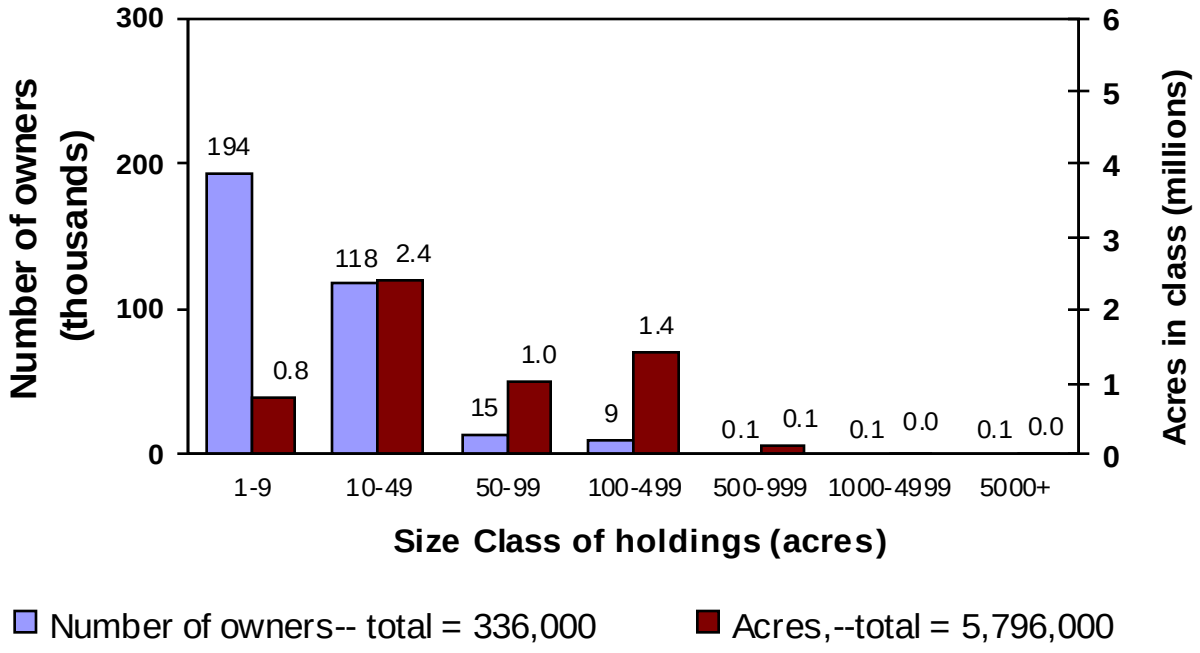


Figure 1y – Number of family forest landowners and acres of forests by size class of holdings. From *Ohio's Forests: 2006* (Widmann et al. 2009).

Indicator 4 – Status of forest/woodland communities and associated species of concern

A core metric of the conservation of biological diversity is the variety of species and their population levels. This indicator describes forest communities and associated species in Ohio. It also reports the current condition and trends of forest-associated species of concern or species that can be used as indicators of community or ecosystem integrity. On the Phase 3 plots during the most recent FIA inventory in Ohio, 609 different species or undifferentiated genera of vascular plants were observed (Widmann et al. 2009). In those plots, the species group (based on growth habit) with the greatest richness was the forb/herb group, which had 228 different species. Seventy-two grass or grass-like plants were found, and 95 distinct tree species were identified. Fourteen percent, or 88 species of plants were non-native (exotic plants). The second most-common species on the Phase 3 plots was the exotic invasive shrub multi-flora rose; however, no other exotic species were in the top 30 (Widmann et al. 2009). Invasive plants are discussed in more details under Indicator 7 of this report.

Discussions about biological diversity and species of concern can occur at multiple scales, including biomes, ecoregions or ecological sections, ecological landscapes or subsections, ecosystems, biological communities, species populations, or individuals. For this indicator, the discussion will start at the scale of Ohio's ecological sections, which are roughly equivalent to the Level III ecoregions developed U.S. EPA. Ohio's ecological sections from the US Forest Service's ECOMAP 2007 project are shown in Figure 1b. Table 1a provides a brief summary of each section, including any unique or rare ecosystems, communities, or plant species of note.

Table 1a – Summary of Ohio's ecological sections. Examples of rare ecosystems, plant communities, and plant species are listed (Brockman et al. unpublished); animals are addressed later in this report. Common names are given for rare species.

Section Name	General Description	Dominant Forest Type	Rare Ecosystems, Communities, Species
South Central Great Lakes	Relatively flat terrain with end moraines; abundant agricultural lands with generally small, isolated woods.	elm-ash-red maple; maple-beech	grasslands, wetlands
Erie and Ontario Lake Plain	Nearly level coastal strip of lacustrine deposits punctuated by beach ridges and swales; lake-modified climate that often has longer growing season; abundant urban and commercial development.	beech-maple	marshes, bogs
Lake Whittlesey Glaciolacustrine Plain	Much of area was the former Black Swamp; flat terrain with abundant agriculture; urban areas (Toledo); woods often occupy poorly drained areas or sandy, well-drained dunes and ridges.	elm-ash-red maple, maple-beech	oak savannas, sedge meadows, sand barrens, wet prairies, marshes, old growth forests/swamps, lakeside daisy, prairie fringed orchid, pumpkin ash, swamp cottonwood
Central Till Plains-Beech-Maple	Relatively flat terrain, with some rolling hills and end moraines; abundant agricultural lands with generally small, isolated woods.	elm-ash-red maple, oak-hickory, maple-beech-birch	remnant prairies, fens (e.g., Cedar Bog), old growth forests, spreading rock-cress, snow trillium, glade mallow, running buffalo clover, purple fringed orchid
Interior Low Plateau-Bluegrass	Rolling to deeply-dissected, rugged terrain; mosaic of forests, agriculture, and urban areas (Cincinnati).	maple-beech-birch, oak-hickory, oak-gum	remnant prairies, wall rue, blue false indigo, dwarf hawthorn, Carolina willow
Western Glaciated Allegheny Plateau	Rolling to level terrain that is less fertile than other glaciated areas of Ohio; abundant urban, industrial, and agricultural development, and some heavily wooded areas.	maple-beech-birch, elm-ash-red maple, oak-hickory	bogs, prairie fringed orchid, painted trillium, woodland bulrush, Northern monkshood, pumpkin ash, swamp cottonwood, striped maple
Southern Unglaciated Allegheny Plateau	Hilly and wooded terrain (unglaciated); formally extensive mixed-mesophytic forests; some isolated urban and agricultural areas, mostly in valleys and river bottoms.	oak-hickory, oak-pine, Virginia-pitch pine	old growth forests, prairie fringed orchid, Northern monkshood, rock clubmoss, shale barren pussytoes, mountian fringe, snow trillium, prickly pear, rattlesnake-master, bigleaf magnolia, chestnut oak

Forest and woodland communities

In general, statewide maps of distinct forest communities are lacking, and developing trend data is difficult. Data from the FIA provide good coverage of tree species and forest structure, but without corresponding data on understory species (e.g., shrubs and herbaceous plants), characterizations of complete plant communities cannot be made. Data from the Phase 3 FIA plots could potentially be used to address this data gap, but, such community scale analyses have not been completed to date. The trends for overstory tree species and forest types were described under Indicator 2; the data indicate a general reduction in the relative dominance of oaks and hickories and an increase in other hardwood species, particularly maple and yellow poplar. Figure 1z is a detailed map of existing vegetation (at the 30 X 30 meter pixel scale) developed using data from the Landfire program. In the map, vegetation cover is described by ecological system (i.e., ecosystem) using NatureServe's ecological systems units (Comer et al. 2003). NatureServe also has global conservation status rankings of ecological associations (~community level). Table 1b shows the forest associations in Ohio that are globally critically imperiled (G1 status) with the ecological system(s) in which they occur. Using the GIS map of ecological systems in Ohio (i.e., Figure 1z), potential sites for these globally imperiled forest communities can be identified geospatially.

Table 1b – Ecological associations in Ohio that have woody species and are globally imperiled (G1 or G2 status). Data source is NatureServe Explorer (NatureServe 2009).

Ecological Association Name	Global Consevation Status	Ecological Systems Placement
Cottonwood Dune Woodland	G1G2	Great Lakes Wooded Dune
Bluegrass Cat Prairie	G1	Central Interior Highlands Calcareous Glade and Barrens
Post Oak Chert Barrens	G1	Central Interior Highlands Dry Acidic Glade and Barrens
Central Bur Oak Opening	G1	North-Central Interior Oak Savanna

The Ohio Division of Wildlife maintains a natural heritage database that contains records on the locations of Ohio's rare plants and animals, high quality plant communities, and other unique natural features (e.g., geologic features). Data from the natural heritage database were used to identify priority landscapes in the geospatial analyses phase of this statewide assessment (described in Section 5), but maps generated from that database cannot be shown due to data sensitivity. The Ohio Division of Wildlife maintains a separate statewide database called the Wildlife Diversity Database that includes geospatial data on documented state and federal listed wildlife species. Ohio's forest communities provide breeding or nesting habitat for at least 350 terrestrial wildlife species, including 134 birds, 44 mammals, 71 herpetofauna (reptiles and amphibians), 93 lepidopterans (butterflies and moths), and 8 beetles (Data source: Ohio Div. of Wildlife). The Ohio Division of Wildlife identified several unique habitats in its Strategic Plan (2001-2010), including Lake Erie Islands, oak savannas, Northeastern Ohio boreal communities, blue holes, and caves. Other unique forest habitats that have high conservation value in Ohio include old growth forests and vernal pools. Known locations of state or federally listed rare species are also considered to be high conservation value areas. Ohio has 134 state nature preserves that protect some of the State's most unique and important habitats or biological communities. The Nature Conservancy and other non-governmental organizations (e.g., land trusts) have also protected important natural areas through land acquisitions and conservation easements.

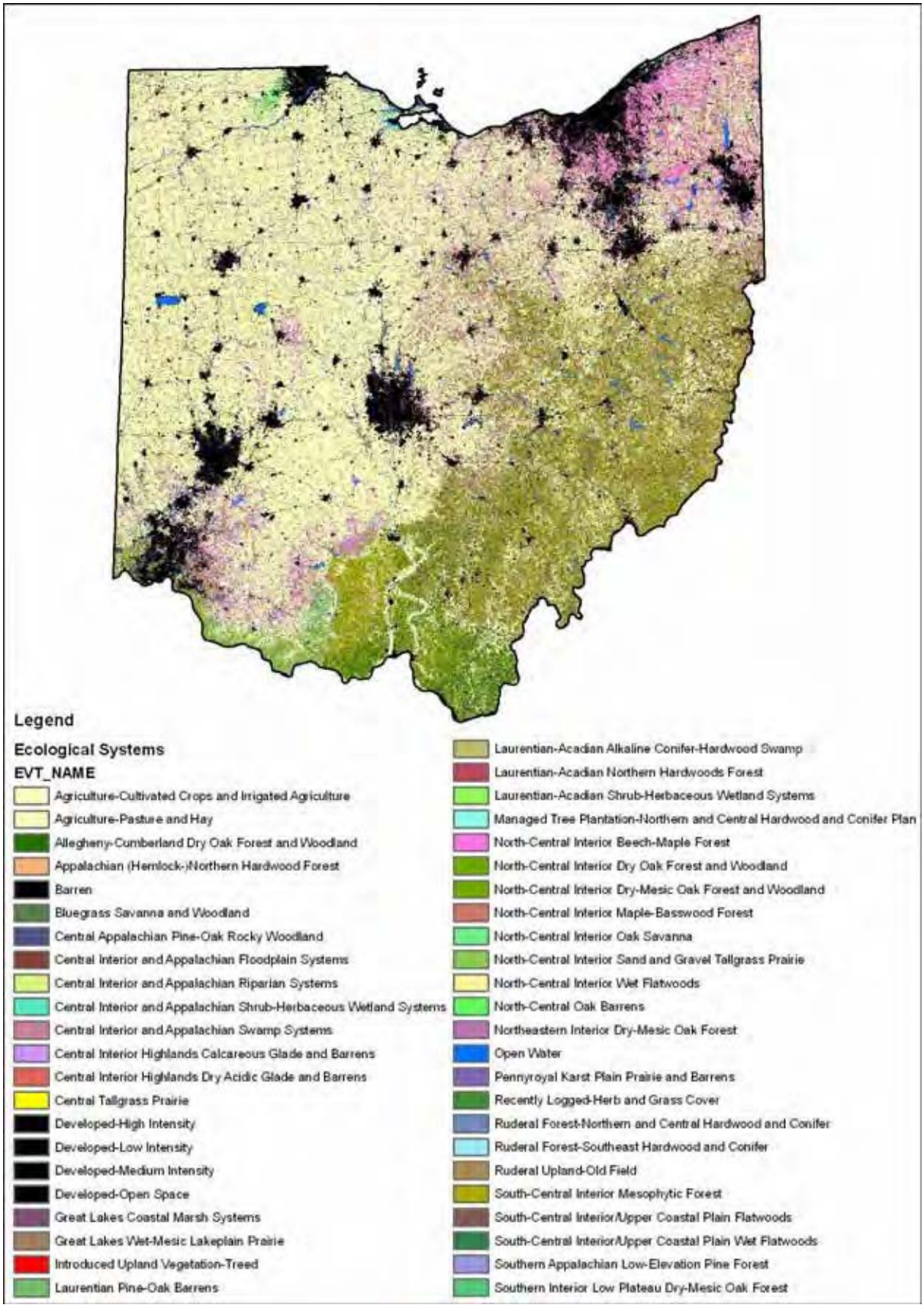


Figure 1z – Existing vegetation types of Ohio, using the ecological system units developed by NatureServe (Comer et al. 2003). Map created using Landfire data (LANDFIRE 2010).

Forest-associated species of concern

While community-level data are limited in Ohio, good data exist for individual species that are listed by the state or federal government. The U.S. Fish & Wildlife Service is the lead agency administering the federal Endangered Species Act, and they enforce the protection of federally listed species (e.g., endangered or threatened). The Ohio Division of Wildlife administers the state's program for listing threatened and endangered species. In the past, the state listing of plant species was managed by the Natural Heritage Program of the Ohio Division of Natural Areas and Preserves, but the program was recently transferred to the Ohio Division of Wildlife and is now called the Ohio Biodiversity Database Program. Table 1c describes Ohio's federally listed plants. A comprehensive list of Ohio's rare plants (i.e., state listed species) can be obtained from the Ohio Division of Wildlife (phone: 1-800-945-3543) or accessed online at: http://ohiodnr.com/Home/Rare_Plants/20102011RareNativeOhioPlants/tabid/22557/Default.aspx . The 2010-2011 state list of rare native plants includes 97 presumed extirpated, 250 endangered, 152 threatened, and 130 potential threatened taxa. Ohio has 16 federally threatened and endangered wildlife species (Tables 1d and 1e) and 180 State threatened and endangered wildlife species (Table 1f).

A statewide strategic plan for wildlife species conservation is outlined in Ohio's Comprehensive Wildlife Conservation Strategy (CWCS) developed by the Ohio Division of Wildlife in 2005 (ODOW 2005). A major trend for forest wildlife species has been the increase in populations of forest-dependent species, like wild turkey, deer, and black bear. However, the CWCS notes a decline in multiple species that require early successional forest habitat (ODOW 2005). In addition to the rare species data, the analysis of forest-associated wildlife species in this assessment uses trend data for forest bird populations as an indicator of the condition of all forest-associated wildlife. When populations of forests birds are stable in the different forest successional stages, the habitat needs of other taxa of wildlife are generally met (Caldwell pers. comm.). The Ohio Division of Wildlife's approach for sustaining Ohio's forest wildlife species, as outlined in the CWCS, is to use forest focus areas in and around Shawnee and Zaleski State Forests (Figure 1aa). Both of these focus areas are large forest blocks (>60,000 acres) that are capable of meeting the needs of all area-sensitive forest wildlife species and incorporate natural disturbances. The two forest focus areas are described in more detail in the CWCS. The plan describes how they will be managed to sustain a diversity of wildlife species by maintaining set distributions of different forest successional stages. Beyond the forest focus areas, the CWCS identifies other statewide strategies related to forest wildlife, including a public awareness program on viable forest management practices and the promotion of several specific management objectives including management for oak regeneration and the use of timber harvests to increase early successional forest habitat and maintain diversity (ODOW 2005).

The 2006 Forest Plan for the Wayne National Forest outlines its goals and objectives for sustaining favorable aquatic and terrestrial habitat conditions for wildlife and plant species and biological communities. The Wayne National Forest Plan also outlines goals and objectives for the recovery of endangered, threatened, and sensitive wildlife and plant species. A copy of the Wayne National Forest plan can be accessed from the "Land & Resources Management" page on the forest's website: http://www.fs.fed.us/r9/wayne/ . The Wayne National Forest also has a wildlife program called "Get Wild!" that focuses on protecting and restoring native habitats important for conserving biodiversity and managing habitats in a manner that meets public demand.

Table 1c – Federal listed Ohio plant species. Listed status symbols are: endangered (E) and threatened (T).

US Status	OH Status	Common Name	Scientific Name	Comments
T	E	Northern monkshood	Aconitum noveboracense	Habitat is shaded ravines with nearby running water; threats are loss of forest canopy, site/soil disturbance, invasive species, and herbivory. Currently restricted to 2 (possibly 3) small, isolated populations.
T	E	Lakeside daisy	Hymenoxys herbacea	Require open habitat; expansion of forest cover threatens habitat.
T	E	Small whorled pogonia	Isotria medeoloides	Habitat is open, second-growth hardwood forests; rarest orchid in North America; restricted to Scioto and Hocking Counties in Ohio. Difficult to locate new populations.
T	T	Prairie fringed orchid	Platanthera leucophaea	Habitat is open, mesic to wet prairies, marshes, fens, and fields; threats are agricultural land use, encroaching forests, and invasive plants.
T	E	Appalachian spiraea	Spiraea virginiana	Habitat is gravelbars or streambanks of mid-sized streams; threats are change in stream morphology and invasive plants. Only found in Scioto County in Ohio.
E	E	Running buffalo clover	Trifolium stoloniferum	Believed to have originally occupied ecotone between open forests and prairie; prefers somewhat open habitat but not full sun; currently found in partially shaded woods, mowed areas, and along streams and trails.

Table 1d – Federally listed endangered (E) and threatened (T) animal species in Ohio.

US Status	OH Status	Scientific name	Common name	Comments
E	E	*Myotis sodalis*	Indiana bat	Found throughout the state. Roosts during the warmer months in dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas; live trees (such as shagbark hickory and oaks) which have exfoliating bark; and stream corridors, riparian areas, and upland woodlots which provide forage sites. Hibernates in caves and underground mines.
E	E	*Charadrius melodus*	Piping plover	Habitat includes sand or pebble beaches with sparse vegetation along the shore of Lake Erie. Designated Critical Habitat exists in the vicinity of Sheldon Marsh State Nature Preserve, Huron, Erie County, Ohio.
E	E	*Dendroica kirtlandii*	Kirtland's warbler	May migrate through Ohio. Nest in Michigan, Wisconsin, and Ontario on the ground beneath 6 to 22 year old Jack Pine trees.
T	E	*Nerodia erythrogaster neglecta*	Copperbelly water snake	Habitat includes lowland swamps or other warm, quiet waters (both seasonal and permanent), adjacent wooded migration corridors, adjacent upland slopes with underground hibernation sites below the frost line, and streams or rivers.
T	E	*Nerodia sipedon insularum*	Lake Erie water snake	Inhabits the cliffs, ledges and rocky shorelines of limestone islands and forages in the nearshore waters of Lake Erie. During winter, hibernates underground. Historically fed on madtoms, shiners, and salamanders; the invasive round goby makes up about 90% of its diet today. Currently proposed for delisting due to recovery.
E	E	*Noturus trautmani*	Scioto madtom	Is known only from Big Darby Creek in Jackson Township of Pickaway County. Habitat for this species includes riffles where the water velocity is decreasing and the substrate is composed of sandy gravel with some small stones no larger than 4 inches in diameter. However, this species has not been seen since 1957.
E	E	*Cyprogenia stegaria*	Fanshell	Inhabits medium to large rivers with sand or gravel substrate and also prefer areas with riffles or moderate current.
E	E	*Epioblasma o. obliquata*	Purple's catspaw	Inhabits large rivers in the Ohio River basin in areas with sand or gravel substrate, and prefers shallow areas with riffles and runs.
E	E	*Epioblasma obliquata perobliqua*	White catspaw	Found in the sand or gravel of small to medium streams and rivers with swift current.
E	E	*Epioblasma torulosa rangiana*	Northern riffleshell	Inhabits small to large streams with firmly packed sand or gravel.
E	E	*Lampsilis orbiculata*	Pink mucket	Found in large rivers with strong currents in shallow to deep water with substrates composed of boulders, rubble, gravel, sand or silt.
E	E	*Pleurobema clava*	Clubshell	Occurs in small to large rivers with clean, loose sand and gravel in which they can bury themselves up to 4" deep.
E	E	*Somatochlora hineana*	Hine's emerald	Extirpated from Ohio. Today the dragonfly can only be found in Illinois, Michigan, Missouri and Wisconsin in calcareous (high in calcium carbonate) spring-fed marshes and sedge meadows overlaying dolomite bedrock.
E	E	*Lycaeides melissa samuelis*	Karner blue	Found in the Oak Openings region of northwest Ohio due to the presence of wild lupine (*Lupinus perennie)* for the larval stage and nectar-producing flowers for the adult stage.
E	E	*Neonympha mitchellii*	Mitchell's satyr	Found in fens with low nutrient, carbonate-rich ground water.
E	E	*Nicrophorus americanus*	American burying beetle	A generalist as far as habitat preference is concerned, meaning that it can be found in grasslands, open woodlands and brushlands. Requires available carrion to bury.

Table 1e – Federally listed animals that are candidate species (C) and species of concern (SC) in Ohio.

US Status	OH Status	Scientific name	Common name	Comments
C	E	*Sistrurus catenatus catenatus*	Eastern massasauga	Found in wetlands, wet prairie, or nearby woodland or shrub edge habitat, including dry goldenrod meadows with a mosaic of early successional woody species such as dogwood or multiflora rose. Wet habitat and nearby dry edges are utilized, especially during the spring and fall, and dry upland areas < 1.5 miles away are utilized during the summer, if available.
C	E	*Villosa fabalis*	Rayed bean	Found in smaller, headwater creeks, but records exist in larger rivers, where they are in or near shoal or riffle areas, and in the shallow, wave-washed areas of lakes. Substrates typically include gravel and sand, and they are often associated with, and buried under the roots of vegetation.
C	E	*Quadrula cylindrica*	Rabbitsfoot	Occur in small to medium-sized streams and some larger rivers. Usually occurs in shallow areas along banks and adjacent runs and shoals where the water velocity is reduced. It may also occur in deep water runs, having been reported in 9-12 feet of water. Bottom substrates generally include sand and gravel.
C	E	*Plethobasus cyphyus*	Sheepnose	Found in larger streams where it typically occurs in shallow shoal habitats with moderate to swift currents over coarse sand and gravel. Habitats may also have mud, cobble, and boulders
SC	T	*Haliaeetus leucocephalus*	Bald eagle	Nest in large, supercanopy trees usually on forest edges or openings near large rivers and lakes which provide fish.
SC	E	*Cryptobranchus a. alleganiensis*	Eastern hellbender	Inhabits perennial streams with large, flat rocks and clear, swift-flowing water.
SC	E	*Crotalus horridus horridus*	Timber rattlesnake	Habitat is restricted to the un-glaciated Allegheny Plateau. Winters are spent in dens usually associated with high, dry ridges. In the fall, timber rattlesnakes return to the same den.
SC	E	*Epioblasma triquetra*	Snuffbox	Occurs in swift currents of riffles and shoals over gravel and sand with occasional cobble and boulders.

Table 1f – Number of species by taxa classified as Endangered, Threatened, Species of Concern, Special Interest, Extirpated, and Extinct in Ohio, as of January 2009 (Data source: Ohio Division of Wildlife). List includes both State and Federal listed species. A description of each listing category can be obtained from the Ohio Division of Wildlife (available online at: http://www.dnr.state.oh.us/Portals/9/pdf/pub356.pdf).

Taxon	Endangered	Threatened	Species of Concern	Special Interest	Extirpated	Extinct
Mammals	5	0	8	0	9	0
Birds	16	11	13	31	4	2
Reptiles	5	2	13	0	0	0
Amphibians	5	1	2	0	0	0
Fishes	23	13	11	0	5	2
Mollusks	24	4	9	0	13	5
Crayfishes	0	2	3	0	0	0
Isopods	0	0	2	0	0	0
Psuedoscorpions	0	0	1	0	0	0
Dragonflies	13	6	1	0	0	0
Damselflies	3	0	0	0	0	0
Caddisflies	3	6	3	0	0	0
Mayflies	2	0	1	0	0	0
Midges	1	3	1	0	0	0
Crickets	0	0	1	0	0	0
Butterflies	8	1	2	1	1	0
Moths	14	4	22	10	0	0
Beetles	3	2	6	0	0	0
Total	**125**	**55**	**99**	**42**	**32**	**9**

Figure 1aa – Forest focus areas identified in Ohio's Comprehensive Wildlife Conservation Strategy. Source: Ohio Division of Wildlife.

Bird populations.

As mentioned in the previous section, forest bird populations provide a good indicator of overall forest wildlife communities. For this analysis, different indicator bird species were selected based on their habitat requirements related to forest age, structure, and successional stage, and their conservation status or importance as gamebirds. Table 1f shows the indicator bird species and their associated forest successional stage. The listed species are not directly linked to specific forest types, as many of them will utilize several different forest types. The majority of the mature and mid-successional forest bird species are increasing, although some exceptions exist. For example, in mature forests Cerulean warblers and Kentucky warblers are declining, and in mid-successional forests, eastern wood pewees are declining (Figure 1ab). Many early-successional forest bird species are showing population declines, including the American woodcock, whippoorwill, and field sparrow (Figures 1ab through 1ae). Northern bobwhites have not been able to significantly recover from their population crash in the late 1970s from historic winter storm events.

In its 2007 *State of Birds Report*, Ohio Audubon lists several common bird species that have precipitously declined over the past several decades. Forest-associated species that made that list include the red-headed woodpecker, northern flicker, and yellow-breasted chat. Some possible causes for decline cited in the report were competition for nest cavities with non-native species (for

red-headed woodpecker and northern flicker), loss of early-successional shrub habitat to farming, development, and forest succession (for yellow-breasted chats), and loss of forest habitat to development (for red-headed woodpecker). Management recommendations in the report related to forest-habitat include maintaining oak-hickory stands, dead standing trees or snags (for nest cavities), and establishing early successional shrub habitat along field edges and openings (Audubon 2007). Ohio Audubon has identified Important Bird Areas (IBAs) across Ohio (Figure 1af). IBAs provide essential habitat for at least one bird species and are often areas where groups of birds gather for critical habitat needs (e.g., nesting cover, wintering, or during migration).

Table 1f – Description of indicator forest bird species in Ohio. The fourth column identifies priority bird species of conservation concern, as listed by the Ohio Bird Conservation Initiative (OBCI), the Appalachian Mountains Joint Venture (AMJV), or the Upper Mississippi River / Great Lakes Region Joint Venture (UMRGLRJV; indicates "focal" species).

Bird Species	Successional Stage	Habitat Preference	Priority Species
Cerulean warbler	Mature forest	Upper slope canopy gaps	OBCI (highest priority), AMJV, UMRGLRJV
Worm-eating warbler	Mature forest	Mesic coves	OBCI (highest priority), AMJV
Kentucky warbler	Mature forest	Understory gaps in mature forest	OBCI (high priority), AMJV, UMRGLRJV
Pileated woodpecker	Mature forest	Big trees/snags	
Yellow-throated warbler	Mature forest	Riparian zones	AMJV
Wood thrush	Mid-successional	Mesic sites	OBCI (highest priority), AMJV, UMRGLRJV
Eastern wood-pewee	Mid-successional	Large forest blocks	AMJV
Red-eyed vireo	Mid-successional	Deciduous forests	
American woodcock	Early successional	Shrub-riparian zones	OBCI (highest priority), UMRGLRJV
Whippoorwill	Early successional	Dry open woods near fields	OBCI (high priority), AMJV, UMRGLRJV
Blue-winged warbler	Early successional	Old fields reverting to woods; forest clearings and edges	OBCI (highest priority), AMJV, UMRGLRJV
Field sparrow	Early successional	Abandoned fields with scattered shrubs and trees	OBCI (high priority), AMJV
Northern bobwhite	Early successional	Shrubby field edges	OBCI (high priority), AMJV
Wild turkey	Various: early successional & mature forest	Food: hard mast from mature forest and fields or early successional forest for cover, soft mast, and invertebrates	AMJV
Ruffed grouse	Various: early successional & mature forest	Food: hard mast from mature forests; young forest for cover and soft mast.	AMJV

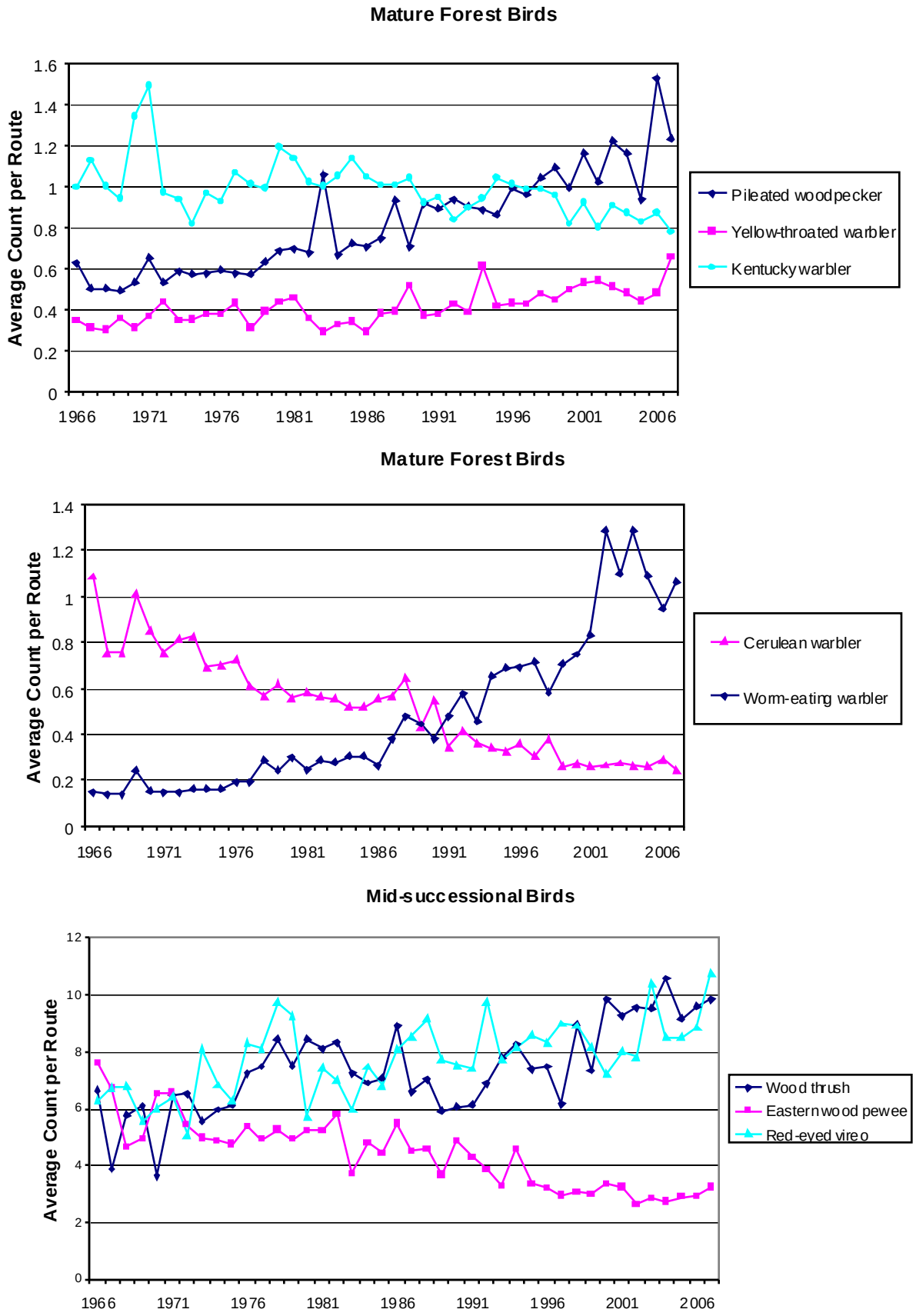


Figure 1ab – Trends in Ohio for select forest-associated bird species grouped by their associated successional stage. Data source: USGS Breeding Bird Survey (http://www.pwrc.usgs.gov/bbs/).

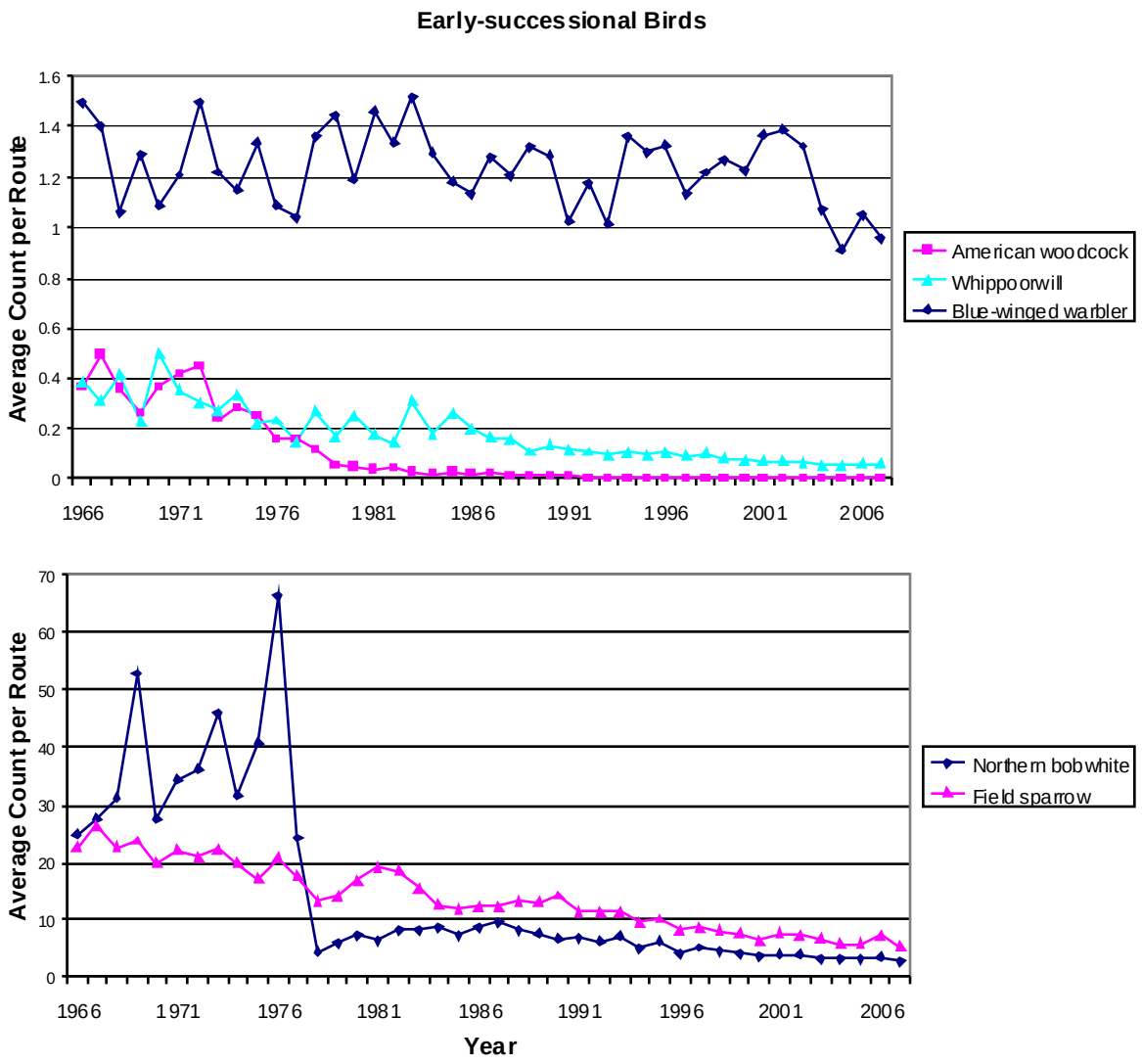


Figure 1ac – Trends in Ohio for select bird species associated with early successional forest habitat or open field/shrub habitat. Data source: USGS Breeding Bird Survey (http://www.pwrc.usgs.gov/bbs/).

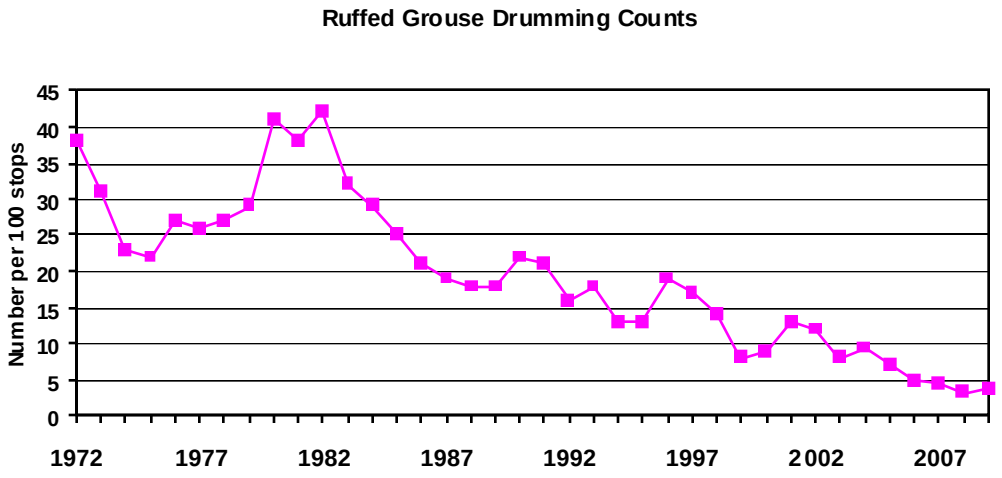


Figure 1ad – Trends for ruffed grouse in Ohio based on drumming counts from 1972 to 2009. Data source: Ohio Division of Wildlife.

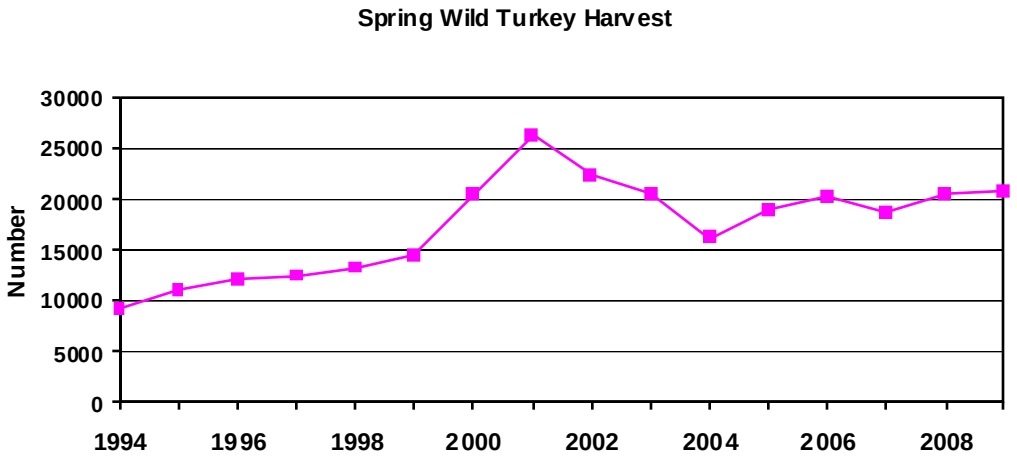


Figure 1ae – Trends for wild turkey in Ohio based on spring harvest data from 1994 to 2009. Data source: Ohio Division of Wildlife.

Figure 1af – Ohio's Important Bird Areas identified by the Audubon Society. Source: Ohio Audubon Society.

Criterion 2 – Maintenance of Productive Capacity of Forest Ecosystems.

"Forests, directly or indirectly, provide a wide range of extractive and non-extractive goods and services. The nature of these goods and services change over time as a consequence of changes in social and economic demands, technology, and actions taken in the forest to provide the goods and services. Changes in the productive capacity of forests could be a signal of unsound forest management or unforeseen agents affecting ecosystems." (USDA 2008)

Indicator 5 – Area of timberland

Timberland is the area from which wood is capable of being harvested for a myriad of uses, from wood for furniture to biomass for production of energy. Timberland supports $15 billion of economic activity in Ohio. Timberland is defined as forest land producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and not withdrawn from timber utilization (FIA definition). This is differentiated from forest land (described in Criterion 1, Indicator 1 of this document), which includes timberland and all noncommercial forest land. Currently there are almost 7,691,000 acres of timberland in Ohio, which comprises 97% of the State's forest land.

Trends for area of timberland show an increase that parallels forest land. However, the relative proportion of forest land that is timberland has decreased slightly since 1968 (Figure 2a).

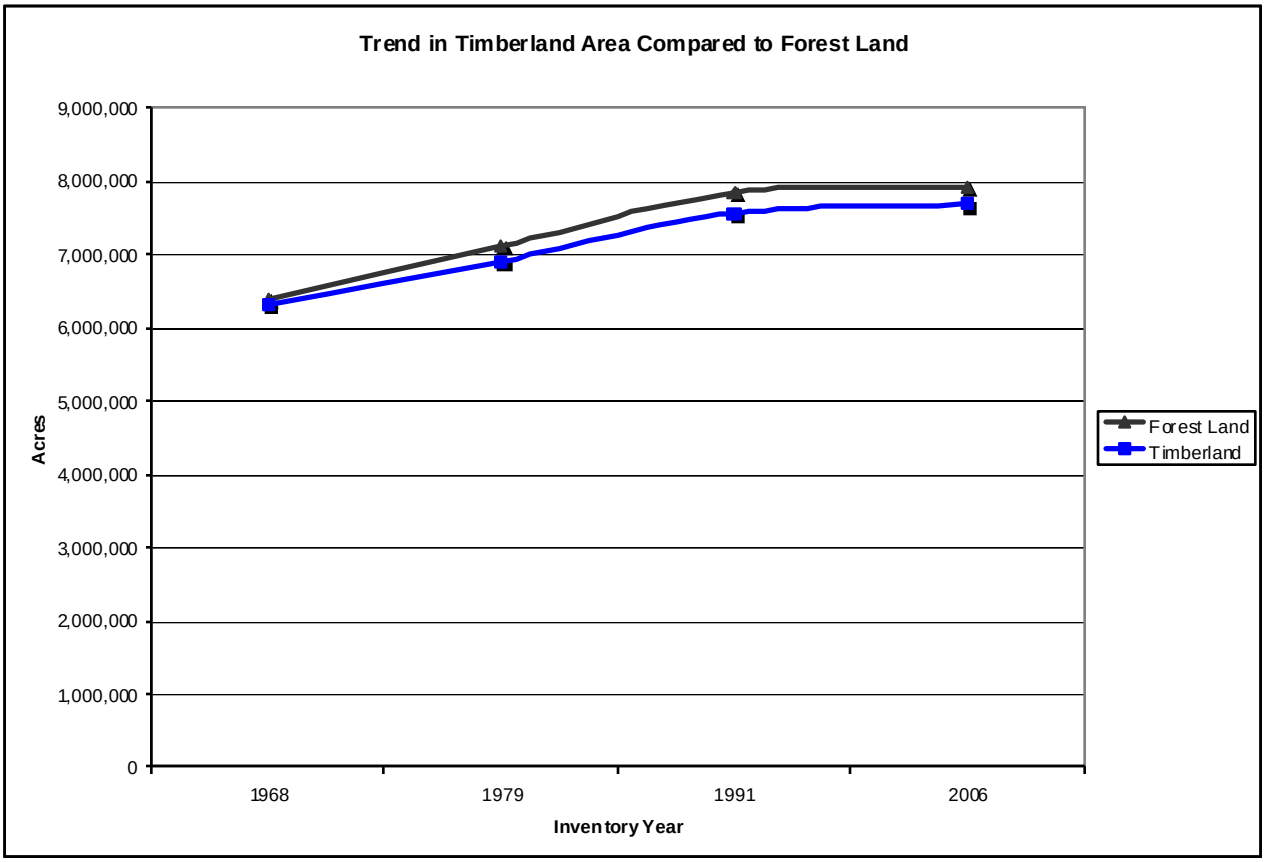


Figure 2a - Trend in Timberland Area Compared to Forest Land
Data Source: USDA Forest Service Forest Inventory and Analysis.

Indicator 6 – Annual removal of merchantable wood volume compared with net growth.

This indicator shows the growth or loss of tree volume. Net growth is defined by FIA as the change, resulting from natural causes, in growing-stock volume during the period between surveys. Components of net growth are ingrowth plus accretion, minus mortality, minus cull increment, plus cull decrement. Removals are defined as the net growing-stock volume harvested or killed in logging, cultural operations (such as timber stand improvement), or land clearing, and the net growing-stock volume that was reclassified from timberland to noncommercial forest land during the period between surveys. In general, growth outpaces removals (Figure 2b). Growth to removal ratios for individual species vary, but the trend is that most oak species have ratios less than 2:1 while maples and poplars are greater than 2:1 (Figure 2c). These trends show another mechanism in which the relative dominance of oaks will decrease while maples increase. In the aggregate, growth continues to outpace removals and mortality resulting in increasing wood volumes in Ohio's forests (Figure 2d).

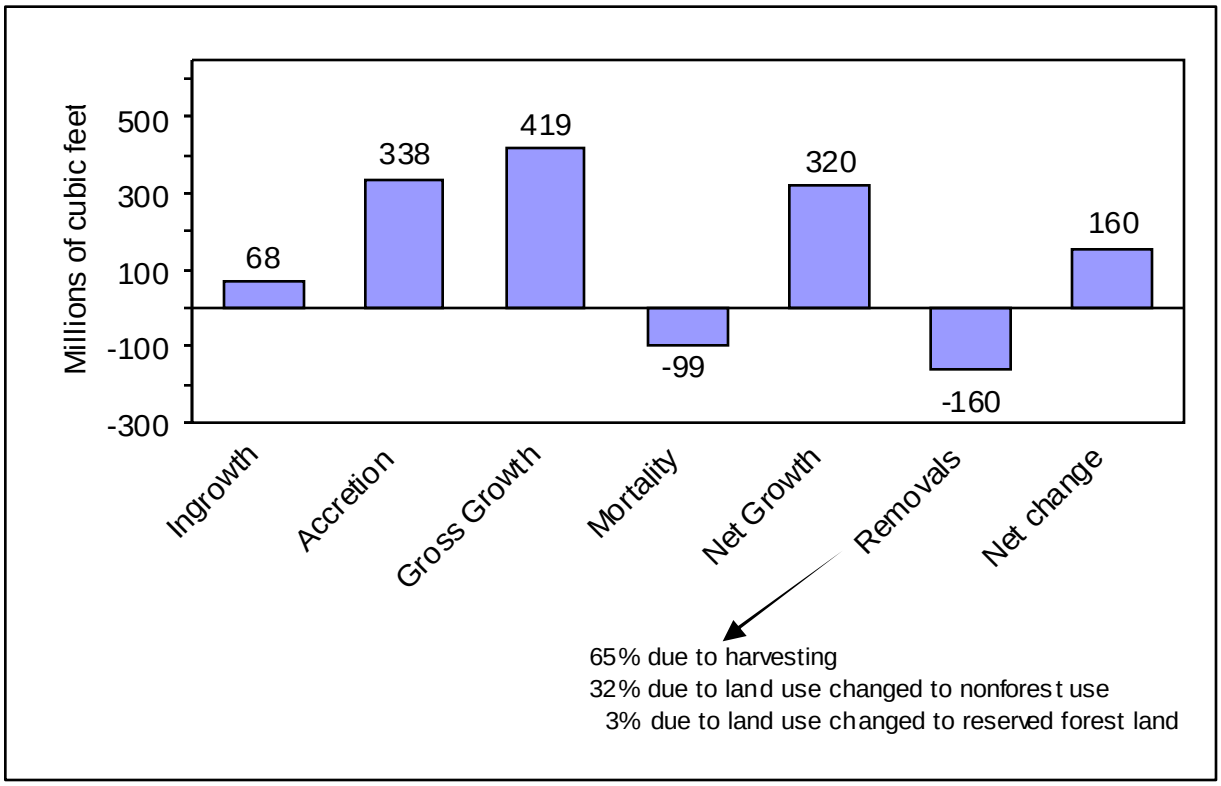


Figure 2b - Annual components of change in growing-stock volume, Ohio, 1991 – 2006
Data Source: USDA Forest Service Forest Inventory and Analysis.

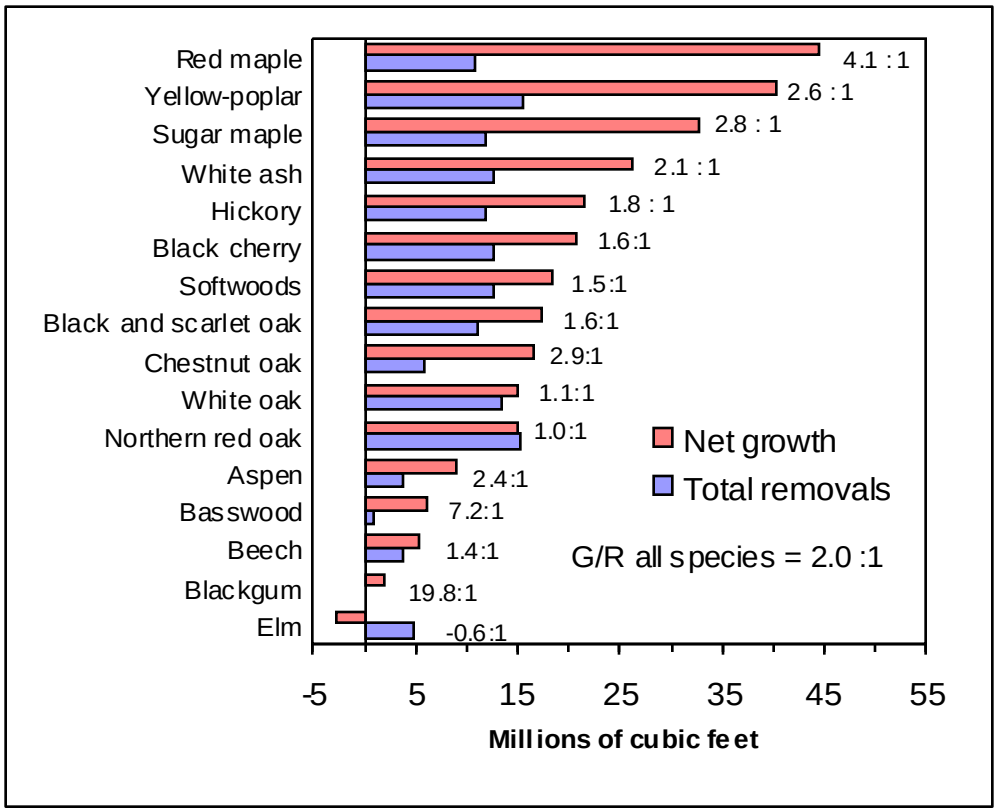


Figure 2c - Average annual net growth, removals, and G/R ratio for major species, Ohio, 1991-2006
Data Source: USDA Forest Service Forest Inventory and Analysis.

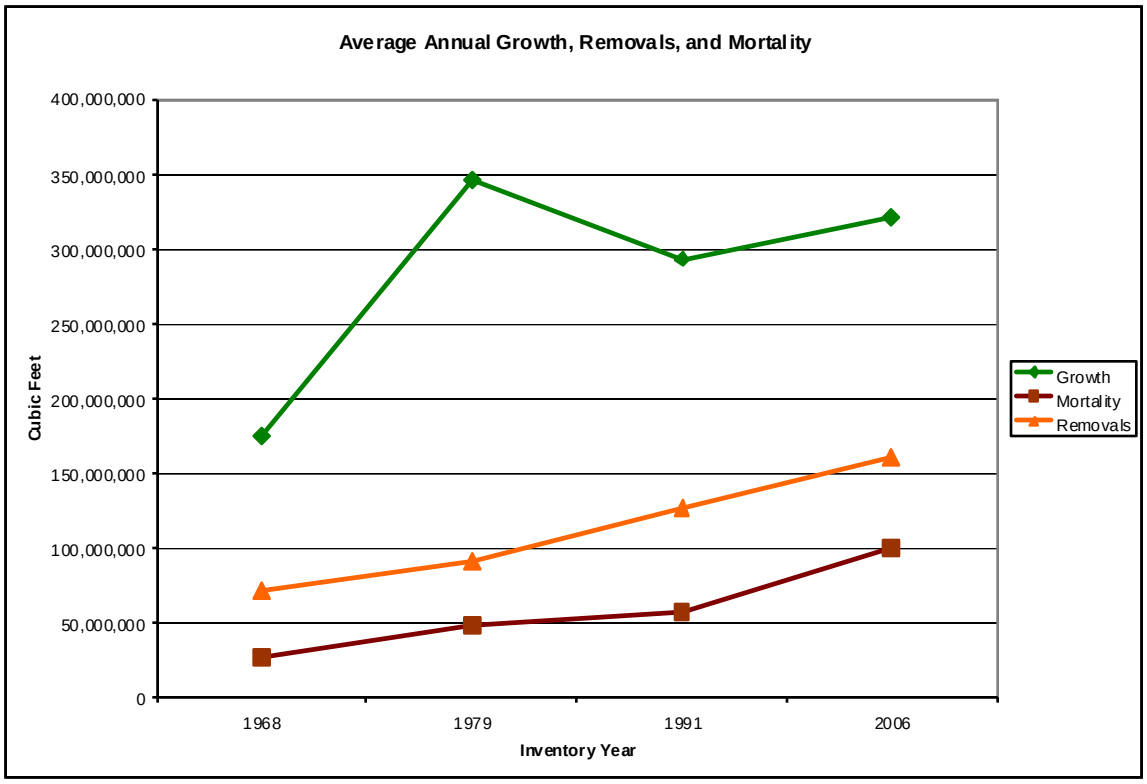


Figure 2d - Growth and removal trends in Ohio, 1968 – 2006
Data Source USDA Forest Service Forest Inventory and Analysis.

Type of removals.

The definition of removals includes not only volume removed due to a harvest but also conversion of the land to a nonforest use and a reclassification of the land from timberland to noncommercial forestland. According to the 2006 FIA inventory, 65% of the removals were due to harvesting of trees, 32% was due to land use change to nonforest, and 3% was due to a land use change to reserved forest land. Removals due to timber harvesting do not typically have a significant impact on long term productive capacity of timberland, as the forests generally regenerate successfully. Consequently, such removals are considered to be temporary. However, removals due to land use change are generally permanent. Therefore, a continued increase in the removals due to land use change would likely lead to a reduction in the productive capacity of Ohio's timberland, particularly since less "new" forest land is being added annually from croplands reverting back to forests (see discussion of 'Forest Land Area' on page 6).

Criterion 3 – Maintenance of Forest Ecosystem Health and Vitality.

"Ecosystem health depends on the functionality of natural, nondegraded ecosystem components and processes. The underlying premise is that forest species and ecosystems have evolved to function within particular environmental conditions determined largely by geological and climatic forces. Humans, meanwhile, have historically (and prehistorically) adapted their economic and social activities to environmental conditions and to the resulting ecological processes. Substantial modification of environmental conditions therefore threatens species' adaptive capacities, ecosystems' functional capacities, and that of the associated human economies and societies." (USDA 2008)

Indicator 7 – Area of forest land affected by potentially damaging agents.

This indicator shows the relative health and vitality of the forest. Ohio's forests are constantly under pressure from insects, diseases, invasive plants, and environmental pressures such as drought and flood. Climate change is a new environmental pressure that will need to be considered when managing Ohio's forests for the future.

Tree mortality and damage type.

Mortality is a measure of trees that die from natural causes such as insect, disease, fire, and suppression from competing trees. Timber harvests are excluded from this metric. The average annual mortality of growing stock on Ohio's timberland from 1991 to 2006 was 99 million cubic feet or 0.9 percent of the inventory volume (Widmann et al. 2009), which represents an increase from the previous inventory period (1979-1991) when annual mortality averaged 0.6 percent of the inventory volume (Widmann et al. 2009). Some tree mortality is normal and beneficial to forest ecosystems, as dead standing and downed trees provide important food and habitat for wildlife and a source of stored nutrients.

The primary causes of tree mortality in Ohio's forests are suppression resulting from stand dynamics/competition and insects and diseases that affect specific species. As reported previously in this document, Ohio's forests are experiencing a maturing trend. As forests mature, a natural thinning occurs due to limited growing space and resources (e.g., sunlight). Many of the species that are experiencing the highest mortality are early successional species that are intolerant to shade, like black cherry, aspen, and all softwoods (Figure 3a; Widmann et al. 2009). Insects and disease are likely causing high mortality rates in a few other select species. For examples, emerald ash borer may be increasing ash mortality, while Dutch Elm's disease is likely driving the high mortality rate for elm. Insects and disease will be discussed in more detail later in this section.

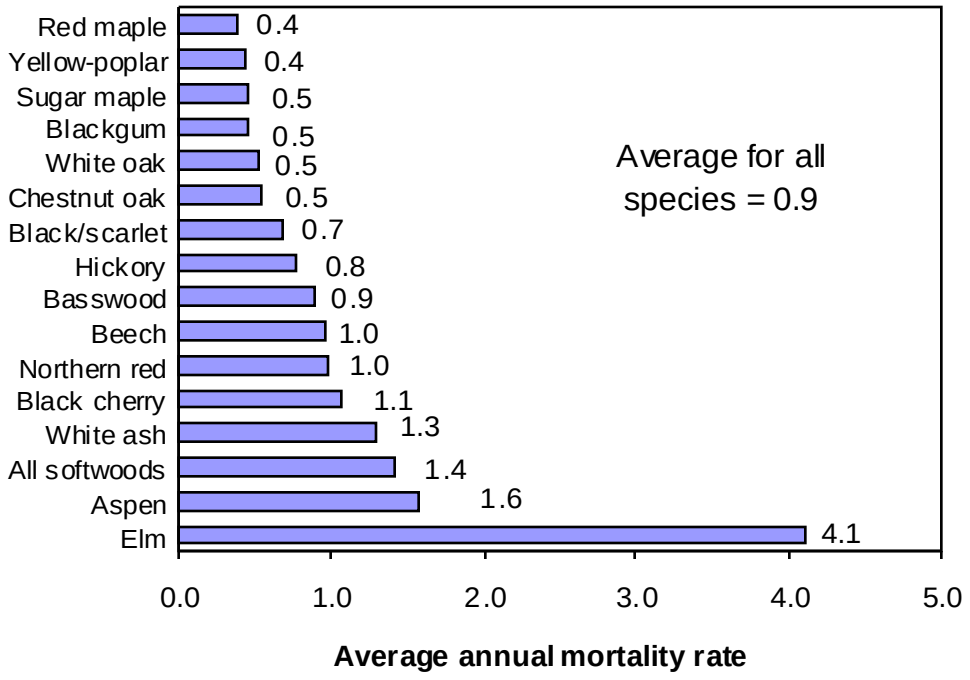


Figure 3a – Average annual mortality rate (percent) for major species, Ohio, 1991-2006. From *Ohio Forests: 2006* (Widmann et al. 2009).

Wildfire.

Wildfires annually affect Ohio's forests, causing some damage and mortality of trees. However, wildfires can also be beneficial to forest ecosystems and individual tree species (e.g., oaks) when they occur at frequencies and intensities that were common historically (see discussion of natural fire regimes that follows). Figure 3b shows the trend for annual fire occurrence (number of wildfires) and acres burned statewide from 2003 to 2009. In 2009, the substantial increase in occurrence and acreage resulted from dry spring conditions and a large fire in Shawnee State Forest; such spikes are typical every 8 to 10 years in Ohio. Figure 3c shows the average annual occurrence and acres burned by county over the same time period. Most of Ohio's wildlife activity occurs in "hill" country of southeast Ohio, particularly in the southern most counties of Scioto, Lawrence, and Gallia. Wildfires in Ohio are primarily caused by careless burning of debris and litter and arson.

When evaluating forest ecosystems in the context of wildfires, an understanding of natural fire regimes is important. Fire regime classifications are based on the frequency (fire return intervals) and severity of fires that landscapes experienced prior to modern human intervention. Aboriginal use of fire is considered in fire regime classification (e.g., the use of fire by Native Americans). Fire regime condition class is a measure of the current departure from reference conditions. Reference conditions often consider natural fire regimes and associated vegetation from pre-settlement times (Hann et al. 2004). Figure 3d shows the current fire regime condition classes (FRCC) in Ohio. The majority of Ohio's forests are classified in FRCC III, which indicates a high departure from reference conditions. The few areas that approximate reference conditions (FRCC I) are located primarily in Lawrence and Gallia Counties, where recent wildfire activity has been the greatest. Another related factor that may contribute to their FRCC I classification is the type of

forest ecosystem that occurs in those counties – Allegheny-Cumberland Dry Oak Forest and Woodland (see figure 1z), which occupy drier, nutrient-poor sites that might support periodic fire.

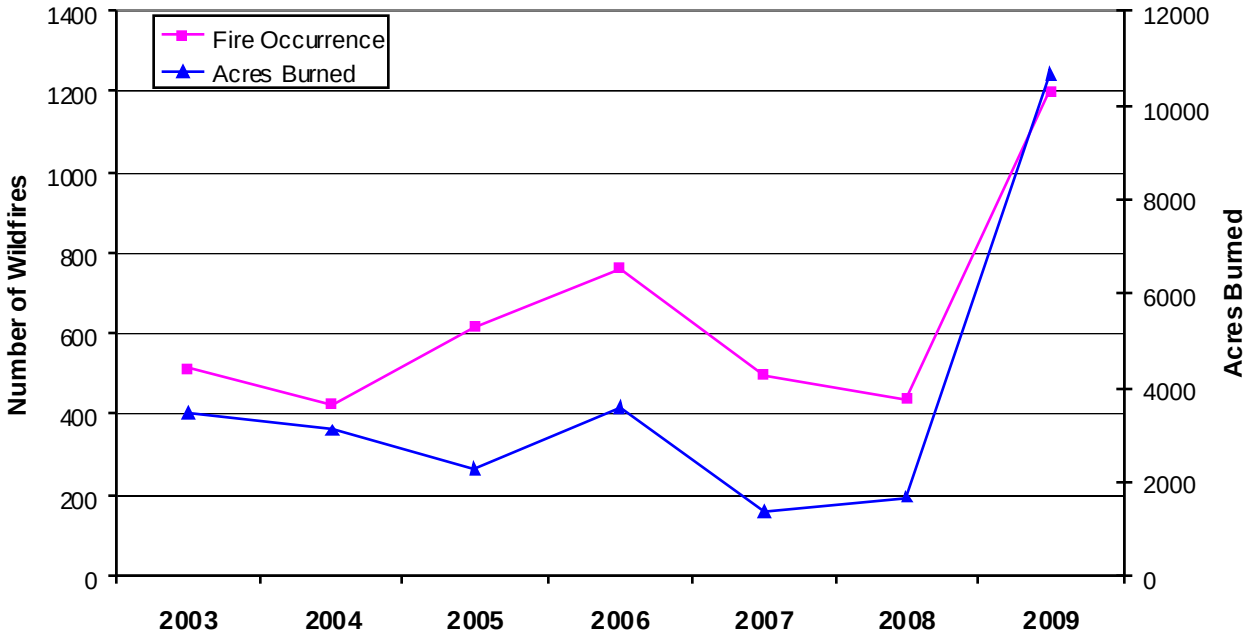


Figure 3b – Annual fire occurrence (number of wildfires) and acres burned by wildfires in Ohio. Data are all reported wildfires from 1/1/2003 to 12/31/2009 (Source: Ohio Division of Forestry).

Another important resource to consider when evaluating the threat of wildfires in Ohio is the rural fire department. In Ohio, rural fire departments are often the first responders on the scene of wildfires within proximity of residential properties or communities (i.e., wildland-urban interface areas). These departments play an invaluable role when it comes to protecting communities from wildland fire. However, fires at the wildland urban interface present firefighters with situations that they may be unprepared or inadequately trained to face. Ensuring that Ohio's local, rural and volunteer fire departments are provided with sufficient training and equipment resources to attack wildfires helps to minimize the effects of those fires at the wildland urban interface. In 2003, rural fire departments in Ohio were surveyed to determine their training, funding, and equipment needs and capabilities. The survey found that rural fire departments rated wildland fire as one of the top three emergency situations impacting them. Some specific needs of fire departments include basic wildland firefighting training, improvements in mutual aid agreements and emergency communications capabilities, additional funding, and additional wildland firefighting equipment (particularly wildland fire protective gear). A copy of the full report can be accessed online at: http://ohiodnr.com/tabid/5144/Default.aspx .

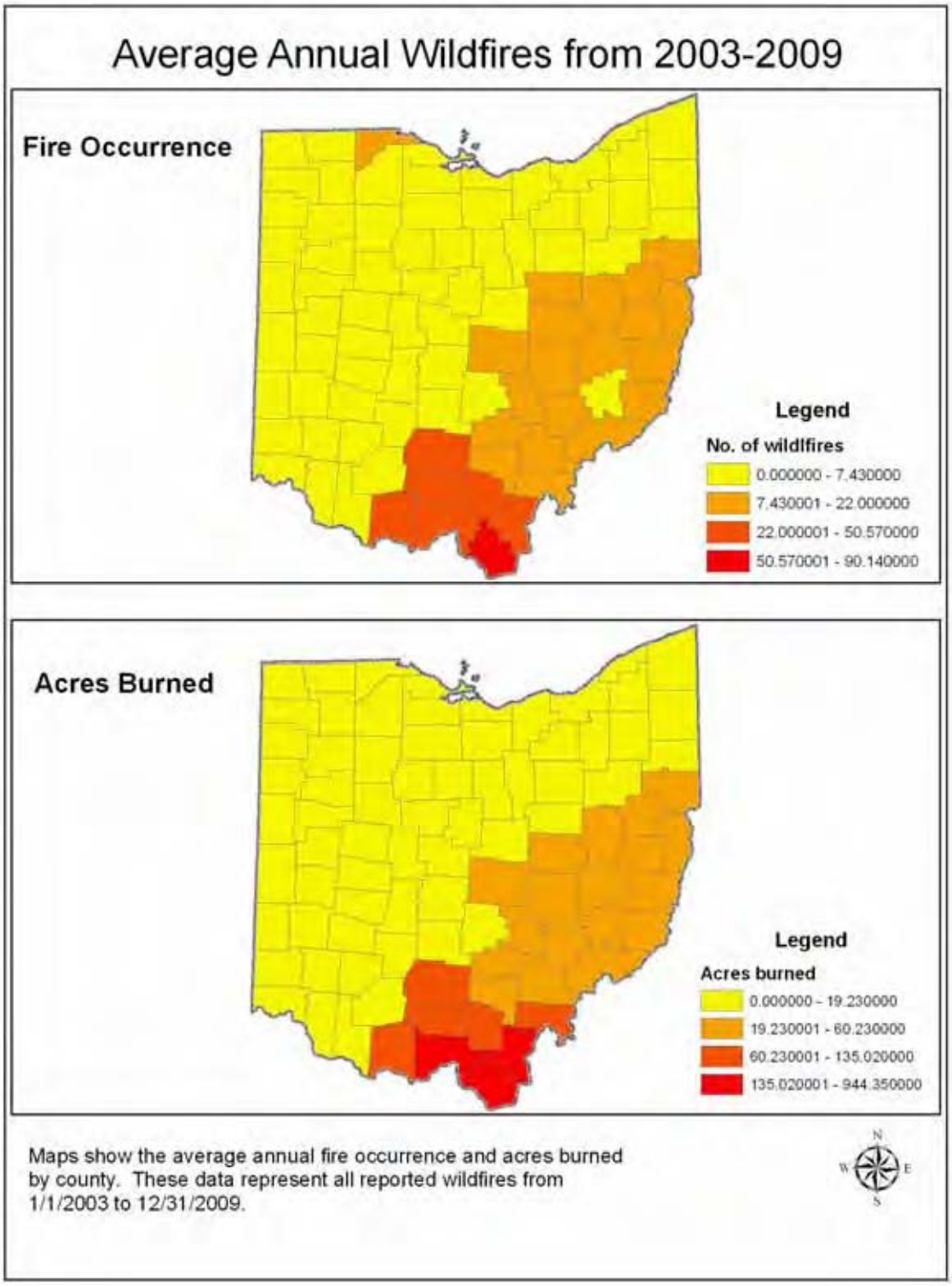


Figure 3b – Average annual wildfire occurrence and area burned by county, Ohio, 2003-2009. Data source: Ohio Division of Forestry.

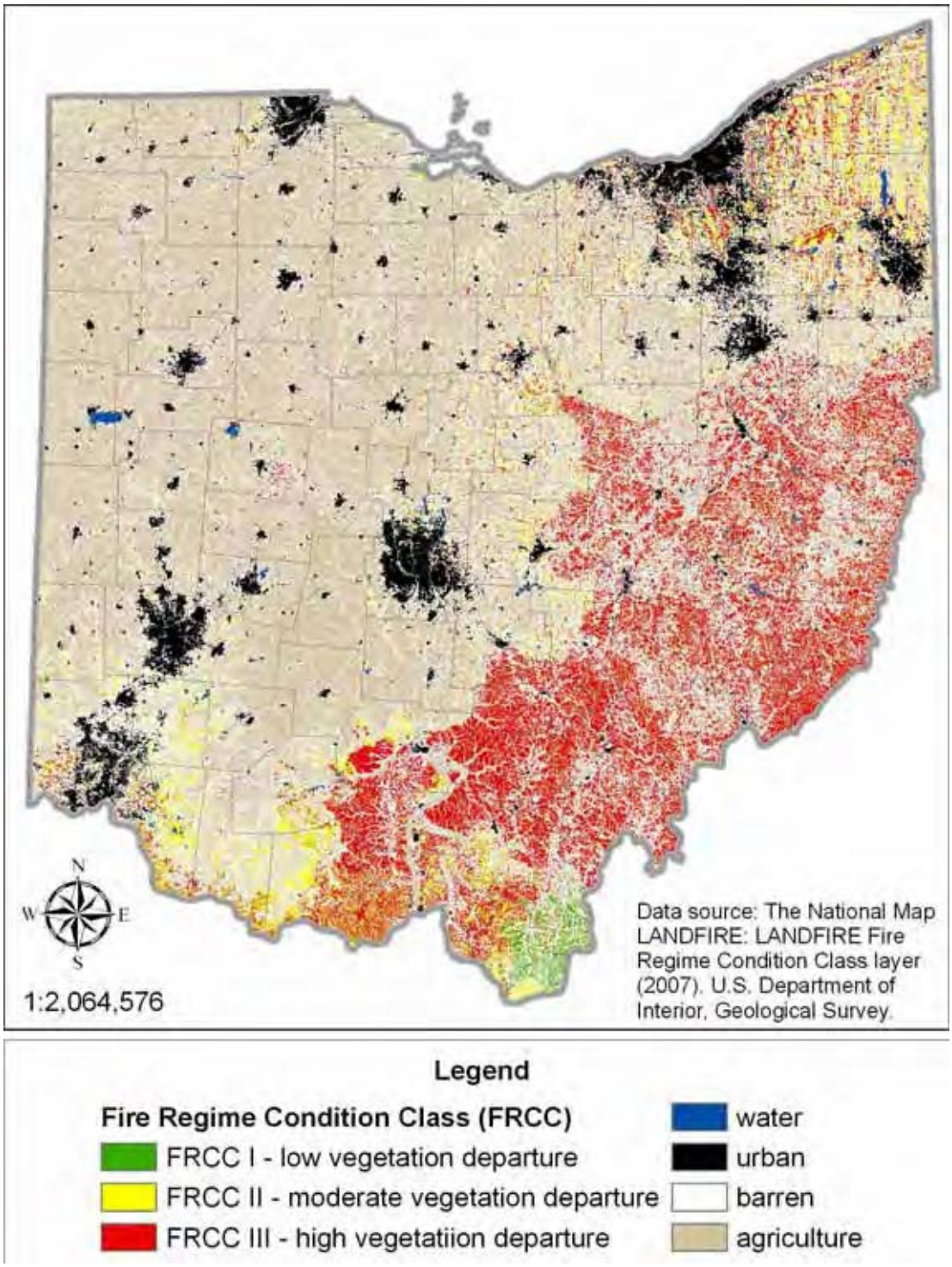


Figure 3c – Fire regime condition class of Ohio's forests. Map was generated using data from Landfire (LANDFIRE 2010).

Drought

During a normal year, Ohio gets abundant precipitation distributed throughout the year. The two driest periods of the year are January/February and October (Table 3a). Some geographic variation in precipitation exists across Ohio. From 1931 to 1980, the southern and northeast portions of the State tended that have a higher annual precipitation while the northwest part of the State had the least precipitation (Figure 3d). However, drought index data from the past 5 years show a different trend, with northeast Ohio being the wettest and southern Ohio being the driest (Figure 3e). The positive drought index numbers statewide indicate normal to wet conditions, with no long-term droughts during that period. Short-term wet or dry spells are common in Ohio (Figure 3f), but droughts occur on average twice per decade (Rogers unpublished). During droughts, Ohio's forests experience increased fire hazard, decreased growth during prolonged drought periods, failure of new tree plantings, and increased susceptibility to insect and disease problems.

Table 3a – Average monthly statewide precipitation (in inches) for Ohio, 1971 to 2000. Data are from NOAA's National Climatic Data Center publication Climatography of the United States No. 81 (NOAA 2002).

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
2.5"	2.25"	3.04"	3.48"	4.05"	4.09"	4.03"	3.76"	3.09"	2.62"	3.15"	3.17"	38.94"

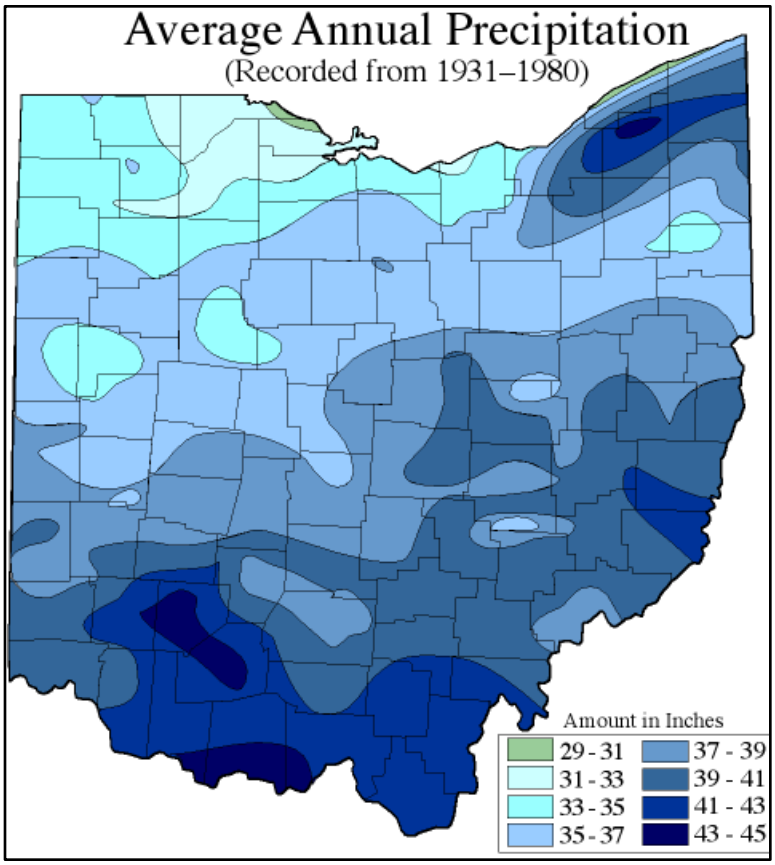


Figure 3d – Statewide map of average annual precipitation in Ohio. Map created by Ohio DNR Division of Soil and Water Resources.

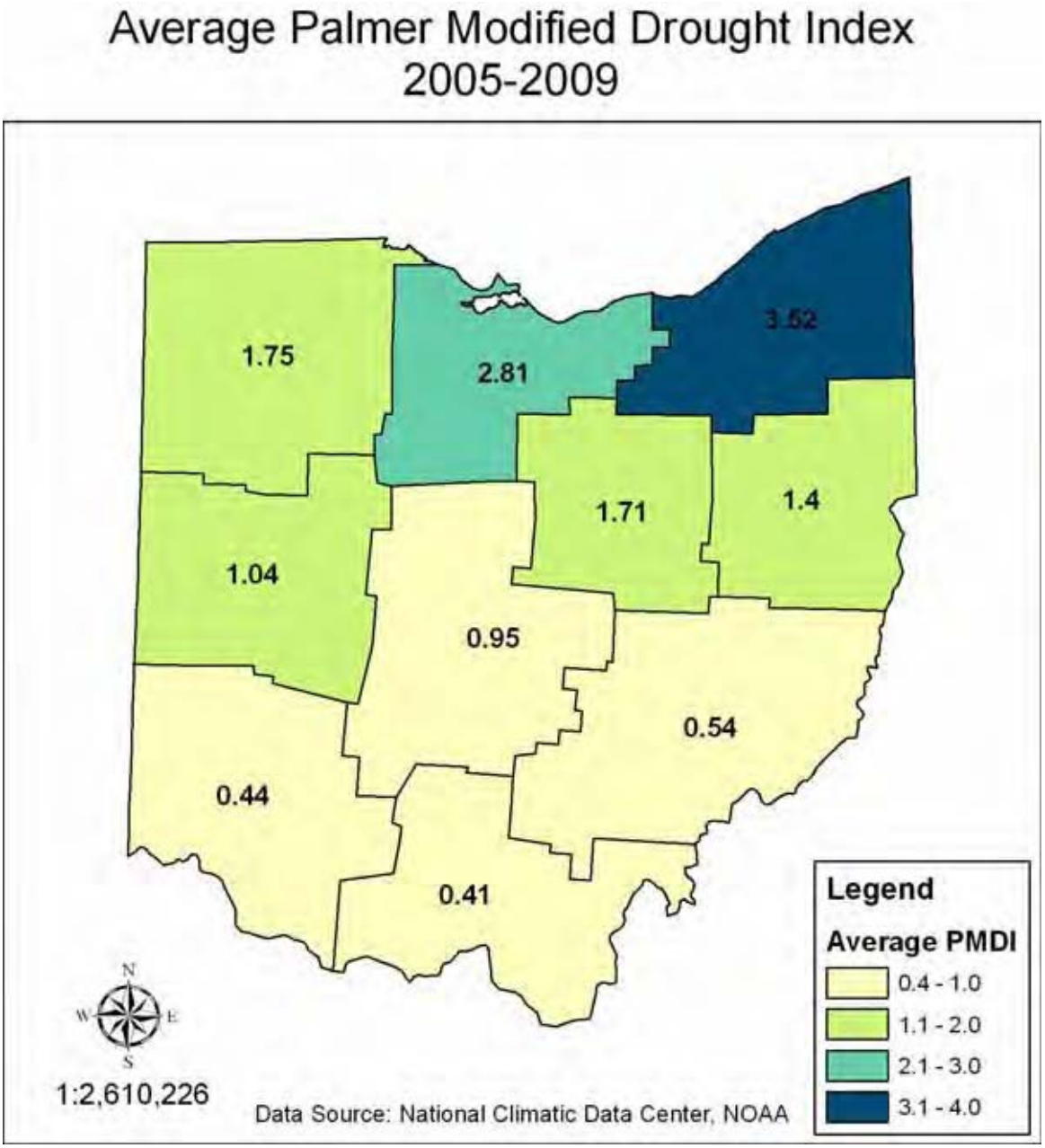
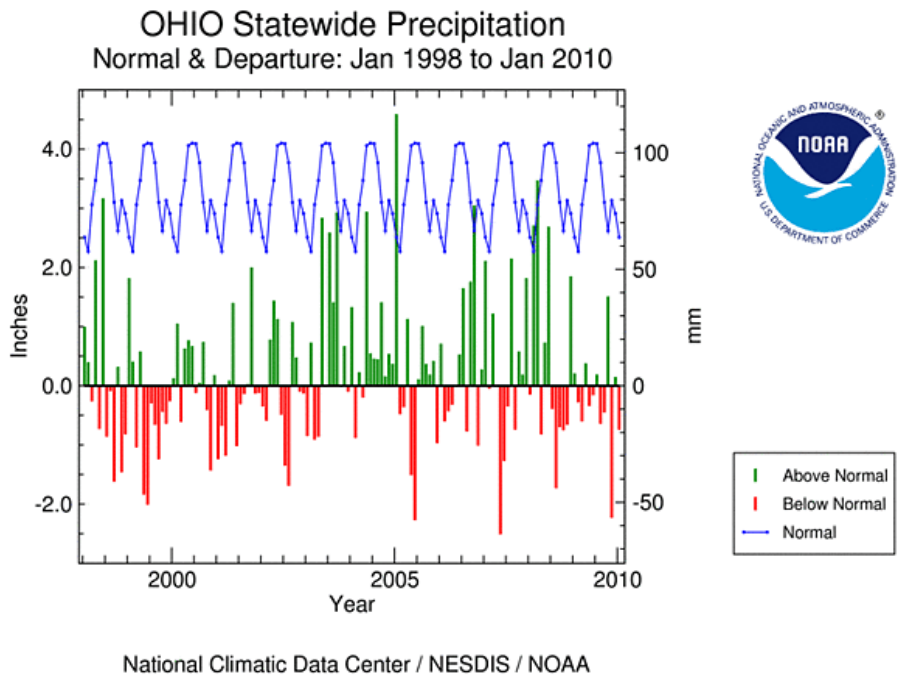


Figure 3e – Average Palmer Modified Drought Index (PMDI) in Ohio by U.S. Climate Division from 2005 to 2009. Positive values of the PMDI indicate moist conditions, and negative values indicate drought conditions. Data are from the National Climatic Data Center, U.S. Department of Commerce, NOAA.



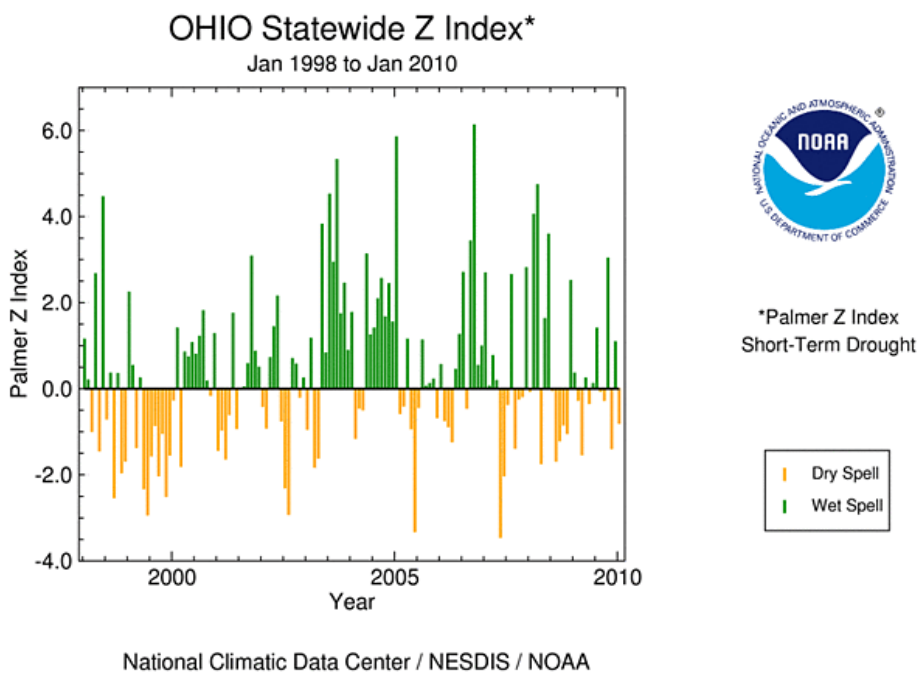


Figure 3f – Statewide precipitation (normal and departure from normal) and drought index for Ohio from January 1998 to January 2010. Data source: NOAA National Climatic Data Center (http://www.ncdc.noaa.gov/oa/ncdc.html; NOAA 2010).

Insects, diseases, plants, and animals.

Insects and disease issues continue to be a primary focus of forest health programs in Ohio. A national insect and disease risk map was developed by the USDA Forest Service in 2006 showing forest areas that are at risk of tree mortality (Krist et al. 2007). Risk areas on the map were defined as forests with the expectation that 25 percent or more of the standing live basal area on trees greater than 1 inch diameter will die over the next 15 years due to insects and diseases. The resulting risk map for Ohio from that project is shown in Figure 3g. The primary contributors to mortality in the "at risk" areas in Ohio are: oak decline on red oaks, gypsy moth, and hardwood decline. Brief summaries of recent activity for major insects and diseases in Ohio follow.

Emerald ash borer:

In January of 2010, the Ohio quarantine area for the emerald ash borer (EAB) included 67 Counties (Figure 3h). In the past two years, efforts focused on performing a state-wide survey throughout un-infested Ohio counties using purple traps instead of detection trees, which were used previously. Ohio Division of Forestry Service Foresters continue to advise private woodland owners on managing their forests so they can capture the value in ash trees and make their woods more resistant to EAB. Ohio Division of Forestry Urban Foresters assist communities by providing information about EAB, administering community grants, and promoting proactive EAB management plans.

Researchers with the U.S. Forest Service recently developed a risk map for the spread of EAB through Ohio that combines two different spread models. One model predicts spread by the natural flight of the pest, and the second model predicts spread by "ride", which considers spread along highways, at campgrounds, and the movement of wood products (Figure 3i; Prasad et al. 2010).

White oak mortality:

Defoliation of white oak trees in southern Ohio was more difficult to find in 2009. Mortality has slowed, but has continued through 2009, requiring continued salvage of dead and dying white oak trees in some areas. Several insect pests began defoliating white oak trees in 2002. Severe defoliation, coupled with drought conditions in 1999 and 2002, caused significant tree mortality starting in 2002, especially in some Ross County white oak stands. Other affected counties included Pike, Lawrence, Scioto, Vinton, and Athens. The half-wing geometer (*Phigalia* spp.), the common oak moth (*Phoberia autumalis*), and tent caterpillars joined forces to cause the initial defoliation damage. Two-lined chestnut borer, Armillaria root rot, Hypoxylon canker, and *Phytophthora* root rot worked together as a group of secondary pests to kill already weakened trees.

Gypsy moth:

Surveys in 2009 by the Ohio Department of Agriculture (ODA) revealed high gypsy moth population densities in some Ohio forests with caterpillars defoliating about 2,100 acres of forested land. Oak mortality is localized. The gypsy moth threat has been lessened by the fungus, *Entomophaga maimaiga*, which has drastically reduced this pest in many areas since 1996. Dry weather conditions in May 2008 lessened the impact of the fungus in Ohio; however, Ohio experienced a wet spring in 2009. Even though this pathogen was active, it could not completely control gypsy moth populations. Gypsy moths damaged trees in previously infested areas and continued to spread to new areas in the State, including the oak-hickory forests of southern Ohio in

2009. Evidence of this spread is found in the treatment of about 30,000 acres in unregulated parts of Ohio as part of the National Gypsy Moth Slow the Spread Program compared to 53,000 acres in 2009.

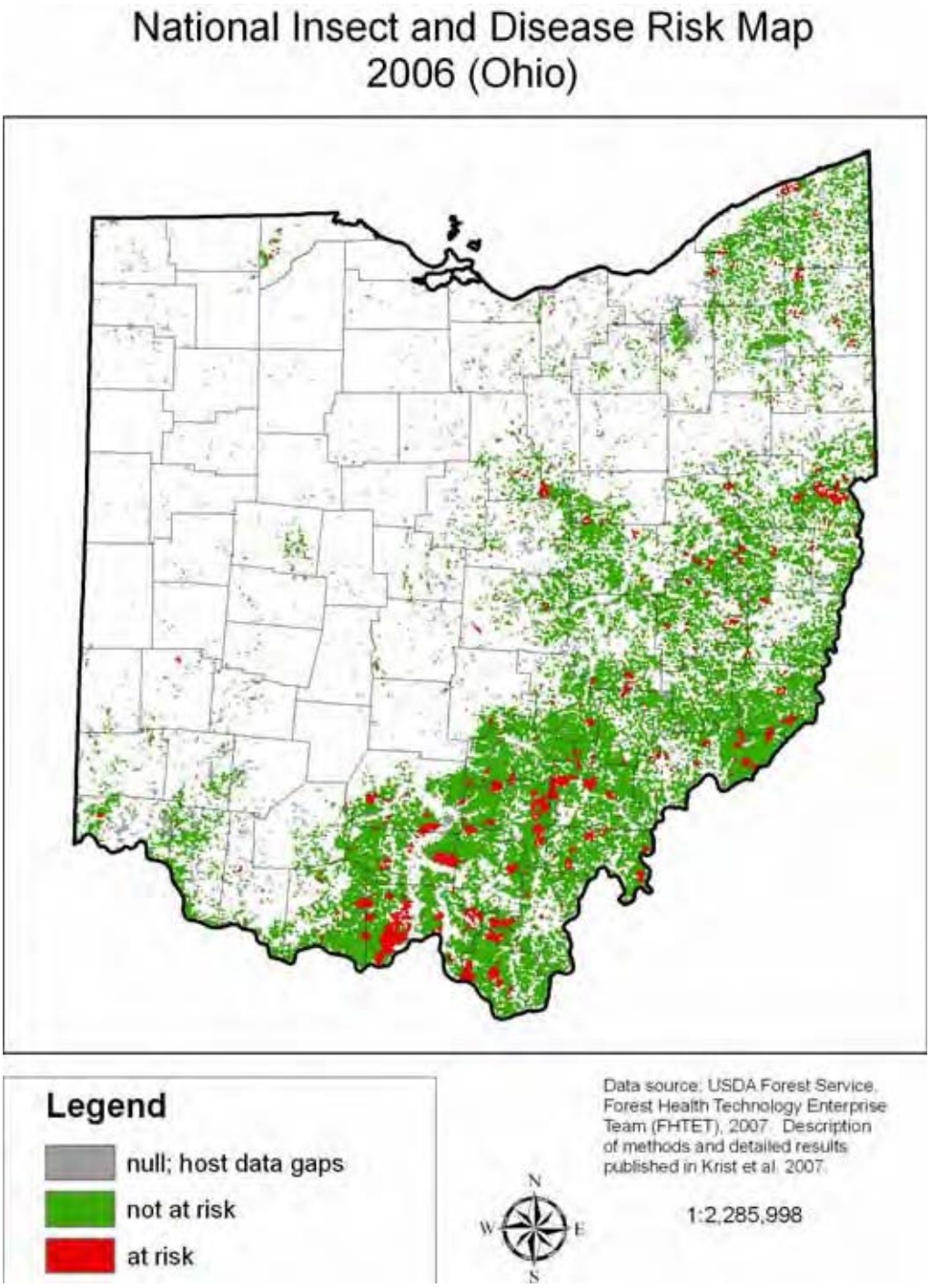


Figure 3g – Risk map of mortality in Ohio's forests from insects and diseases, 2006. From the *National Insect and Disease Risk Map 2006* (Krist et al. 2007).

Hemlock woolly adelgid:
Hemlock woolly adelgid (HWA) was found in two Ohio counties in2009: Cuyahoga and Clermont. The Cuyahoga find was on a landscape tree that was removed and burned. Several lightly infested hemlock trees were discovered during a routine inspection by ODA personnel at a nursery in Clermont County. The entire shipment associated with these trees was seized and sent back to the shipper in Tennessee. Several trees associated with this load were sold and subsequently found and ordered to be treated or destroyed. Follow-up inspections will be done at these locations to ensure that no HWA is present. HWA was found in a Summit County landscape in 2008. In 2007, a few trees in Lake County were found to be infested with HWA. The infested trees discovered in 2008 and 2007 were destroyed by ODA personnel. In 2006, about 10 landscape trees were destroyed by ODA in Lorain, Cuyahoga, and Geauga Counties. No infestations were found during a 2007 or 2008 survey of the Clearfork Gorge area in Ashland County and the Hocking Hills region, or during a 2009 survey of these regions.

White pine decline:
Although Ohio experienced short-term dry conditions in 2008, wet soils during the past four growing seasons are still contributing to decline and mortality of white pine. About 1,400 acres of white pine forests were affected in Ohio in 2008. Mortality is highest in over-stocked stands. Blue stain fungi appear to be invading wounds created by heavy pine bark adelgid feeding on the trunks of white pine trees weakened by soil conditions and/or overstocking. A similar decline was observed in the mid 1990s. Timely thinning of white pine stands seems to be the best defense against periodic decline.

Sudden oak death:
The Ohio Division of Forestry cooperated with Ohio State University (OSU) and the U.S. Forest Service on a sudden oak death (SOD) survey in 2008. This fungal disease is capable of killing trees in the red oak group. It is currently found in California and Oregon. Two streams were monitored for SOD fungus in 2008. Alum Creek in Westerville, Ohio and Buck Creek near Springfield, Ohio served as monitoring sites. OSU served as sample processing lab for the National SOD program. Results for Ohio were negative.

Sirex wood wasp:
A USDA trapping survey was conducted in Ashtabula, Fulton, Geauga, Lake, Lucas, Mahoning, Ottawa, Trumbull, and Wood Counties. One live adult was found in a trap in Lake County.

Beech bark disease:
The beech scale, *Cryptococcus fagisuga*, was first discovered in Ohio in 1985 at the Holden Arboretum in Lake and Geauga Counties. Since then, this area has been periodically inspected for Beech Bark Disease (BBD), and the arboretum set up a monitoring program for its beech trees. In December 2003, the fungal component of this disease was found on American beech trees at the arboretum. This was the first confirmed case of BBD in Ohio. In 2008, beech surveys continued in northeastern Ohio. While the BBD fungus was not found at any new sites, beech scale is still easily found in several northeastern Ohio counties, including Medina, Portage, Cuyahoga, Trumbull, Ashtabula, Lake, and Geauga.

Bacterial leaf scorch:
There was a positive find of bacterial leaf scorch, *Xylella fastidiosa*, in 2009 on a white oak tree in Franklin County in central Ohio. The Ohio Division of Forestry is planning on conducting an urban survey in 2010.

Figure 3h – State of Ohio quarantine map for the emerald ash borer. The Ohio Department of Agriculture released this version on January 14, 2010.

Risk Map for Spread of EAB in Ohio

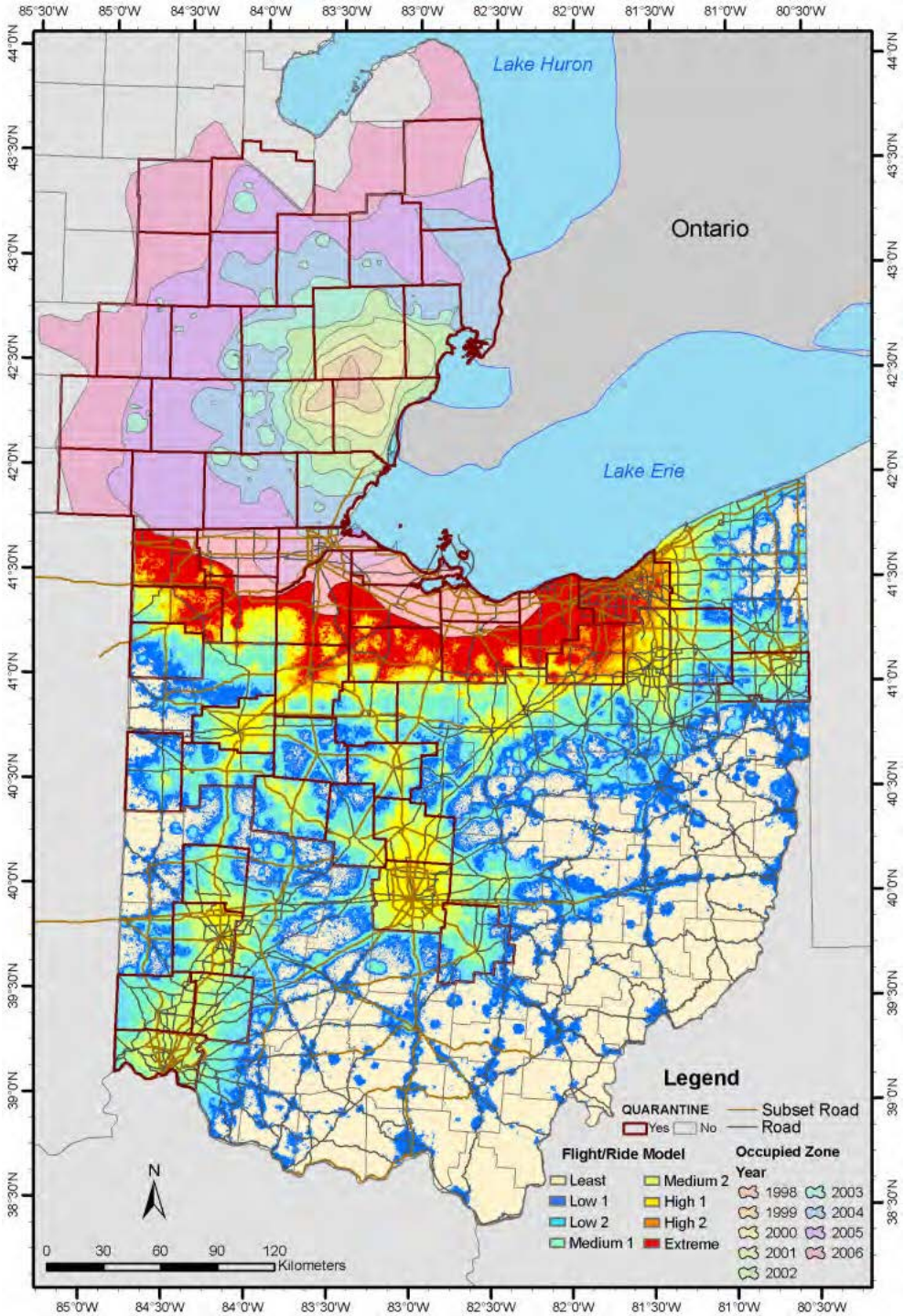


Figure 3i – A map showing the risk of spread for the emerald ash borer in Ohio over the next 2 to 4 years. This map combines spread by flight and ride (e.g., spread through highways, campgrounds, and movement of wood products). Map is published in Prasad et al. (2010).

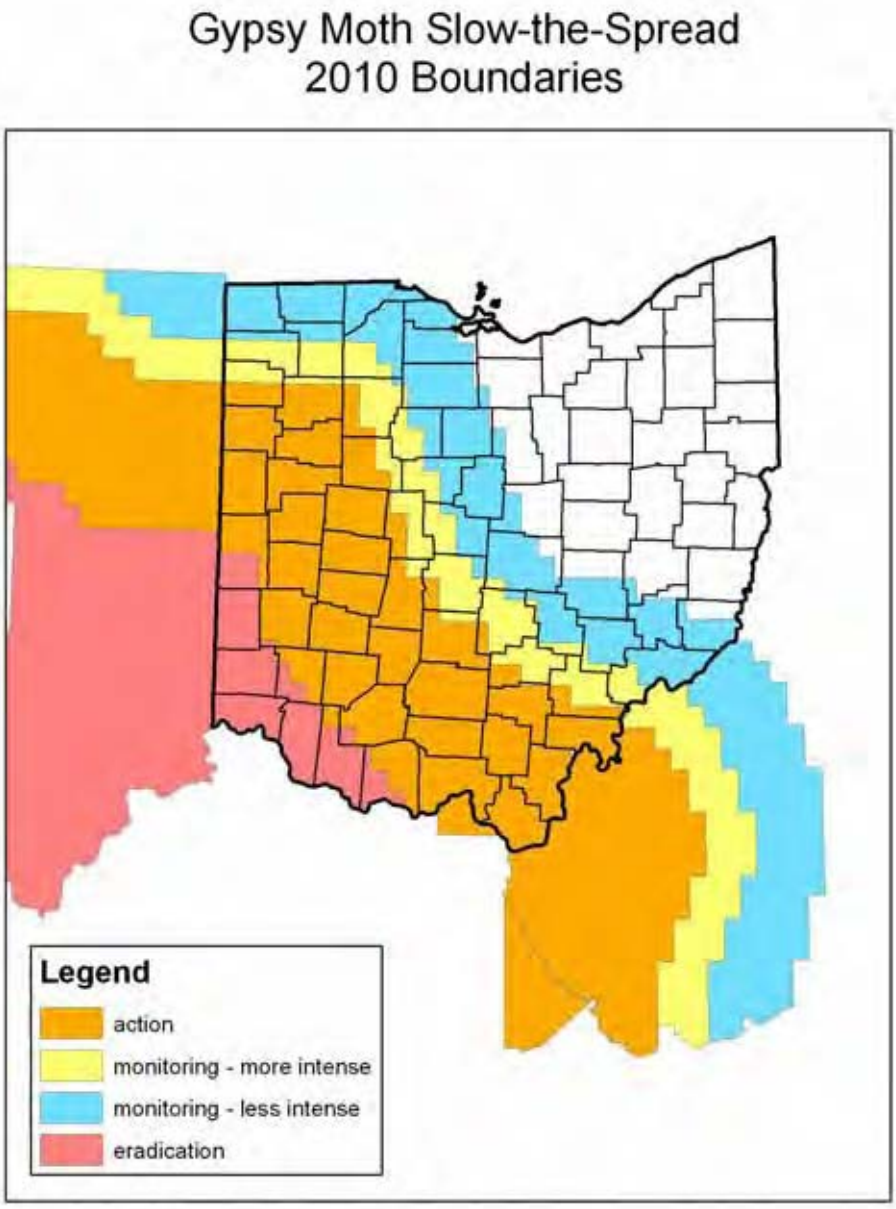


Figure 3j – The 2010 boundaries for the State of Ohio's slow-the-spread program for gypsy moth. In the monitoring zones (blue and yellow on map), gypsy moth populations are surveyed but no control measures are performed. In the action zone (orange on map), management strategies are applied against gypsy moth populations. The eradication zone is considered un-infested by gypsy moth, and populations that are identified in the zone are controlled. Source of map data: Ohio Department of Agriculture, Gypsy Moth Program.

Climate change.

Climate change will likely be a future damaging agent to Ohio's forests. At the global and national level, the data show a significant trend in warming over the last century (Figure 3k) and impacts from this change are already being observed (Backlund et al. 2008). In Ohio, a warming trend is also evident (Figure 3l). The specifics of how regional climate will change in the future (e.g., temperature, precipitation, extreme events) are uncertain, as are the impacts of those changes on flora and fauna. Nevertheless, climate change must be considered when planning current and future management of forests in the State. Various climate models have been developed to predict future climate change. In many of these models, Ohio is predicted to have higher annual precipitation but this predicted change is not uniform across the seasons. For example, winters and springs would be wetter, but summers drier (Thomas et al. 2009). Confounding the precipitation effect, summers could also be longer and more intense, with significantly more days with temperatures over 90 degrees Fahrenheit (Thomas et al. 2009).

Some potential impacts of local and regional climate change on Ohio's forest include (from Ryan et al. 2008 and Thomas et al. 2009):

- Shift in plant hardiness zones (Figure 3m) leads to northern expansion of species from the southern USA, including non-native invasive plants. Table 3b shows a list of Ohio tree species that are expected to be substantially impacted (positively or negatively) by climate change. For additional species-specific climate change scenarios, see the *Climate Change Tree Atlas* (Prasad et al. 2007; available online at: http://www.nrs.fs.fed.us/atlas/tree/).
- Increase in stressors on forests, including insect outbreaks, expansion of invasive plants, more storm events and weather extremes (e.g., summer droughts), and decreased air quality
- Increases in carbon dioxide and nitrogen, leading to increased forest productivity, although some or all of these gains may be negated by other negative impacts like the preceding stressors
- Delayed spring tree plantings due to wet conditions from projected increases in winter and spring precipitation

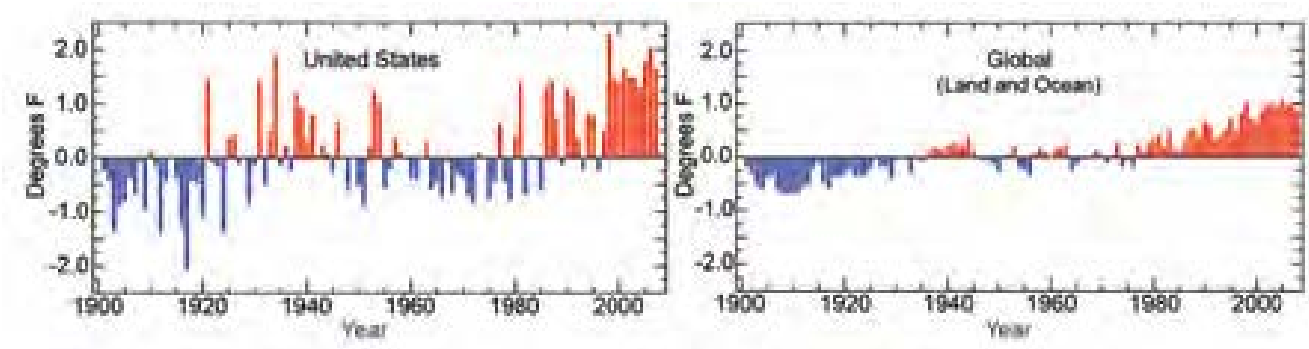


Figure 3k – Annual average temperature for the United States and globally (land and ocean) presented as the departure from the long-term average temperatures (averaged from 1901 to 2000). From *Global Climate Change Impacts in the United States* (Thomas et al. 2009).

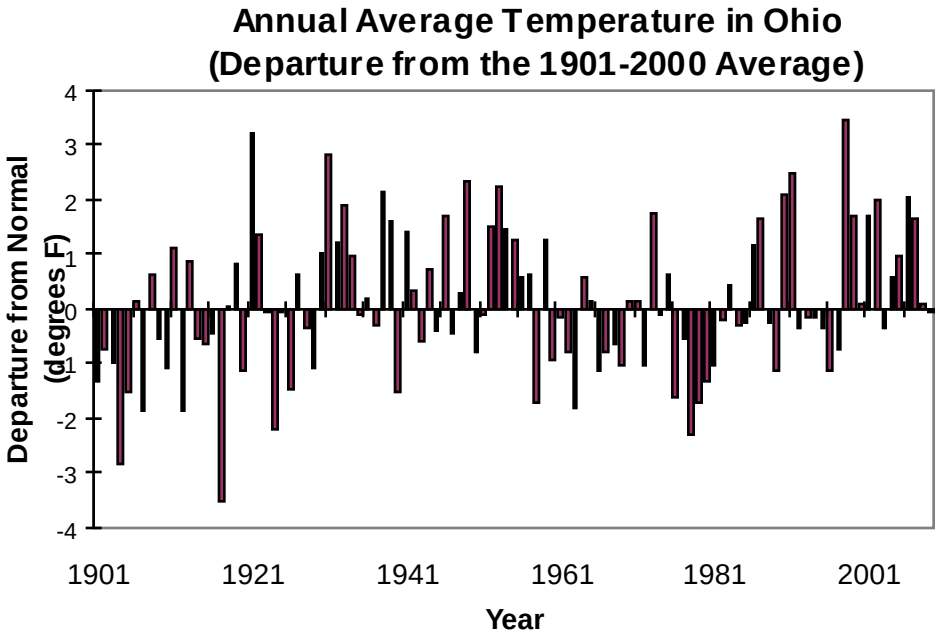


Figure 3l – Annual average temperature for Ohio presented as the departure from the long-term average temperature (average from 1901-2000). Data source: NOAA National Climatic Data Center (available online at: http://www.ncdc.noaa.gov/oa/ncdc.html).

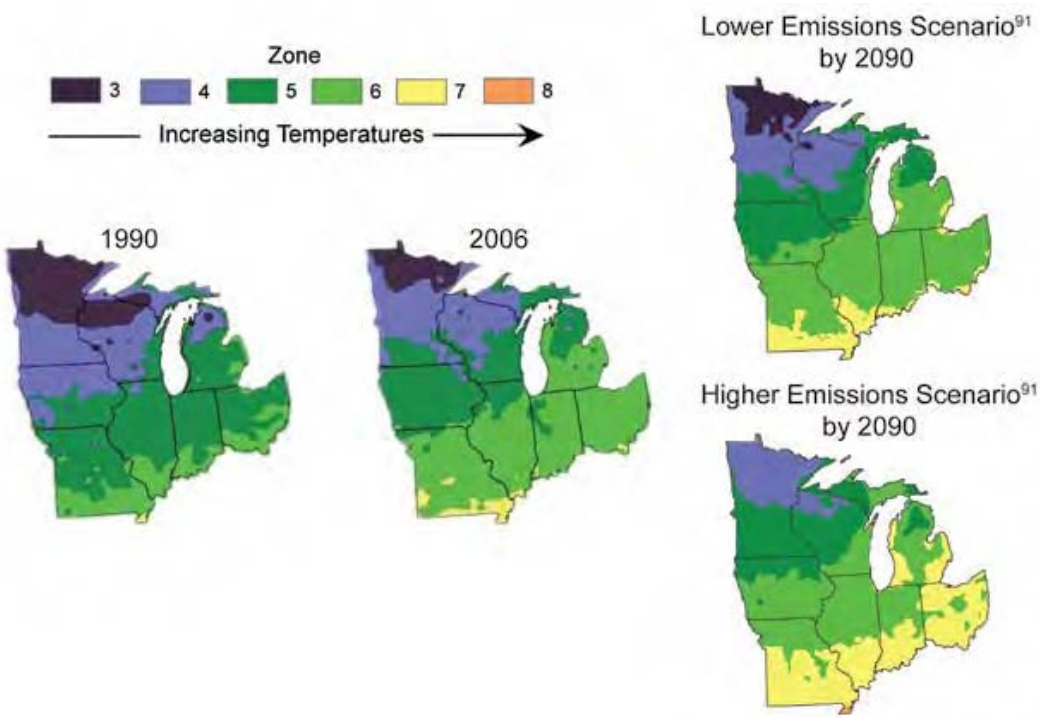


Figure 3m - Observed and projected changes in plant hardiness zones under the lower emissions scenario (IPCC SRES B1) and the higher emissions scenario (A2). From *Global Climate Change Impacts in the United States* (Thomas et al. 2009).

Table 3b – Tree species in Ohio that could experience substantial gains (bold) or losses (italics) in their suitable habitat due to climate change based on changes (percent change) in area-weighted importance values (IV). Using data on the 75 most-common species in Ohio (based on current modeled IV), the top 20 winners (gains in habitat) and losers (losses in habitat) are presented. "GCM3_hi" is the average for high emission scenarios of the three general circulation models (Hadley, PCM, GFDL). "GCM3_lo" is the average for low emissions scenarios of the three general circulation models). Data source is the *Climate Change Tree Atlas* (Prasad et al. 2007; available online: http://www.nrs.fs.fed.us/atlas/tree/).

Common name	Scientific name	Current modeled IV	% Change: GCM3_lo	% Change: GCM3_hi
sugar maple	*Acer saccharum*	2329	*-60.2*	*-75.8*
white ash	*Fraxinus americana*	2298	*-58.9*	*-72.1*
black cherry	*Prunus serotina*	2090	*-72.9*	*-81.6*
black oak	*Quercus velutina*	527	**141.0**	**121.8**
white basswood	*Tilia heterophylla*	486	*-57.2*	*-98.4*
American basswood	*Tilia americana*	471	*-57.1*	*-98.5*
hackberry	*Celtis occidentalis*	405	**157.8**	**82.0**
sycamore	*Platanus occidentalis*	343	**40.8**	**26.5**
eastern redcedar	*Juniperus virginiana*	247	**346.6**	**291.5**
honeylocust	*Gleditsia triacanthos*	244	**214.3**	**70.9**
green ash	*Fraxinus pennsylvanica*	237	**215.2**	**137.6**
eastern cottonwood	*Populus deltoides*	218	**168.3**	**22.5**
swamp white oak	*Quercus bicolor*	216	*-2.8*	*-71.8*
bigtooth aspen	*Populus grandidentata*	214	*-97.7*	*-100.0*
eastern redbud	*Cercis canadensis*	209	**193.3**	**72.7**
osage-orange	*Maclura pomifera*	188	**140.4**	**78.7**
bitternut hickory	*Carya cordiformis*	187	**139.6**	**75.9**
eastern white pine	*Pinus strobus*	180	*-96.7*	*-98.9*
chinkapin oak	*Quercus muehlenbergii*	73	**378.1**	**308.2**
black ash	*Fraxinus nigra*	71	*-71.8*	*-100.0*
quaking aspen	*Populus tremuloides*	69	*-100.0*	*-100.0*
red pine	*Pinus resinosa*	54	*-74.1*	*-85.2*
common persimmon	*Diospyros virginiana*	39	**1120.5**	**894.9**
red mulberry	*Morus rubra*	37	**1294.6**	**673.0**
sweet birch	*Betula lenta*	34	*-91.2*	*-97.1*
eastern hemlock	*Tsuga canadensis*	33	*-90.9*	*-93.9*
chokecherry	*Prunus virginiana*	33	*-93.9*	*-93.9*
shingle oak	*Quercus imbricaria*	23	**1508.7**	**287.0**
shortleaf pine	*Pinus echinata*	17	**2476.5**	**4423.5**
sweetgum	*Liquidambar styraciflua*	14	**592.9**	**1392.9**
yellow birch	*Betula alleghaniensis*	11	*-100.0*	*-100.0*
pin cherry	*Prunus pensylvanica*	10	*-90.0*	*-90.0*
river birch	*Betula nigra*	8	**187.5**	**25.0**
blue ash	*Fraxinus quadrangulata*	7	**142.9**	**71.4**
cucumbertree	*Magnolia acuminata*	7	**28.6**	**57.1**
tamarack (native)	*Larix laricina*	5	*-20.0*	*-100.0*
sugarberry	*Celtis laevigata*	4	**6900.0**	**10375.0**
water hickory	*Carya aquatica*	4	*-100.0*	*-100.0*
northern white-cedar	*Thuja occidentalis*	3	*-100.0*	*-100.0*
striped maple	*Acer pensylvanicum*	3	*-100.0*	*-100.0*

Invasive plants.

Non-native invasive plants are a serious threat to the health and productivity of Ohio's public and private forests. Aggressive invaders like tree-of-heaven (*Ailanthus altissima*), bush honeysuckle (*Lonicera* spp.), privet (*Ligustrum* spp.), and autumn olive (*Elaeagnus umbellata*) are just a few of the invasive plants that crowd out native vegetation in Ohio forests. Invasive plants often become established in forest edge areas, like roads, fields, or homesites, and they may spread into the forests following disturbance events or other dispersal opportunities. Forest landscapes that are significantly fragmented tend to be more susceptible to invasive plant impacts as they have a high relative percentage of forest edge areas (and entryways for dispersal). See pages 23-28 for discussion on current degree of fragmentation and parcelization in Ohio's forests. Some invasive plants are causing problems only at the local or regional scale, while others are common statewide. Table 3c provides a more comprehensive list of non-native invasive plants that are well-established and causing problems in Ohio or on a watch list as potential problem species.

Past efforts to map the distribution of invasive plants across Ohio have been generalized. The US Forest Service mapped the distribution of 43 species of invasive plants in the Northeastern United States at the state level (i.e., present or absent in a given state) using FIA data (Olson and Cholewa 2009). In Ohio, the Nature Conservancy has 2004 distribution maps for 65 known non-native invasive plants (e.g., see Figure 3n). These maps show which counties have known populations of each of the targeted invasive plants, but they do not show the location of known infestations within each county (maps available online at: http://www.nature.org/wherewework/northamerica/states/ohio/science/art6279.html). Some detailed mapping efforts have been completed on a small scale. The Iron Furnace Cooperative Weed Management Area (Iron Furnace CWMA) in southern Ohio completed a mapping project that detailed the distribution of several invasive plants on public and private forest land in the area. Currently, the Iron Furnace is the only formally established CWMA in Ohio, but another group was recently formed, called the Southeast Ohio Non-Native Invasive Species Interest Group (Figure 3o).

To date, there has been no coordinated effort to map the fine-scale distribution of non-native invasive plants on public and private forestland across Ohio. However, efforts are underway to establish a network of weed management groups like those previously listed, to facilitate the sharing of records, to standardize protocols, and to collaborate on surveys. Improvements in the inventory of invasive plants and their distribution in Ohio forests would facilitate more effective containment and control efforts by providing land managers with the information needed to strategically direct resources to maximize efficiency. In addition to the establishment of networks of collaborative organizations, other recent developments in Ohio will likely lead to improved mapping of invasive plants, like the use of aerial surveys and remote sensing techniques to identify isolated individuals or groups of invasive plants within larger forest management units (work being conducting by USDA Forest Service and ODNR Division of Forestry).

Table 3c – Non-native invasive plants that threaten Ohio's woodlands or adjacent habitat (e.g., field edges, wetlands). The species that are more likely to impact forests are in bold.

COMMON NAME	SCIENTIFIC NAME
Autumn-olive	***Elaeagnus umbellata***
Buckthorn, glossy	***Rhamnus frangula***
Buckthorn, European or common	***Rhamnus cathartica***
Common reed grass	*Phragmites australis*
Garlic mustard	***Alliaria petiolata***
Honeysuckle, amur	***Lonicera maackii***
Honeysuckle, Japanese	***Lonicera japonica***
Honeysuckle, Morrow	***Lonicera morrowii***
Honeysuckle, Tatarian	***Lonicera tatarica***
Japanese knotweed	*Polygonum cuspidatum*
Multiflora rose	***Rosa multiflora***
Purple loosestrife	*Lythrum salicaria*
Reed canary grass	*Phalaris arundinacea*
Air-potato	***Dioscorea batatas***
Asian bittersweet	***Celastrus orbiculatus***
Canada thistle	*Cirsium arvense*
Cattail, hybrid	*Typha Xglauca*
Cattail, narrow-leaved	*Typha angustifolia*
Celandine, lesser	***Ranunculus ficaria***
Crown-vetch	*Coronilla varia*
Dame's rocket	*Hesperis matronalis*
Day-lily	*Hemerocallis fulva*
European cranberry-bush	***Viburnum opulus* var. *opulus***
Field bindweed	*Convolvulus arvensis*
Flowering-rush	*Butomus umbellatus*
Japanese barberry	***Berberis thunbergii***
Johnson grass	*Sorghum halepense*
Meadow fescue	*Festuca pratensis*
Moneywort	***Lysimachia nummularia***
Periwinkle or myrtle	***Vinca minor***
Poison hemlock	*Conium maculatum*
Privet, common	***Ligustrum vulgare***
Quack grass	*Agropyron repens*
Queen Anne's lace	*Daucus carota*
Russian-olive	***Elaeagnus angustifolia***
Smooth brome	*Bromus inermis*
Sweet-clover, white	*Melilotus alba*
Sweet-clover, yellow	*Melilotus officinalis*
Tree-of-heaven	***Ailanthus altissima***
Winged euonymus	***Euonymus alatus***
Wintercreeper	***Euonymus fortunei***
Kudzu	***Pueraria lobata***
Porcelain-berry	***Ampleopsis brevipedunculata***
Privet, border	***Ligustrum obtusifolium***
Callery (or Bradford) pear	***Pyrus calleryana & P. calleryana hybrids***
Princesstree (or royal paulownia)	***Paulownia tomentosa***
Mile-a-minute weed	***Polygonum perfoliatum***
Amur Corktree	***Phellodendron amurense***

Figure 3n – Distribution of Morrow honeysuckle, *Lonicera morrowii*, in Ohio according to 2004 statewide invasive plant maps developed by The Nature Conservancy of Ohio. Yellow counties have documented occurrences of species.

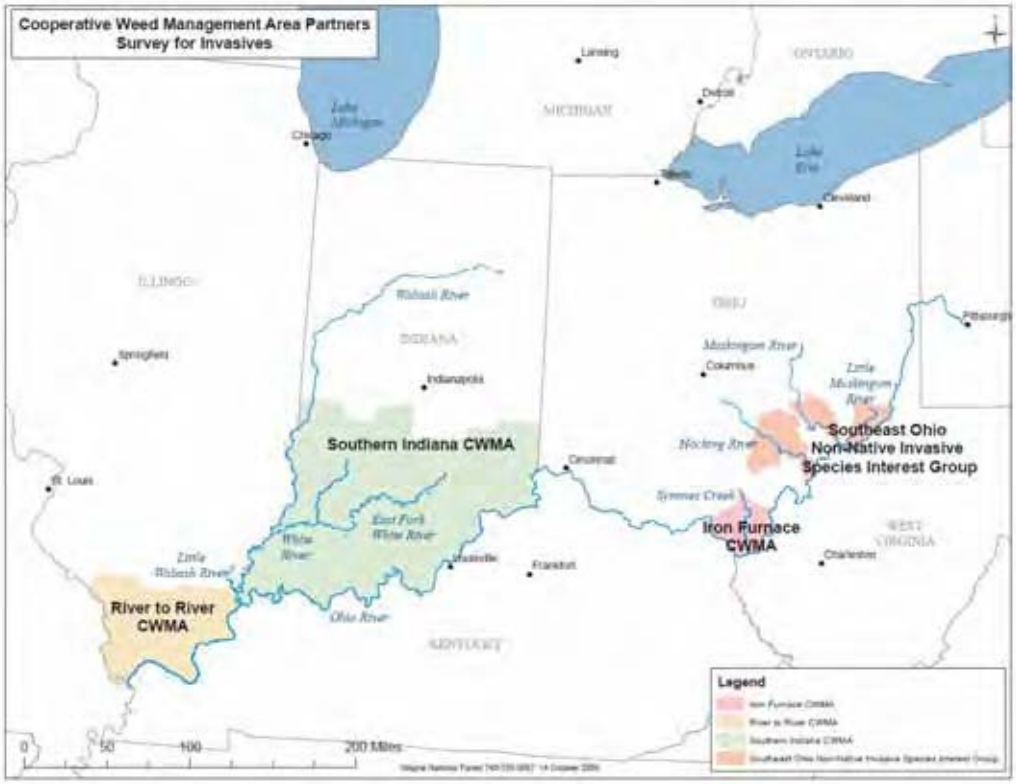


Figure 3o – Map of cooperative weed management areas along the Ohio River. Source: USDA Forest Service, Wayne National Forest.

Air pollution & ozone.

Air quality can influence forests and their management in various ways. Because trees have the ability to sequester some air pollutants and improve air quality, an understanding of the locally abundant air pollutants is useful when developing strategic plans for tree plantings or reforestation efforts, especially in urban areas. Various air pollutants (e.g., ozone) can also cause health problems for many tree species. Currently, the only regulated air pollutant for which Ohio is in non-attainment is particulate matter (PM 2.5); see Figure 3p for non-attainment counties.

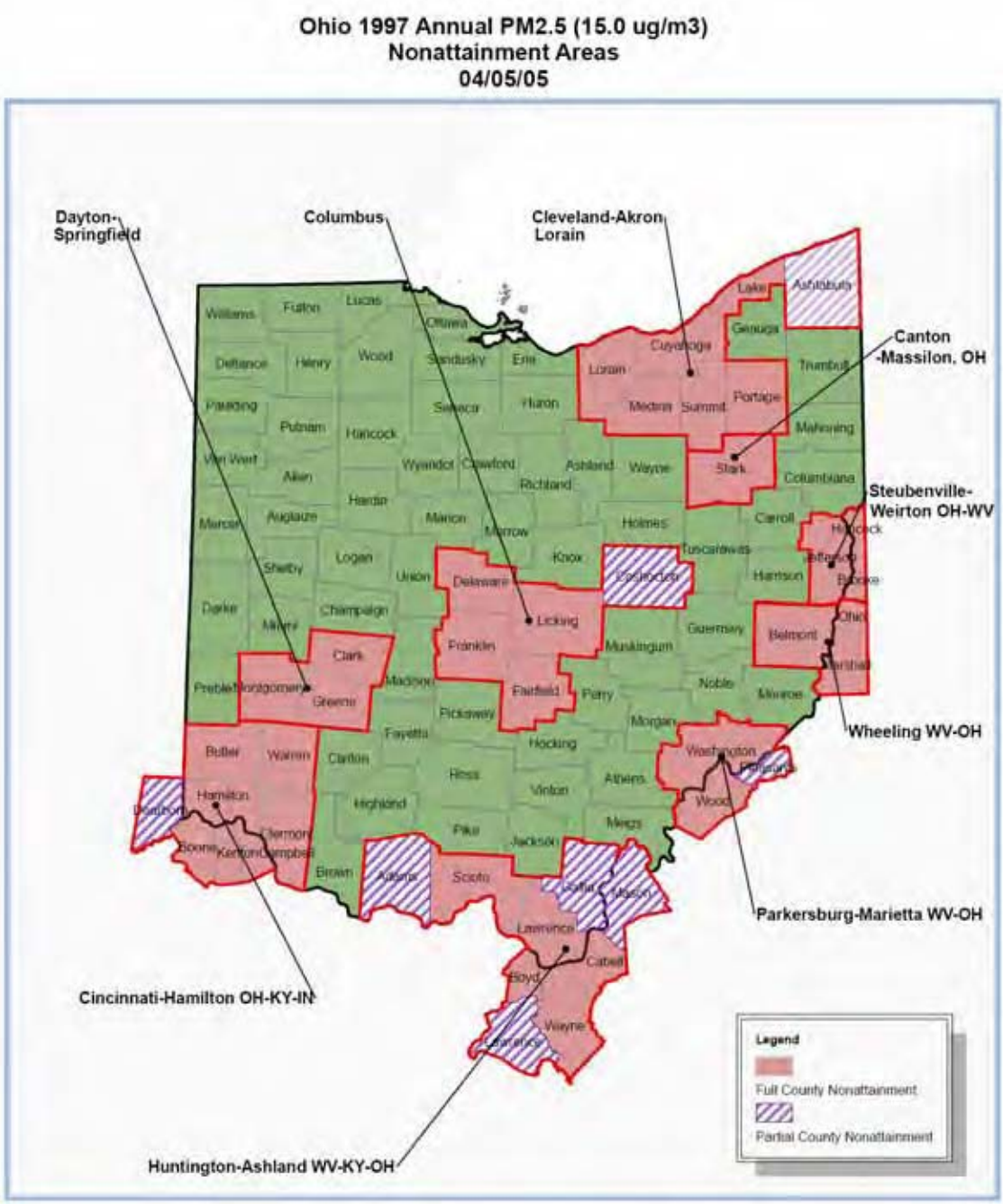


Figure 3p –Non-attainment areas in Ohio for particulate matter (PM2.5). Data and map are from the Ohio Environmental Protection Agency (http://www.epa.state.oh.us/dapc/general/naaqs.aspx).

Criterion 4 – Conservation and Maintenance of Soil and Water Resources.

Indicator 8 – Soil quality on forest land.

Data on forest soils in Ohio are reported in Ohio Forests: 2006, including details on soil carbon, Soil Quality Index (a combination of physical and chemical soil properties), and calcium-aluminum ratios. While these data are not a comprehensive assessment of Ohio's forest soils, they do provide insight into the quality of Ohio's forest soils, particularly when the data are compared to data from neighboring states (West Virginia and Pennsylvania). The average amount of carbon in the top 20 cm (7.9 inches) of mineral soil in Ohio is 22 tons per acre (Widmann et al. 2009), which is similar to neighboring states (Figure 4a). The Soil Quality Index (SQI) integrates physical and chemical soil properties into a single assessment (Amacher et al. 2007), and recent FIA data on SQI show Ohio's forest soils as superior to West Virginia's and Pennsylvania's (Widmann et al. 2009). The higher SQI for Ohio's forest soils was attributed to a greater effective cation exchange capacity and a more desirable calcium-aluminum ratio. The calcium-aluminum ratio for Ohio's forest soils tended to be over 0.5, while Pennsylvania's were mostly less than 0.5 (Widmann et al. 2009; Figure 4b)); calcium-aluminum ratios less than 0.5 indicate ecosystem stress that may be linked to acid deposition (Cronan and Grigal 1995).

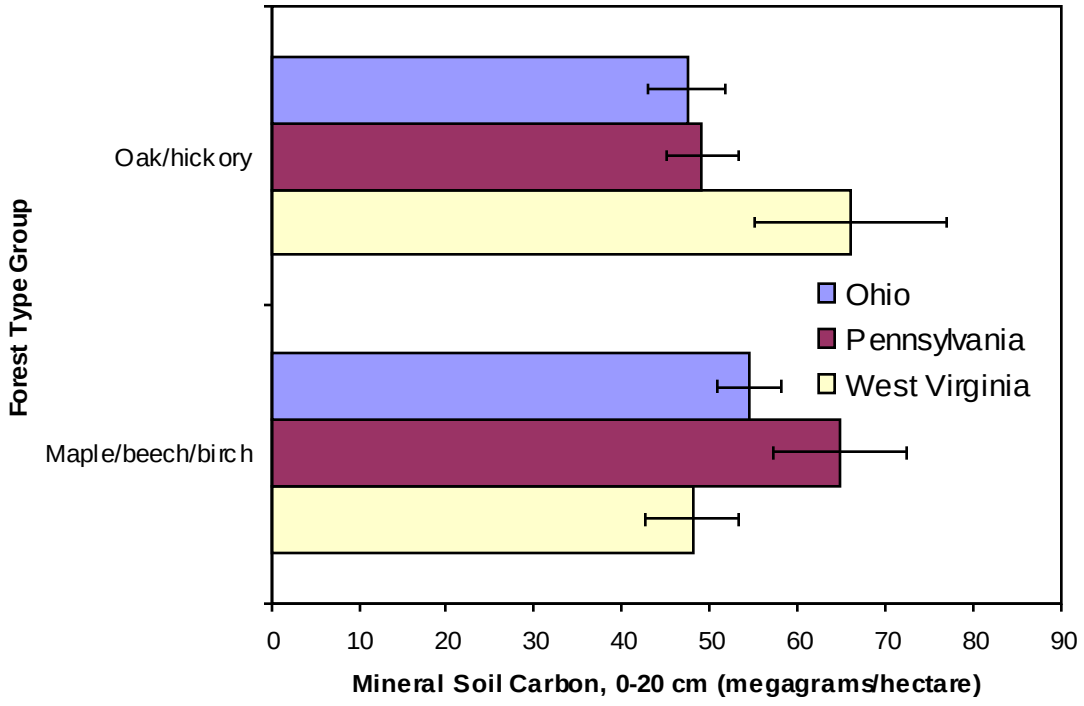


Figure 4a – Mean carbon content of forest soils by forest-type group (67 % confidence intervals are included as error bars). From *Ohio Forests: 2006* (Widmann et al. 2009).

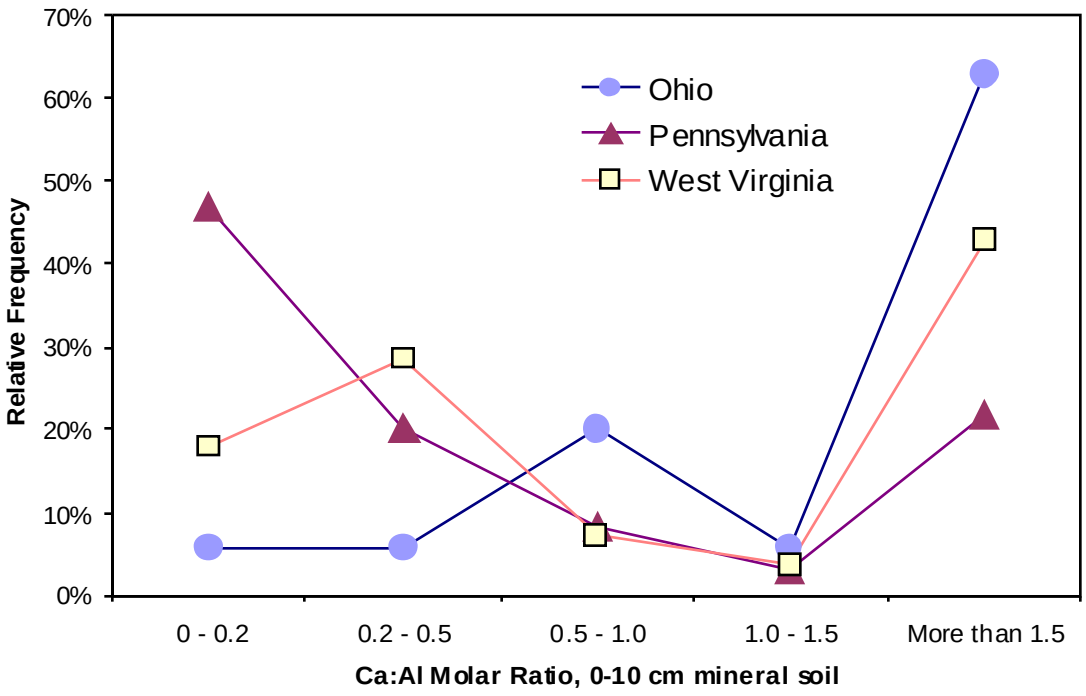


Figure 4b – Mean ratio of calcium to aluminum by state. From *Ohio Forests: 2006* (Widmann et al. 2009).

Management focused on conserving soil and water resources

To evaluate the area of forests in Ohio that is currently being managed to conserve soil and water resources, available data on ownership and forest management commitments were considered. Specifically, the ODNR protected lands database was overlaid with the NLCD 2001 forest cover data to highlight protected forest lands in the state (Figure 4c), which totaled approximately 806,600 acres. The protected lands database includes all ODNR lands (e.g., state forests, parks, wildlife areas, nature preserves), Wayne National Forest, National Park Service lands (e.g., Cuyahoga NP), The Nature Conservancy lands, watershed conservancy districts, metroparks, and other community forests. While this database covers most lands in the State protected through ownership by natural resource agencies or organizations, some lands, like private lands under conservation easements (e.g., lands protected by land trusts) are not included. A total of 60,681 acres of private forest lands are enrolled in the Ohio Forest Tax Law program under the "new law" rules implemented in 1993, which require a commitment to manage for soil and water conservation. Combining protected forest lands and "new law" Ohio Forest Tax Law forest lands, approximately 867,300 acres, or ~10% of Ohio's forests have commitments to soil and water conservation.

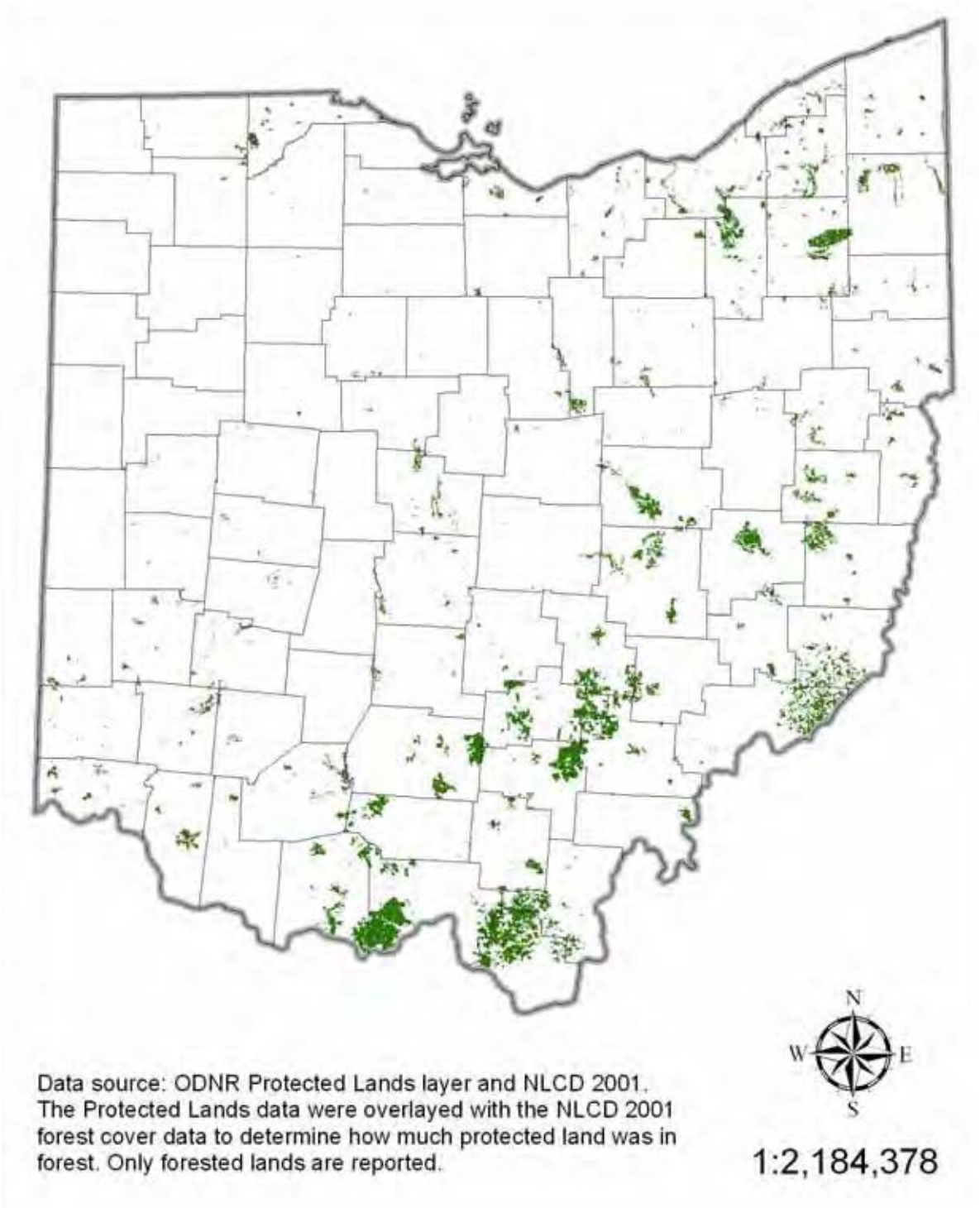


Figure 4c – Protected forest lands in Ohio, identified by overlaying the ODNR protected lands data with NLCD 2001 forest cover data.

Indicator 9 – Area of forest land adjacent to surface water, and forest land by watershed.

There is a direct link between the amount of forest cover within a watershed and water quality within streams. Forests filter the water and retain nutrients and potential pollutants within the soil and humus layers, keeping them from reaching streams; in the soil and humus layers these potential pollutants can be utilized or broken down into harmless compounds. Forests also detain runoff from storm events and allow time for the precipitation to infiltrate the soil and recharge of aquifers. Trees within the riparian area also armor stream banks to keep them from eroding and offer shade to keep stream temperatures cool. All of these factors benefit humans and aquatic life.

Forested riparian area

This metric will indicate the amount of area around various streams and water bodies the amount of forest within a designated "riparian forest buffer". For the purposes of this analysis, the National Hydrography Dataset was used to identify intermittent and perennial streams, open water in rivers, and water bodies such as ponds and lakes. Intermittent streams were given a designated buffer of 50 feet on each side of the stream. Perennials, open water (referred to in the analysis as "Areas"), and water bodies were each given a designated buffer of 100 feet. The amount of forest cover within these designated buffers was calculated using the NLCD 2001 dataset. The data were aggregated at the eight-digit hydrologic unit level (of which all or portions of 44 occur in Ohio). Given the mix of land uses throughout Ohio, a reasonable threshold for riparian forest cover was designated as 50% for all four categories (Figure 4d). For intermittent streams, perennial streams, areas, and water bodies, 21, 20, 15 and, 14 watersheds respectively were at or above the 50% threshold.

The trend could be described as stable overall, as the average change across all types of streams and water bodies falls within the range of between a 1% loss and 1% gain at -0.7%. Intermittent streams are gaining forest cover with a statewide average gain of 1.1%; the number of watersheds in the declining, stable, and gaining categories are 6, 17 and 21 watersheds respectively (Figure 4e). Perennial streams are generally declining with a statewide average decline of 1.8%; the numbers of watersheds in the declining, stable and gaining categories are 21, 12, and 11 respectively. Areas (river/stream open water) are declining in forest cover with a statewide average decline of 1.9%; the numbers of watersheds in the declining, stable and gaining categories are 18, 14 and 12 respectively. Water bodies (ponds, lakes, etc.) are stable in forest cover with a statewide average decline of 0.4%; the numbers of watersheds in the declining, stable and gaining categories are 14, 9 and 21 respectively.

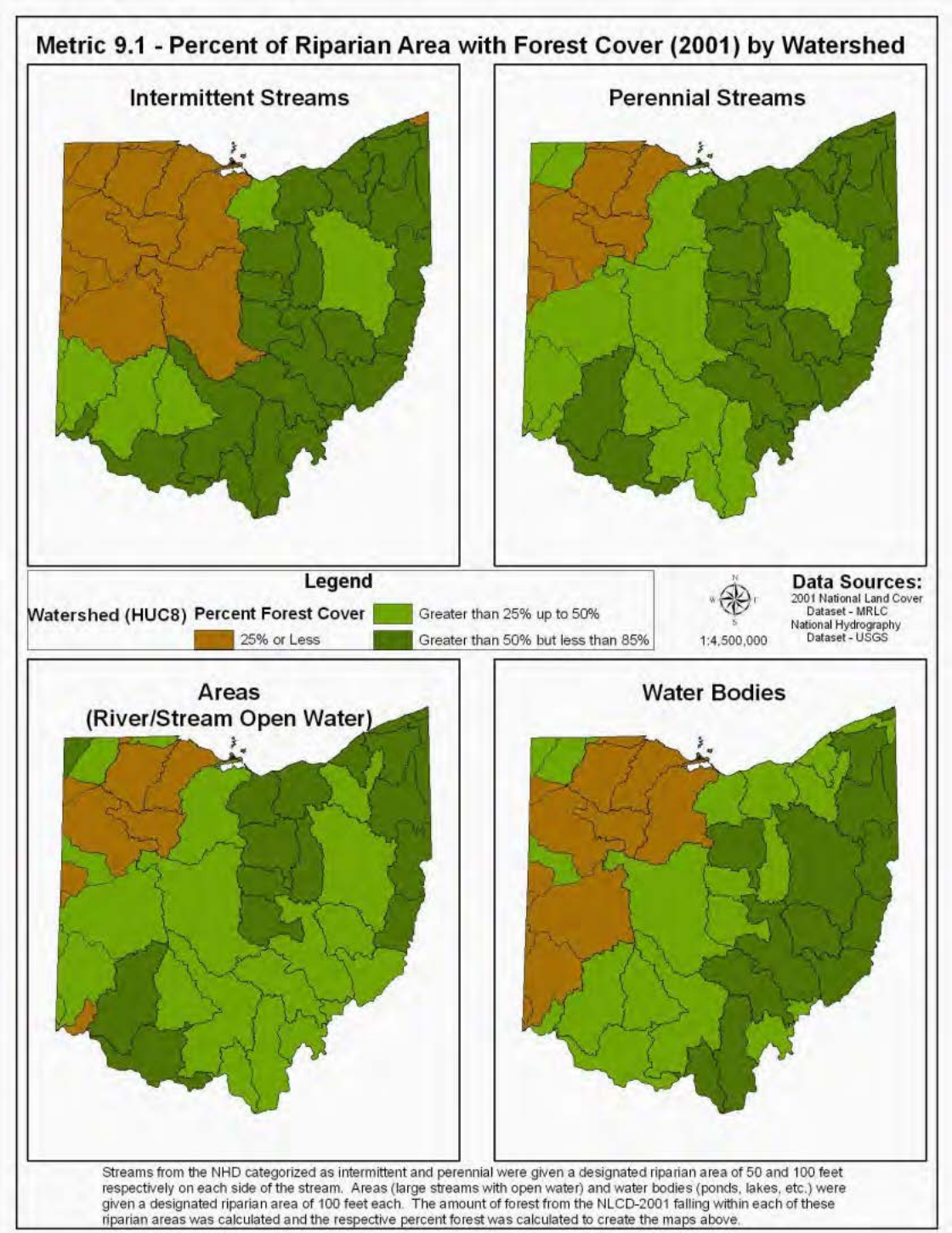


Figure 4d – Percent forest cover in riparian areas and water bodies by 8-digit HUC watershed.

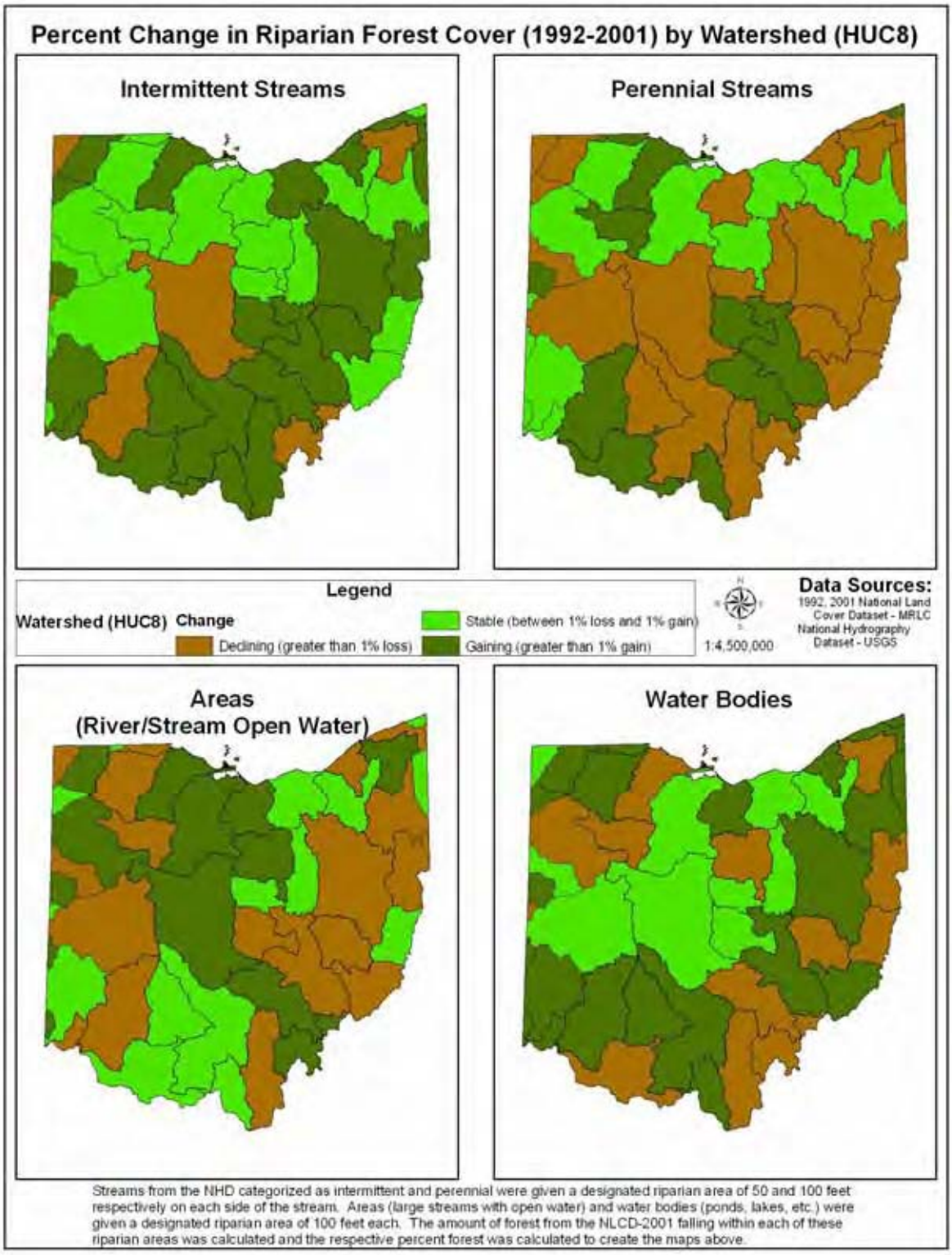


Figure 4e – Percent change in riparian forest cover by 8-digit HUC watershed.

Forest land by watershed

Similar to riparian forest, the amount of forest in the watershed influences the streams that drain them. The influence of forests on infiltration rates and the amount and timing of runoff that reaches streams is very important. For the most part, forest land within watersheds of the state is stable with the most heavily forested watersheds located in southeastern Ohio (Figure 4f). Comparing the NLCD datasets of 1992 and 2001, the watersheds varied from losing 0.94% of their forest cover to gaining almost 0.5%. It is possible that this is simply within the accuracy of the two datasets used to develop the comparison. This stability is also supported by the Forest Inventory and Analysis statistics showing relatively stable forest cover since the last survey.

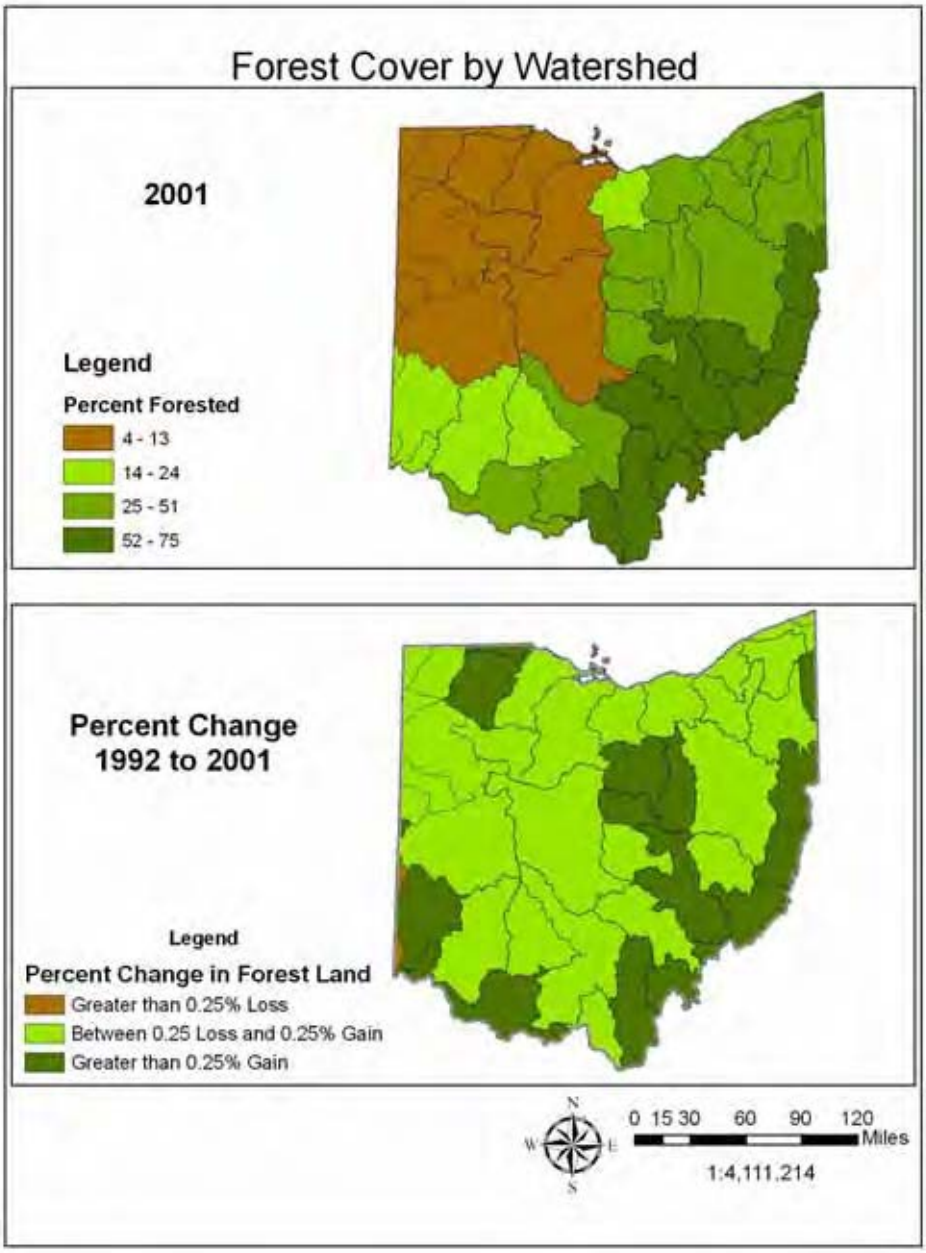


Figure 4f – Percent forest cover by 8-digit HUC watershed (in 2001) and percent change in forest land from 1992 to 2001. Land cover data came from the NLCD 1992 and NLCD 2001 datasets.

Indicator 10 – Water quality in forested areas.

As previously indicated, the most heavily forested watersheds are in southeastern Ohio. The water quality of the heavily forested watersheds varies (Figure 4g). Reports on Total Maximum Daily Loads (TMDLs) exist for some of the impacted watersheds. The principal causes of impairment of Ohio's forested watersheds are related to landscape modification from agricultural land use and urban development (OEPA 2010). More specifically, pollutants that are often cited in water quality reports include: 1) nutrient loading from human sewage, livestock manure, and agricultural chemicals, and 2) sediment flowing into streams from agricultural and developing areas (OEPA 2009a,b). Acid mine drainage is also a common issue in forested watersheds (OEPA 2009a). Most of the Ohio's coal production occurs in the unglaciated Appalachian region in the eastern half of the state (Figure 4h). The Ohio EPA identifies and protects high quality waters through its antidegradation rule (details online at: http://www.epa.ohio.gov/dsw/rules/antidegguide_2003.aspx). Two categories of high quality waters are given greater protection under antidegradation rule: Superior High Quality Waters and Outstanding State Waters (Figure 4i). For a more detailed analysis of water quality in Ohio, see the Ohio EPA's recent publication entitled *Ohio 2010: Integrated Water Quality Monitoring and Assessment Report* (currently available in draft form online at: http://www.epa.ohio.gov/dsw/tmdl/2010IntReport/2010OhioIntegratedReport_draft.aspx).

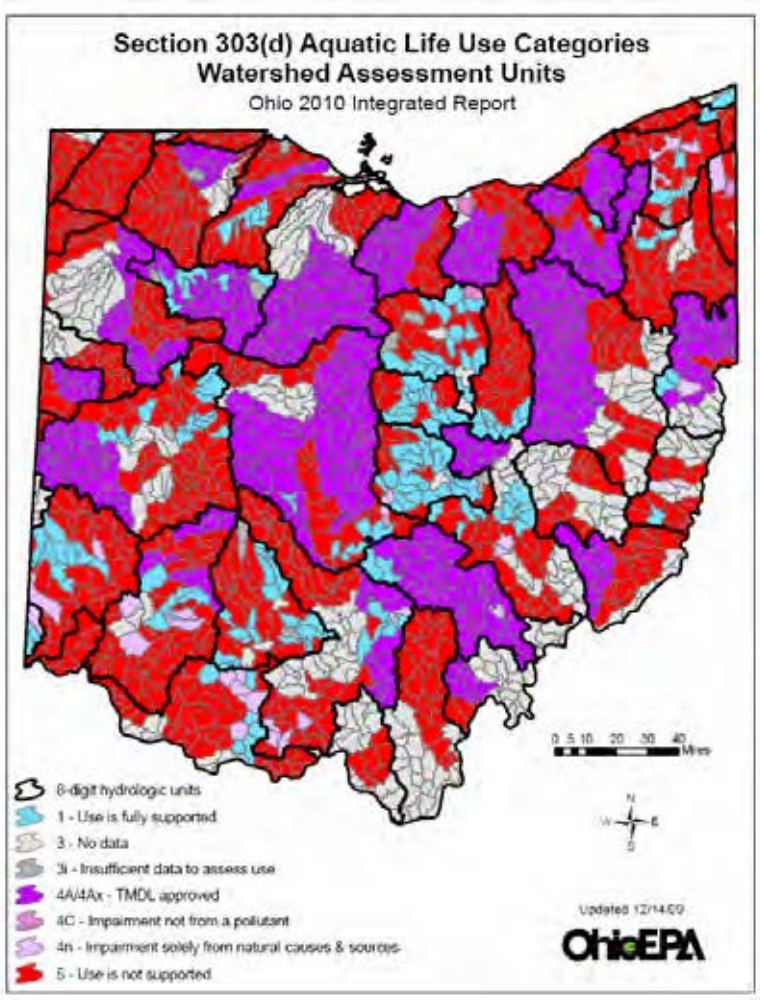


Figure 4g – Assessment of impairment of Ohio's 12-digit HUC watersheds based on aquatic life use scores. Gray areas currently have no data. Data source: Ohio EPA (OEPA 2010).

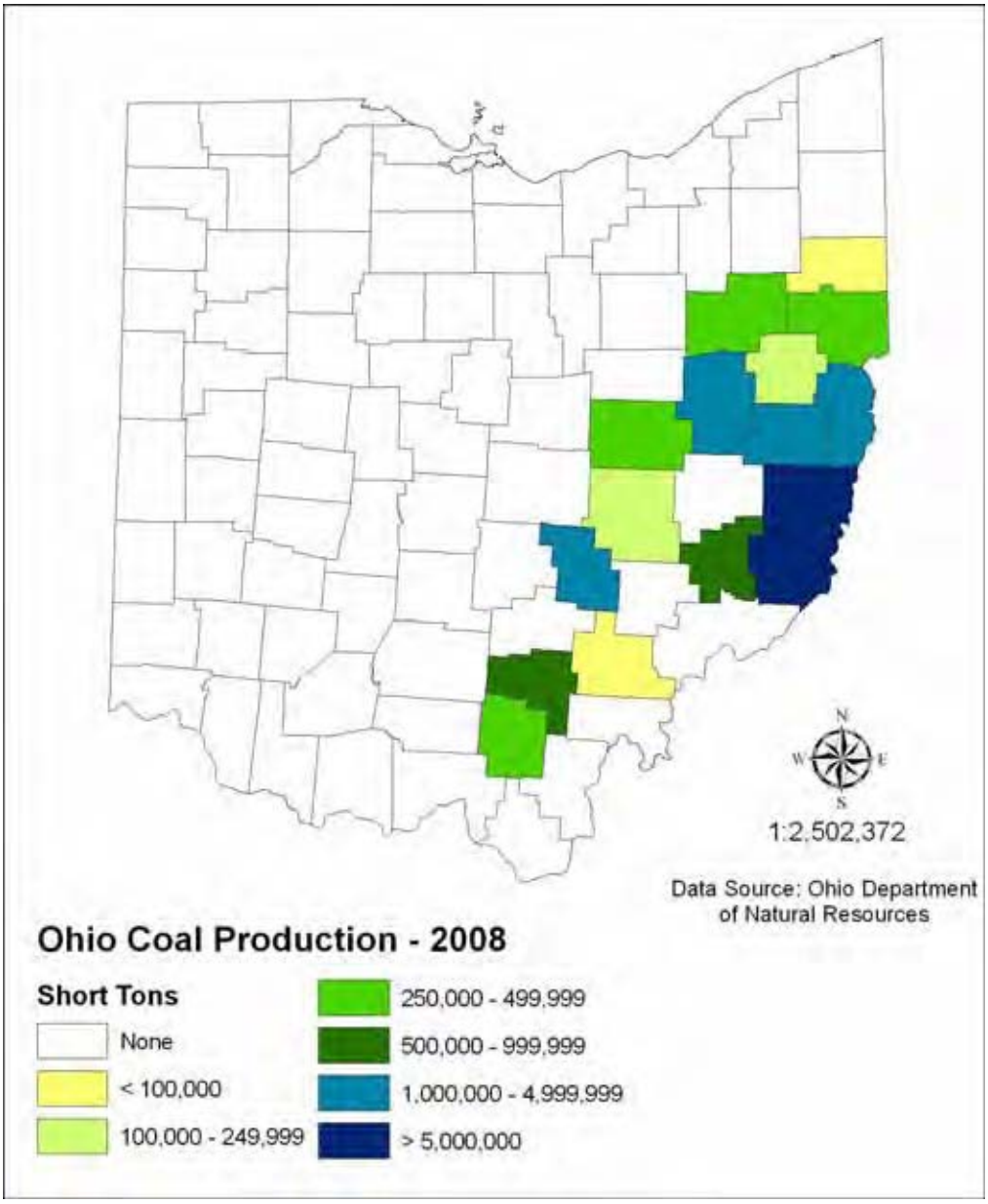


Figure 4h – Coal production in Ohio by County, 2008. Data source: Ohio Department of Natural Resources, Division of Geological Survey.

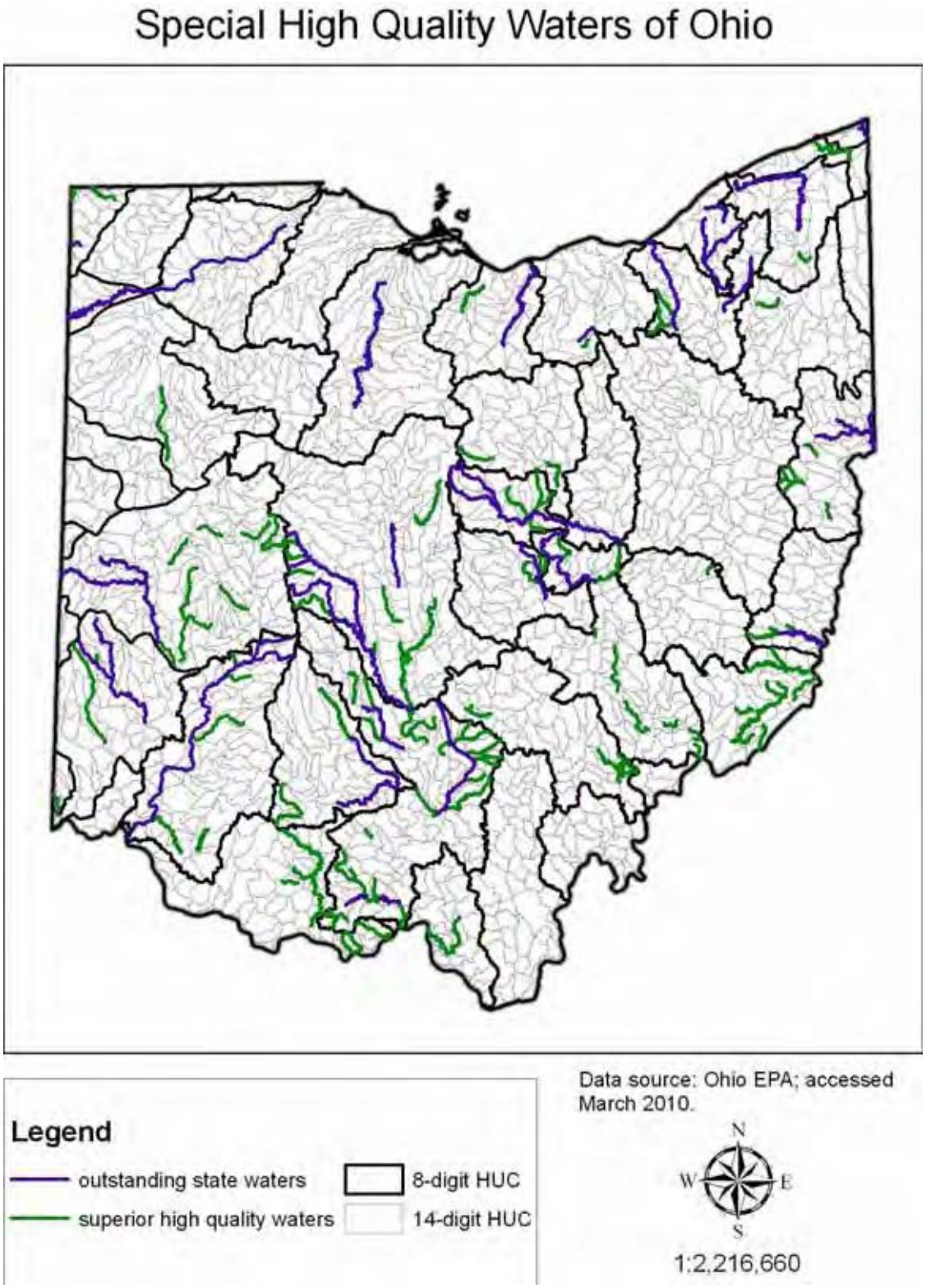


Figure 4i – Special high quality waters in Ohio. Data source: Ohio EPA (OEPA 2010).

Criterion 5 – Maintenance of Forest Contribution to Global Carbon Cycles.

Globally, forest ecosystems are one of largest reservoirs of biomass and carbon, and they play an important role in the global carbon cycle. The carbon budgets of forests include carbon uptake through photosynthesis, allocation to living tissue (biomass), and soil accumulations, as well as carbon loss through cellular respiration and decomposition of soil organic matter (Malhi et al. 1999). Forests can accumulate or sequester carbon and function as carbon sinks, but they can also be a net source of carbon. In general, forests that are more productive have a greater net storage of carbon in biomass. Certain forest management practices can increase carbon sequestration (Perschel et al. 2007), and thereby enhance the role that forest ecosystems play in mitigating climate change. An evaluation of success in carbon sequestration efforts requires data on local or statewide carbon pools and their change over time. This criterion describes the current state of biomass and carbon storage in Ohio's forests, as well as recent trends.

Indicator 11 – Forest ecosystem biomass and forest carbon pools.

The distribution of tree biomass across the state mirrors that of forest cover, with the greatest stores of forest carbon occurring in southeast and northeast Ohio (Figure 5a). Carbon pools in Ohio's forests include live trees, dead trees (standing and downed), understory plants, forest floor (e.g., leaf litter), and organic soil. The largest single pool of carbon is in live trees, followed closely by soil organic matter (Table 5a). Of the statewide forest carbon pool in live trees, 66% is classified in the oak-hickory forest type group (Table 5b). The second most abundant forest type group is the maple-beech-birch group, at 21.6% of forest carbon in live trees. As discussed earlier in this assessment, Ohio's forests have been experiencing a trend of maturing; however, the amount of carbon stored per unit area has changed little over the past 6 years (Figure 5b). From 2003 to 2009, the annual mean total carbon ranged from 157 metric tons per hectare (in 2003 and 2009) to 167 metric tons per hectare (in 2008).

Table 5a – Forest carbon pools on forestland in Ohio, 2008. Data source: USDA Forest Service, FIA (accessed online from EVALIDator at: http://fiatools.fs.fed.us/Evalidator401/tmattribute.jsp)

Carbon Pool	Oven-dry short tons of carbon
Live Trees	277,102,982
Standing Dead Trees	15,743,447
Understory	6,668,519
Downed Dead Trees	23,945,341
Forest Floor	41,395,321
Soil Organic	227,128,713
Total nonsoil	364,855,610

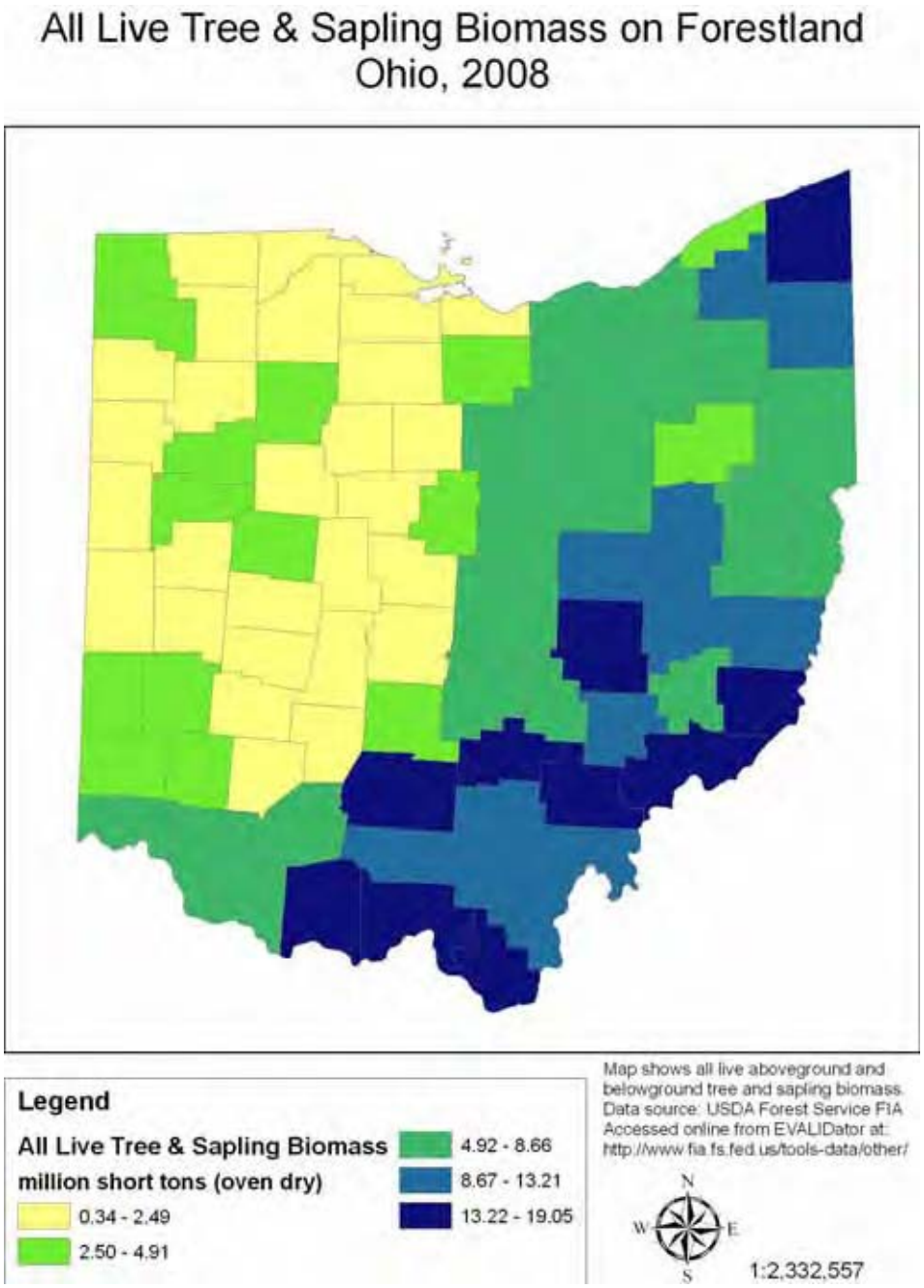


Figure 5a – All live tree and sapling biomass (aboveground and below ground) by Ohio county, 2008. Data source: USDA Forest Service FIA (accessed online from EVALIDator at: http://fiatools.fs.fed.us/Evalidator401/tmattribute.jsp).

Table 5b – Forest carbon in live trees by forest type group on forestland in Ohio, 2008. Data source: USDA Forest Service, FIA (accessed online on from EVALIDator at: http://fiatools.fs.fed.us/Evalidator401/tmattribute.jsp)

Forest Type Group	Oven-dry short tons of carbon
Total – All Live Trees	277,102,982
White / red / jack pine group	2,466,714
Loblolly / shortleaf pine group	1,675,315
Other eastern softwoods group	394,242
Fir / spruce / mountain hemlock group	57,153
Exotic softwoods group	655,973
Oak / pine group	2,762,720
Oak / hickory group	183,100,853
Oak / gum / cypress group	402,363
Elm / ash / cottonwood group	21,616,283
Maple / beech / birch group	59,930,395
Aspen / birch group	3,109,415
Other hardwoods group	590,936
Exotic hardwoods group	203,108
Nonstocked	137,512

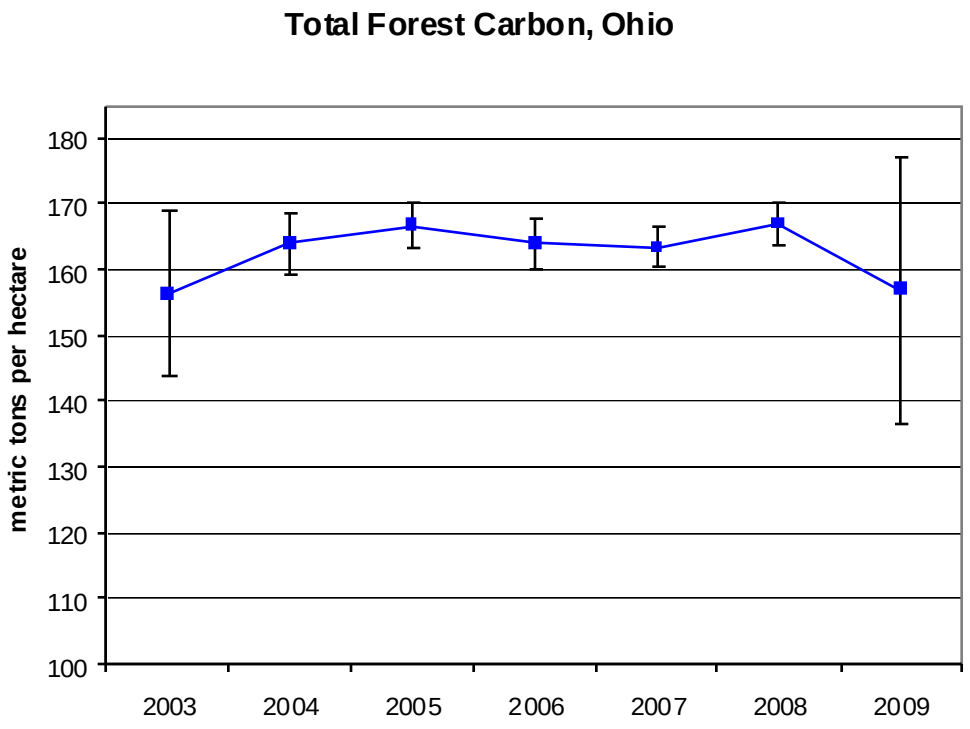


Figure 5b – Annual means for total forest carbon for Ohio from 2003 to 2009. Standard error bars are shown for each data point. Data source: USDA Forest Service, Carbon Online Estimator (http://ncasi.uml.edu/COLE/index.html).

Criterion 6 – Maintenance and Enhancement of Long-Term Multiple Socioeconomic Benefits to Meet the Needs of Societies.

Indicator 12 – Wood and wood products production consumption, and trade.

Value of wood-related products

Gross domestic product (GDP) is a commonly-used measure of economic output or value of products. It represents the total market value of all products from a given geographic area, and GDP can also be calculated for specific industrial classifications. In 2007, the total GDP in Ohio for the manufacturing of wood products (NAICS 321) and furniture and related products (NAICS 337) was $2,634,000,000, which represents 0.6 % of the GDP for all industries in Ohio in 2007. Over the past 10 years, the GDP for wood products and paper (NAICS 322) manufacturing has been relatively stable, while the trend for GDP for furniture products has been a gradual increase over time (Figure 6a). NAICS 322 includes the manufacturing of pulp and paper, as well as converted paper products. Ohio consistently ranks in the top 20 States in GDP for wood-related products. In 2007, Ohio had the 13th highest GDP for wood products manufacturing in the United States (Figure 6b) and the 6th highest GDP for furniture and related products manufacturing (Figure 6c). Another indicator of the value of wood products is the trend for timber prices in Ohio (Figure 6d). One trend for timber prices is the overall decline since 2005. Some other trends of note include: 1) the substantial increase in black cherry prices in the early to mid-2000s followed by a substantial decline, and 2) changes in red oak prices, which were high relative to most other species in the late 1980s through the 1990s but are currently near the bottom.

A unique wood-manufacturing sector recently emerged in Ohio that is influencing hardwood lumber production and value in the state and beyond– the Amish furniture cluster. A cluster of many small firms (median firm size of less than 6 employees) have formed in and around Holmes County, Ohio that provide consumers customized, solid-wood products. Researchers estimated that the Amish furniture cluster in Ohio consumes nearly 44 MMBF of hardwood lumber annually, which represents 11% of Ohio's total hardwood production and has a value of shipments of $280.7 million (Bumgardner et al. 2007).

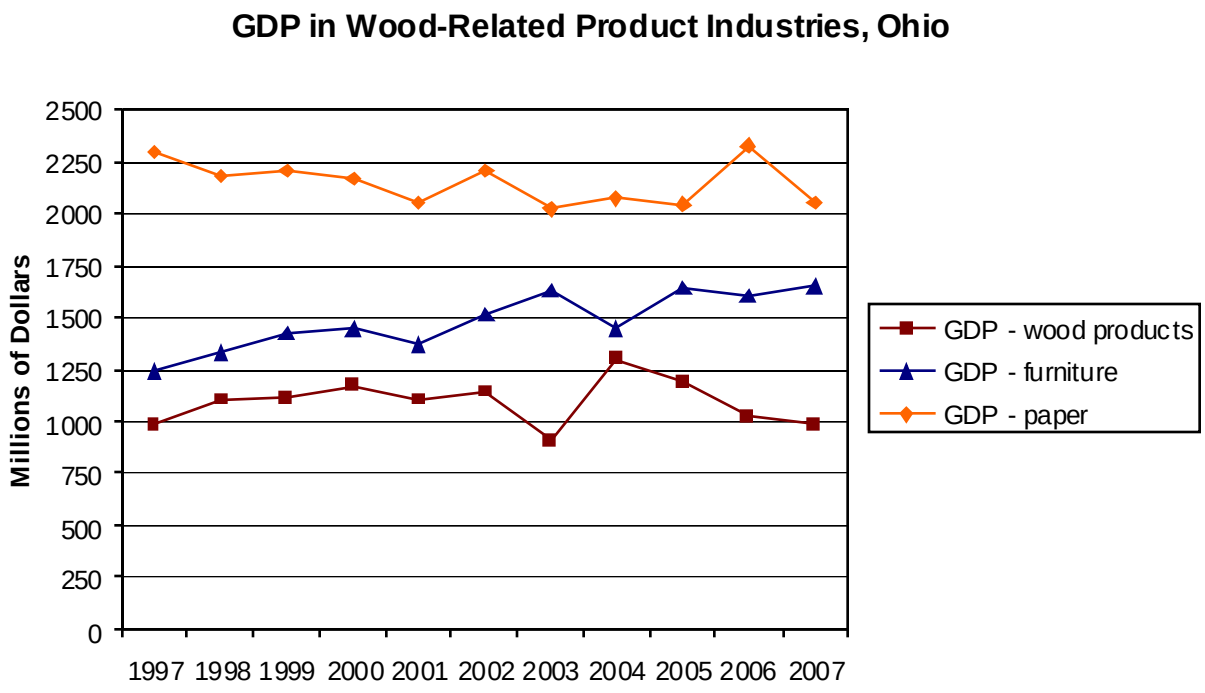


Figure 6a – Gross Domestic Product (GDP) of wood product manufacturing (NAICS 321), paper manufacturing (NAICS 322), and furniture and related product manufacturing (NAICS 337) in Ohio from 1997 to 2007. Data source: Bureau of Economic Analysis, U.S. Department of Commerce.

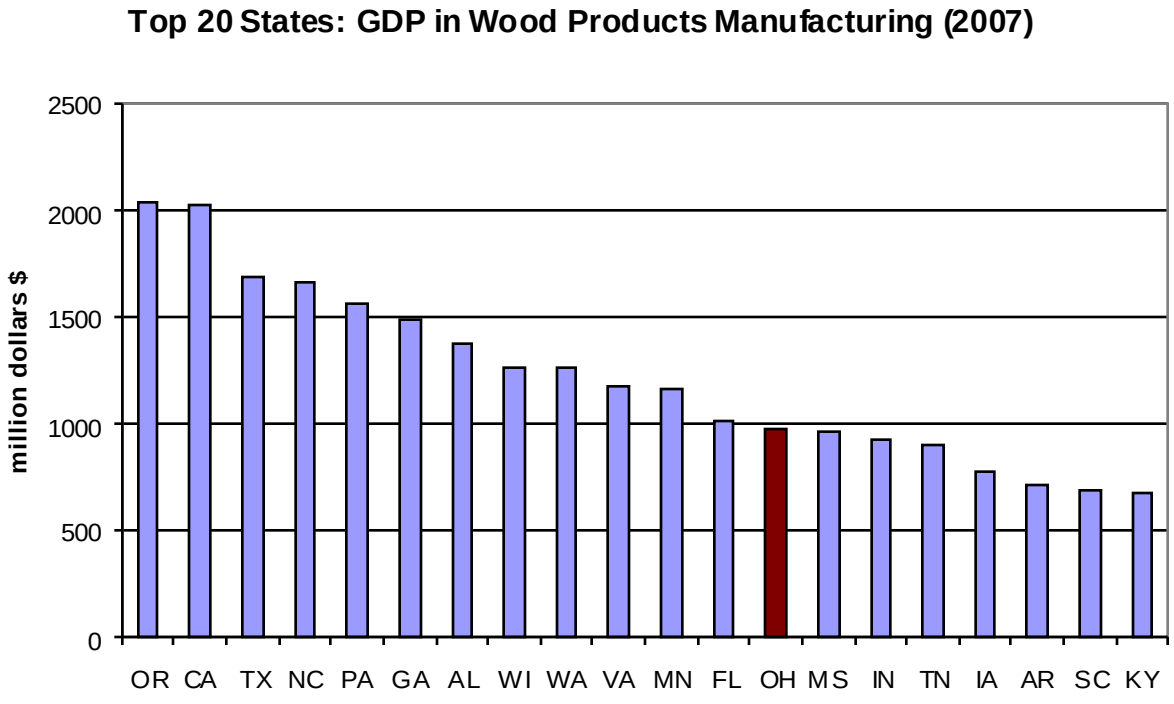


Figure 6b – The top 20 States in Gross Domestic Product (GDP) for wood product manufacturing (NAICS 321) in 2007. Data source: Bureau of Economic Analysis, U.S. Department of Commerce.

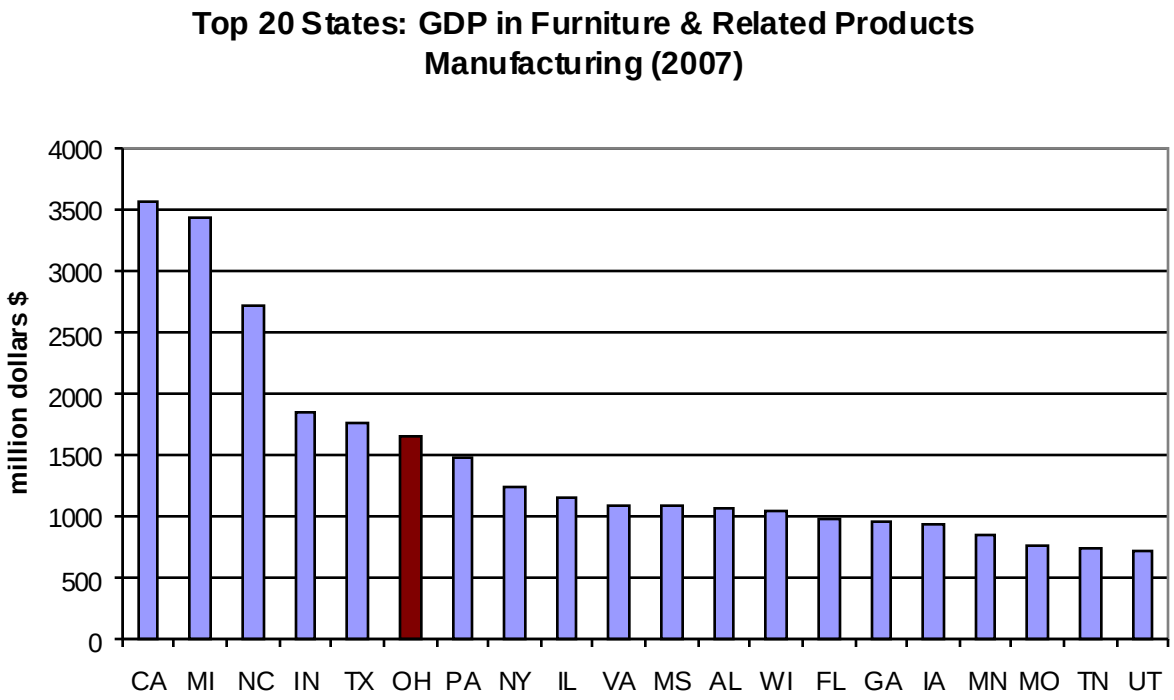


Figure 6c – The top 20 States in Gross Domestic Product (GDP) for furniture and related product manufacturing (NAICS 337) in 2007. Data source: Bureau of Economic Analysis, U.S. Department of Commerce.

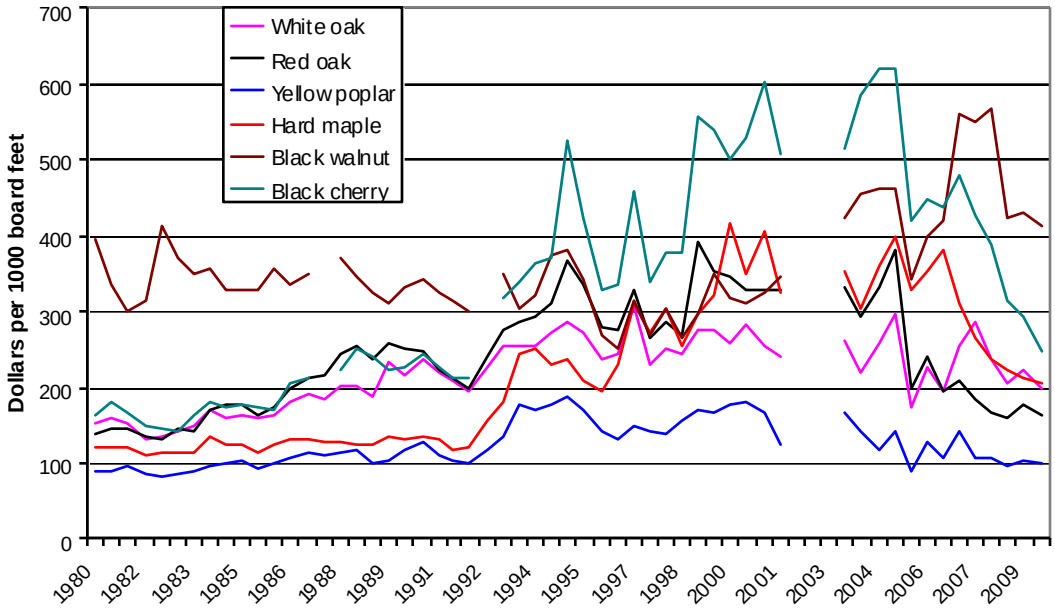


Figure 6d – Ohio timber prices for select hardwood species from 1980 to 2009. Stumpage prices are presented, adjusted for inflation. Data source: Ohio Timber Price Reports (available online at: http://ohiodnr.com/tabid/5253/Default.aspx); compiled by William Luppold, USDA Forest Service.

Production of roundwood

An evaluation of roundwood utilization provides a measure of the volume of wood utilized by primary wood processors in the State as well as the volume of wood harvested from Ohio's forest lands. The total volume of roundwood harvests in the State was similar between 1989 and 2006, with 89.1 million cubic feet harvested in 1989 (Widmann and Long 1992) and 91.2 million cubic feet in 2006 (Wiedenbeck and Sabula 2008). While overall production was similar between 1989 and 2006, the proportion of sawlog harvests increased during that time while pulpwood decreased (Figure 6e). Oaks continue to be the dominant species harvested, with other important hardwoods being yellow-poplar, hard maple, black cherry, soft maple, ash, and hickory (Figure 6f).

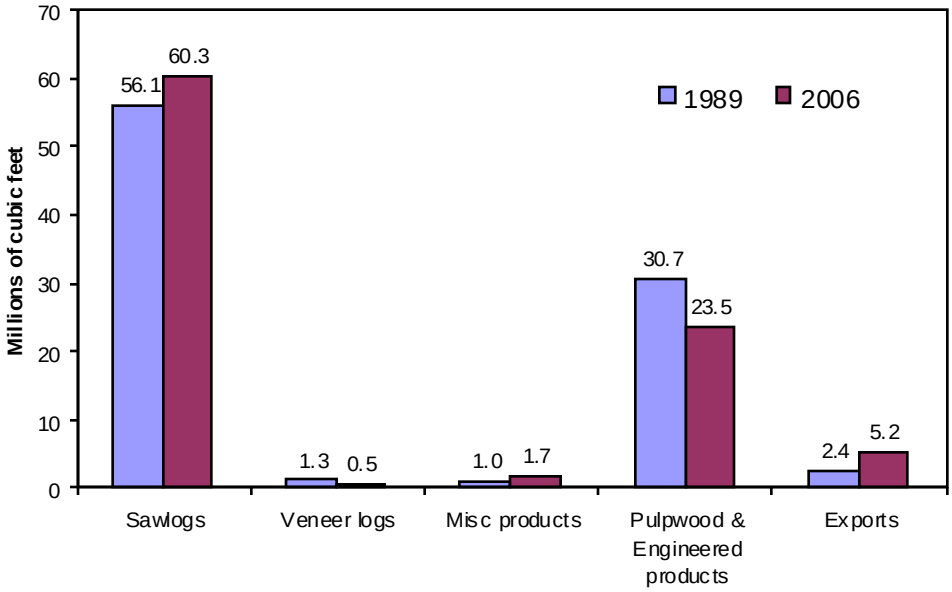


Figure 6e – Roundwood harvest by product, 1989 and 2006. From *Ohio Forests: 2006* (Widmann et al. 2009).

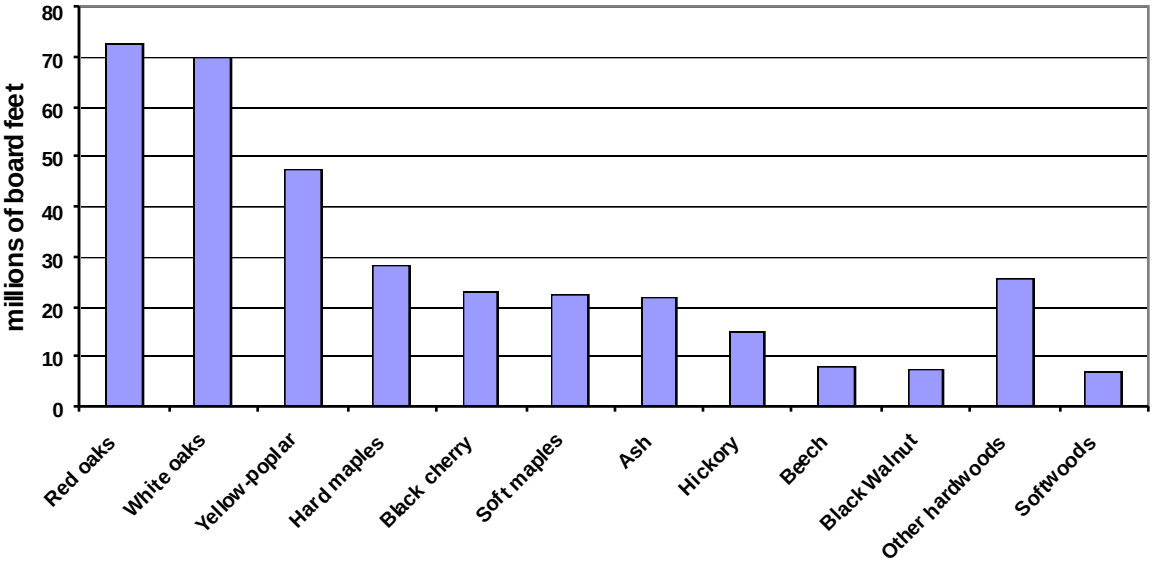


Figure 6f – Sawlog harvests in Ohio by major species group, 2006. Data source: USDA FIA TPO (available online at: http://srsfia2.fs.fed.us/php/tpo_2009/tpo_rpa_int1.php).

Bioenergy

The USDA Economic Research Service defines bioenergy as renewable energy derived from biological sources, to be used for heat, electricity, or vehicle fuel. Interest in bioenergy has increased significantly in recent years, in response to rising fuel costs, climate change concerns, increasing energy demands, and policy changes (e.g., Energy Independence and Security Act of 2007). Biomass from woody plants is often presented as one of the key sources of renewable energy available for large-scale energy production (e.g., Jeanty et al. 2004; Ray and Ma 2009). Large-scale energy production using biomass will likely come as both dedicated biomass facilities and the co-firing of wood in coal-fired facilities (Ray and Ma 2009).

Currently, New England states have the greatest electrical capacity from wood-fired facilities, but planned future projects in Ohio and other neighboring states will significantly expand their wood-fired electrical capacity (Figure 6g; Ray and Ma 2009). Figure 6h shows the current distribution and relative size of wood-fired and coal-fired facilities in the Northeastern United States and demonstrates the potential impact of future conversion to wood co-firing (Ray and Ma 2009).

Various potential sources of woody biomass exist for energy production in Ohio. While mill residue or by-products from current forest industry operations would provide a readily available source, the actual percentage of wood residue that is currently unused is low (Table 6a). A 2004 report found that mill residue only represents ~1% of the potential woody biomass available for bioenergy in Ohio (Jeanty et al. 2004). Woody biomass sources with significantly greater potential in the State include municipal solid waste, forest residue, and construction and demolition debris (Jeanty et al. 2004). Further analysis is needed on sources of woody biomass and their sustainable use. Once wood co-firing reaches a level of 3 percent, the impact on wood demand in Ohio (8.0 million green tons) begins to reach a level where co-firing facilities will negatively impact the competing wood-using industries (Ray and Ma 2009; Figure 6i). In addition to concerns about ensuring sustainable supplies of woody biomass, resource managers are considering the potential ecological impact on Ohio's forests from woody biomass harvesting. Ecological considerations are already an important component of timber harvest planning by forestry professionals, and they would continue to be prominent in the context of harvesting for woody biomass. Nevertheless, some unique forest management practices may be applicable, such as the retention of organic matter from deadwood and logging slash for soil productivity and wildlife habitat (Janowiak and Webster 2010). Some states have developed specific management guidelines or Best Management Practices (BMPs) to address concerns about sustainability and environmental impacts (e.g., Pennsylvania DCNR 2008; www.dcnr.state.pa.us/PA_Biomass_guidance_final.pdf).

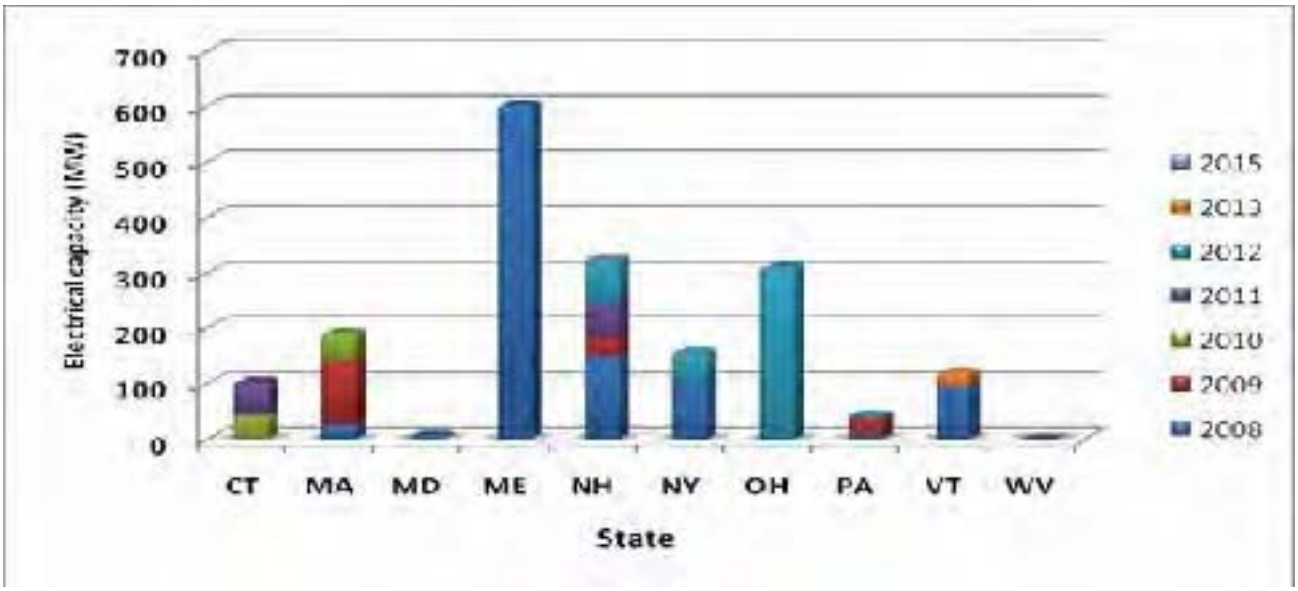


Figure 6g - Electrical capacity, current and planned, from wood-fired power plants in the northeastern United States, 2008 – 2015. From: Penn State University's WoodPro Technote 2009-4 (Ray and Ma 2009).

Figure 6h - Occurrence, size, and location of wood-fired and coal-fired electricity production in the northeastern United States. From: Penn State University's WoodPro Technote 2009-4 (Ray and Ma 2009).

Table 6a – Uses of hardwood and softwood residues in Ohio in relative percentages. The data are weighted using roundwood consumption volumes of firms that responded to a timber product survey. From the publication *Ohio roundwood utilization by the timber industry in 2006* (Wiedenbeck and Sabula 2008).

Type of Residue	Boiler fuel, external	Boiler fuel, internal	Chemical products	Household fuel	Livestock bedding	Mulch	Composite panels	Pulp	Other	Not Used
	----------Percentage----------									
Hardwood bark	1.8	3.3	2.3	16.7	9.4	57.3	1.1	4.3	0.6	**3.2**
Hardwood coarse	8.9	8.5	0.0	2.7	4.2	5.2	0.1	58.2	0.5	**11.7**
Hardwood fine	33.6	26.8	0.2	0.4	23.6	2.5	0.2	5.5	0.0	**7.2**
Softwood bark	0.0	0.0	2.8		0.0	20.8	0.0	0.1	0.0	**10.7**
Softwood coarse	0.0	0.0	0.0	0.0	0.1	95.6	0.0	0.0	0.0	**4.3**
Softwood fine	0.7	67.9	0.1	0.0	11.0	18.0	0.0	1.0	0.0	**1.3**

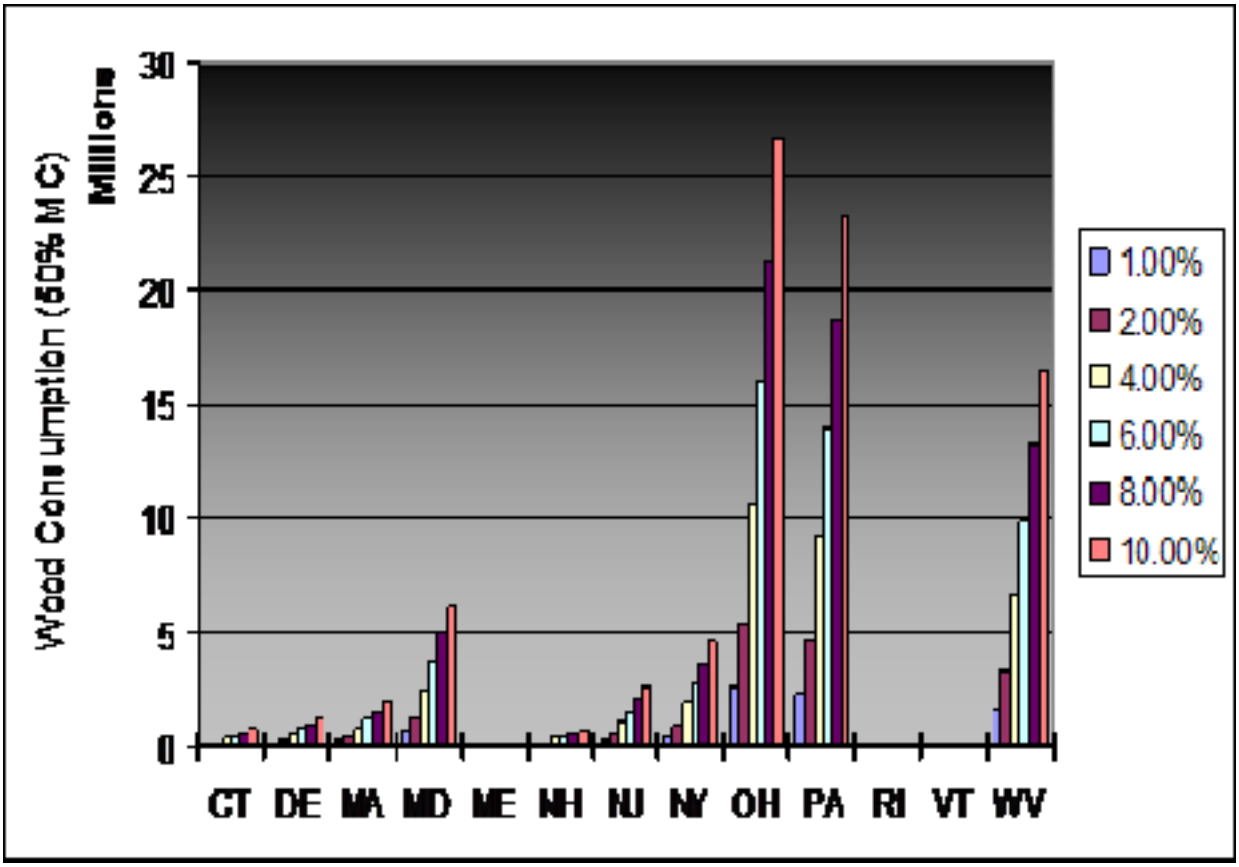


Figure 6i - Additional woody biomass demand associated with potential conversion of coal-fired power plants to wood co-fired units at co-firing rates from 1 to 10 percent. From Penn State University's WoodPro Technote 2009-4 (Ray and Ma 2009).

Trade or wood flow

Ohio is a net importer of saw logs, with a ratio of imports to exports of 5.6:1 in 2006 (Wiedenbeck and Sabula 2008). However, eighty-one percent of logs utilized by Ohio sawmills were harvested in Ohio, indicating that Ohio's wood product industry meets the majority of its demand using local (in-state) sources. Sawmills represent Ohio's largest primary wood products sector. However, not all industry sectors follow that trend; only 15 percent of veneer logs used by the Ohio's veneer manufacturers originated from Ohio timberlands in 2006 (Wiedenbeck and Sabula 2008).

Tables 6b, 6c, and 6d show the value of international exports over the past four years for the various stages of wood products manufacturing. Logging (NAICS 113) has been relatively stable during that time period, with a slight drop in 2009. Primary sawmills (NAICS 321) had a slight downward trend from 2006 to 2008 and a significant drop in 2009. Finally, furniture exports (NAICS 337) showed some increase over the same time period. Overall, the recent trend for international exports from Ohio shows relative stability with a down year in 2009.

Table 6b – Exports from Ohio (top five for 2009) in industrial classification NAICS 113, *Forestry and Logging*. Data source: Foreign Trade Division, U. S. Census Bureau.

Destination	**2006**	**2007**	**2008**	**2009**
		--thousands $ U.S.--		
China	12,971	15,012	15,681	14,176
Germany	2,724	4,418	5,254	4,295
Mexico	1,401	1,105	2,226	4,027
United Kingdom	7,010	5,389	5,450	3,663
South Korea	613	1,108	2,426	3,003
Rest of world	26,168	38,791	34,542	20,394
TOTAL	50,887	65,823	65,579	49,558

Table 6c – Exports from Ohio (top five for 2009) in industrial classification NAICS 321, *Wood Product Manufacturing*. Data source: Foreign Trade Division, U. S. Census Bureau.

Destination	**2006**	**2007**	**2008**	**2009**
		--thousands $ U.S.--		
Canada	82,697	78,701	77,821	56,416
China	11,109	11,491	11,907	12,252
Germany	17,167	13,992	18,688	11,476
Italy	20,093	19,788	17,590	10,272
United Kingdom	7,107	11,494	9,579	8,326
Rest of world	76,141	69,131	65,742	52,934
TOTAL	214,314	204,597	201,327	151,676

Table 6d – Exports from Ohio (top five for 2009) in industrial classification NAICS 337, *Furniture and Related Product Manufacturing*. Data source: Foreign Trade Division, U. S. Census Bureau.

Destination	2006	2007	2008	2009
	--thousands $ U.S.--			
Canada	139,294	164,994	166,661	147,557
Japan	5,710	5,083	2,293	6,256
Mexico	14,182	11,322	12,550	5,941
Australia	417	848	815	4,546
Saudi Arabia	865	913	591	4,467
Rest of world	26,496	24,807	30,623	44,376
TOTAL	186,964	207,967	213,533	213,143

Non-timber forest products

Non-timber forest products (NTFPs) are products that come from the forest that are not timber – based. Wildlife or other fauna are generally not included as NTFPs (Chamberlain 2007). NTFPs are harvested for a variety of purposes, including medicinal, decorative, culinary, and spiritual. They have economic and cultural value, and contribute to Ohio's forest-based economy. Several factors make it difficult to track NTFPs harvests or removals. For example, culinary NTFPs that are harvested for personal consumption are generally not reported, and some high value products, like ginseng, that are collected illegally (e.g., poaching) may be reported with false information, if reported at all. Non-timber forest products in Ohio include ginseng, bloodroot, goldenseal, black cohosh, maple syrup, walnut, various mushrooms, vines for decorative items, and various berries (e.g., blackberry, blueberry). Christmas trees are also considered to be NTFPs. Data exist for maple syrup, ginseng, and Christmas trees, but data are lacking for most other NTFPs.

Maple Syrup:

Maple syrup production provides the most revenue annually in Ohio of the various non-timber forest products. In 2008, the total value of maple syrup production was $3,790,000, and that represents the highest annual total of the past 10 years (Table 6e). In 2008, Ohio ranked 6th nationally in maple syrup production based on volume (Figure 6j).

Table 6e – Annual production, average price per gallon, and total annual value of maple syrup in Ohio. Data source: USDA National Agricultural Statistics Service (NASS).

Year	Total Production (1000 gallons)	Price per gallon	Total Value (1000 dollars)
1998	78	$29.80	$2,324
1999	95	$30.00	$2,850
2000	34	$34.30	$1,166
2001	96	$31.30	$3,005
2002	75	$32.30	$2,423
2003	51	$35.10	$1,790
2004	78	$32.00	$2,496
2005	63	$36.00	$2,268
2006	71	$34.00	$2,414
2007	63	$39.00	$2,457
2008	100	$37.90	$3,790

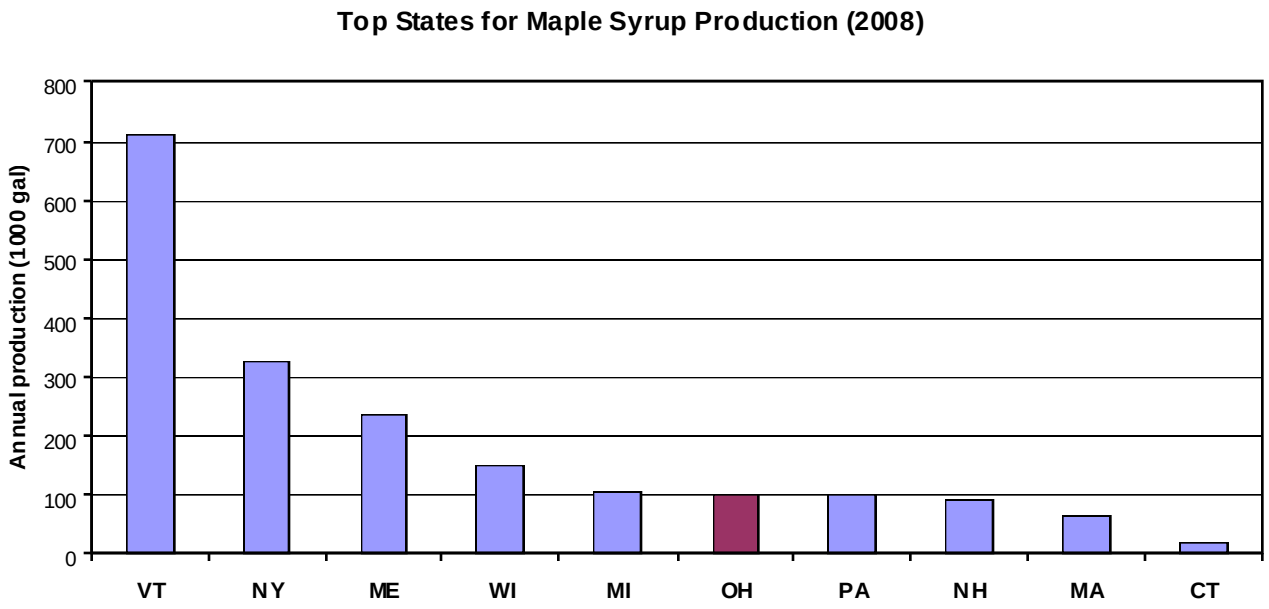


Figure 6j – Maple syrup production by State in 2008, presented as 1000 gallons of syrup. Data source: USDA NASS.

Ginseng:

Per unit weight, ginseng is one of the most valuable non-timber products. From 1997 to 2007, the average price of wild ginseng was $84.50 per pound (Source: Foreign Trade Service, U.S. Department of Commerce). Based on annual reports from the Ohio Division of Wildlife's Ginseng Program, harvests dropped significantly in the late 1990s but have remained relatively steady since then (Figure 6k) with 3627 lbs dry weight harvested in 2008. Ohio consistently ranks around 6th among States for its ginseng production (Figure 6l). Ohio Administrative Code sets laws governing the harvesting, selling, and buying of ginseng, and the Ohio Division of Wildlife administers Ohio's ginseng program. More details about Ohio's ginseng laws are available online at: http://www.dnr.state.oh.us/tabid/5845/default.aspx.

One challenge when evaluating data on ginseng harvests is the lack of information on how the harvested ginseng was produced. In addition to naturally occurring wild populations of ginseng, ginseng producers may grow "wild-simulated" ginseng or use "woods-cultivated" methods. Wild-simulated growers purchase seeds and plant them in the woods for future harvest, and their plantings are often less than 1 acre in size. Woods-cultivated growers expend much effort on site preparation, often using mechanized equipment, and plant large beds of ginseng over several acres. Woods-cultivated growers may also use more intensive agricultural practices, like pesticide applications and tilling. In Ohio, estimates of 350 to 400 wild-simulated growers have been made, with possibly an additional 30 woods-cultivated growers (Persons and Davis 2008; Rural Action pers. comm.), but no comprehensive data exist on ginseng harvests in Ohio that distinguishes between wild ginseng, wild-simulated, and woods-cultivated ginseng.

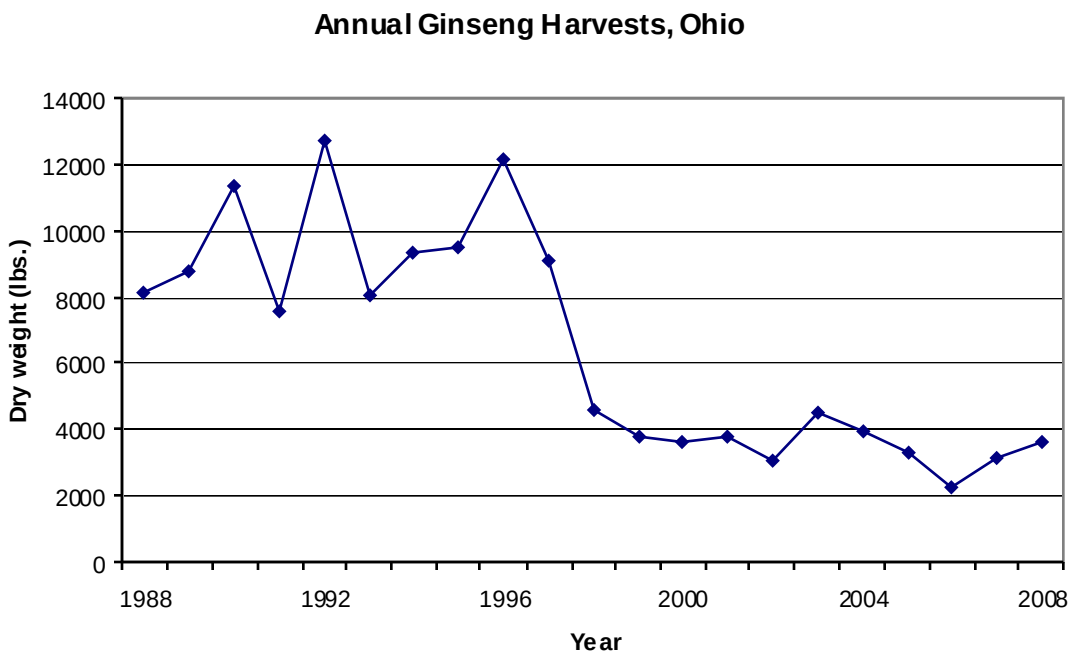


Figure 6k – Annual ginseng harvests in Ohio, as reported by the Ohio Division of Wildlife Ginseng Program.

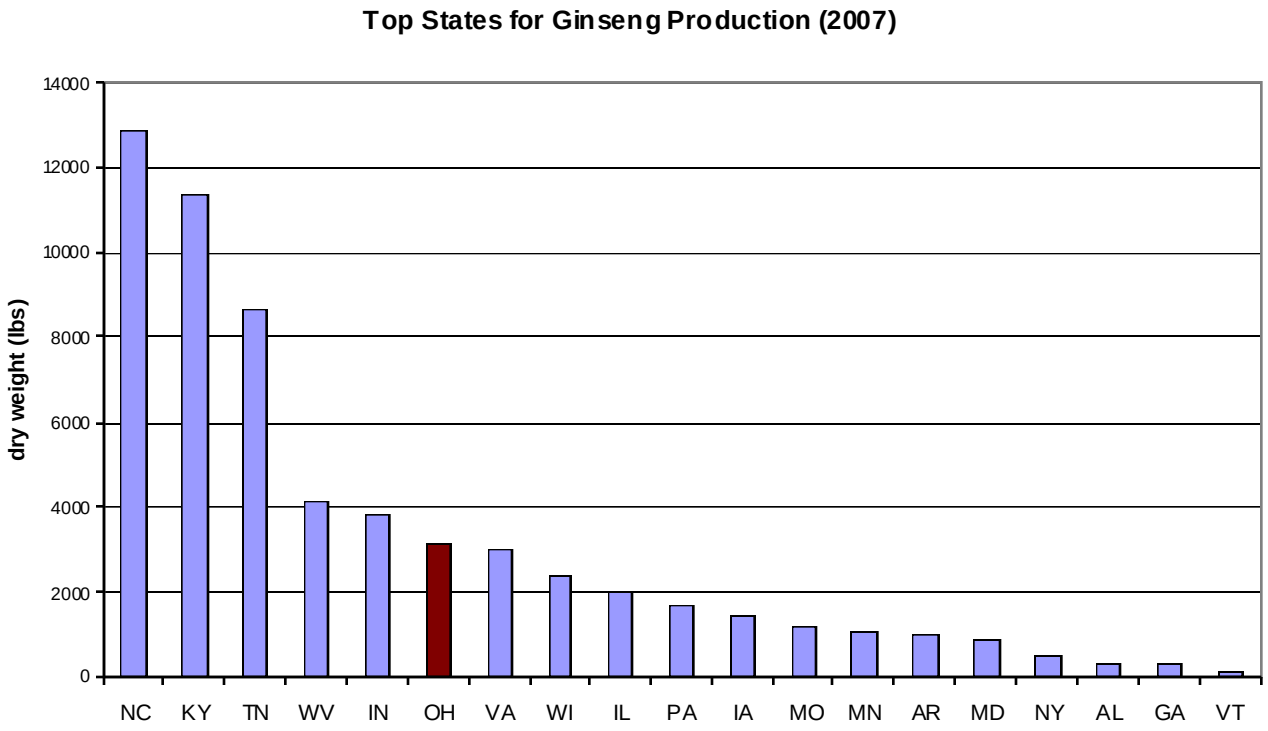


Figure 6l – Ginseng production in dry weight by State for 2007. Data source: U.S. Fish & Wildlife Service.

Christmas Trees:
Christmas trees are another important non-timber forest product in Ohio. Gross sales from Christmas trees totaled $1.6 million in 2006 (Table 6f). Ohio ranked 9th among States based on gross sales of Christmas trees in 2006 (Figure 6m).

Table 6f – Comparison of Christmas tree production in Ohio between 2003 and 2006, by number of producers, number of trees sold, gross sales, and area in production. Data source: USDA NASS, *Nursery Crops 2006 Summary* (2007).

	2003	2006
Producers	17	21
Quantity sold (trees)	51,000	49,000
Gross sales (dollars $)	1,997,000	1,587,000
Area in production (acres)	1,000	1,069

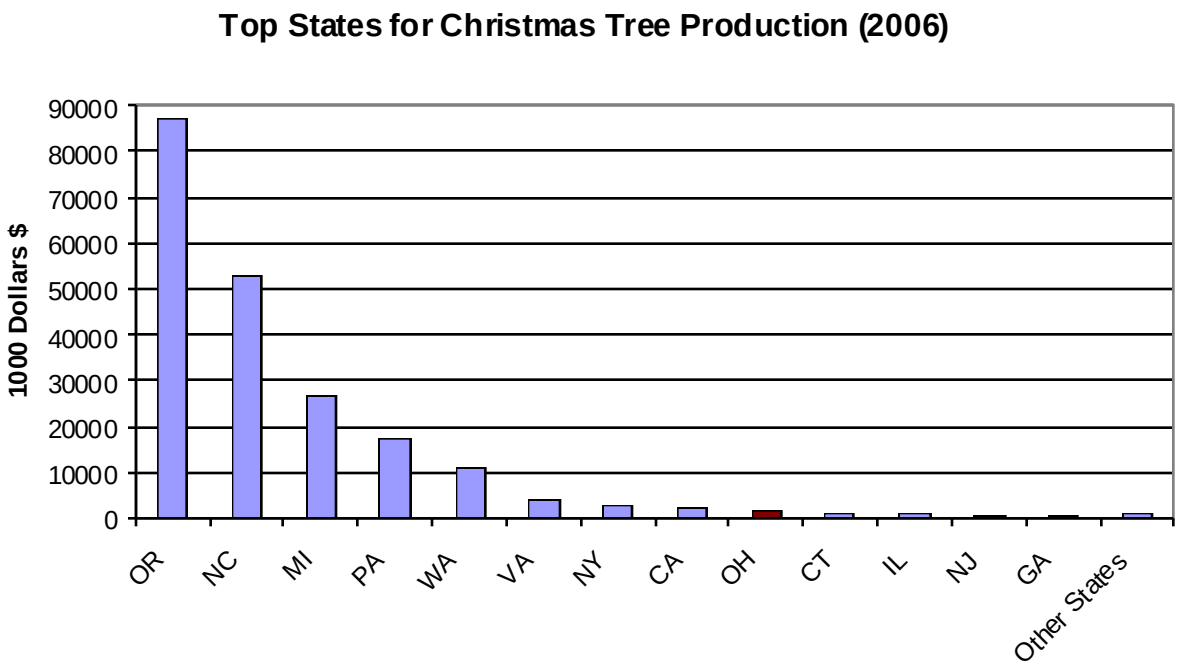


Figure 6m – Christmas tree production by State by gross sales, 2006. Data source: USDA NASS, *Nursery Crops 2006 Summary* (2007).

Indicator 13 – Outdoor recreational participation and facilities.

Forests are an important aspect of outdoor recreation in Ohio. Recreational aspects of property consistently rank high as a reason for owning forest land. According to the 2008 Statewide Comprehensive Outdoor Recreation Plan (SCORP), there were 7,561 recreational sites (public and private) inventoried in the state (ODNR 2008). Of these 5,880 were able to be located on a map. Of these mapped locations 3,638 (62%) have a forest based recreational component. A site was considered to have a forest based recreational component if the mapped location was within a quarter mile (1,320 feet) of a forest patch that was at least five acres in size. Ohio continues to rank

low nationally for per capita outdoor recreation acreage. Only 5.7 percent of the state's total acreage is designated for outdoor recreation (ODNR 2008).

Participation in outdoor recreation

The 2008 SCORP does not give an actual number of user days of outdoor recreation experiences but uses the number of times that households participated in a given outdoor recreational activity and the percentage of households that participated. As indicated in Table 6g, outdoor activities for which forests provide a context are popular. Activities such as wildlife observation, trail use, and picnicking are assumed here to have at least a significant forest base to them.

Table 6g - Statewide Participation in Outdoor Recreation Categories. Data Source: 2008 Ohio SCORP (ODNR 2008). Table shows the average number of times that households participated in each outdoor recreation category and the percentage of households reporting participation.

Activity (Categories)	Mean	% of Households
Wildlife observation or photography in PUBLIC area	31.7	61.1
Trail activities	29.8	68.2
Field and court sports	19.6	45.7
Other outdoor recreation activities	17.0	70.8
Outdoor swimming and beach	10.9	55.1
Golf	10.7	45.8
Playground	8.0	52.9
Bicycling for transportation	4.8	15.5
Picnicking	4.3	59.7
Fishing	3.4	26.4
Boating	3.4	31.3
Camping	1.9	34.6
Winter sports	2.5	33.1
Hunting	1.8	9.9
Motorized trail activities on PRIVATE lands	1.8	7.5
Shooting sports	1.4	9.2
Motorized trail activities on PUBLIC lands	0.2	2.9

Several trends are noted in the 2008 SCORP germane to this forest resource assessment. Niche recreation, such as orienteering, geo-caching, and ATV riding seem to be increasing. It is also noted that many Ohioans increasingly enjoy quiet, nature-based activities such as hiking, wildlife observation and photography, mountain biking, kayaking and camping; yet many open areas around Ohio's cities continue to experience ever broadening development sprawl. Also, hiking, walking and jogging on Ohio trails is a major source of recreation for Ohioans and is expected to increase (ODNR 2008).

Federal land open to recreation

There are four main federal entities that own and manage properties in Ohio: the Forest Service, Department of Defense, Fish and Wildlife Service and the National Park Service. In the aggregate, these areas account for approximately 375,000 acres.

The Department of Defense, through the Army Corp of Engineers, manages 23 areas for the purposes of flood control; these areas are typically open water or an associated area to handle the flood pool level for the reservoirs. The Army Corp of Engineers properties are typically open for recreation; while not directly forest based recreation forests typically provide a backdrop for the

water based recreation. The Department of Defense also manages three major military installations: Wright-Patterson Air Force Base, the Ravenna Arsenal, and the Defense Construction Supply Center. While Wright-Patterson AFB and the Ravenna Arsenal in particular contain forest land, these lands are not typically open for recreation. As such, Department of Defense lands are not considered for the purposes of this analysis.

The U.S. Fish and Wildlife Service maintains three areas in Ohio: West Sister Island National Wildlife Refuge, the Cedar Point National Wildlife Refuge and the Ottawa National Wildlife Refuge. These areas have some forest cover but are primarily water and marsh and, while open to recreation and providing a great deal of recreational value, do not provide forest based recreation. Therefore, these areas are not considered for the purposes of this analysis.

The U.S. National Park Service maintains two areas in Ohio: the Hopewell Culture National Historical Park and the Cuyahoga Valley National Park. These areas, to a varying degree, contain forest land. The Cuyahoga Valley National Park contains a large amount of forest. The U.S. Forest Service manages the Wayne National Forest in Ohio. This forest contains over 244,000 acres, all of which is open to some form of recreation. Of the approximate 375,000 acres of federal land in Ohio, 264,000 acres are open for forest based recreational activities.

Both the U.S. Forest Service and National Park Service buy lands as budgets and lands become available within their areas of interest. Neither can be considered to be in a rapid expansion phase. The Wayne National Forest in the recent past has had local resistance to expansion for fear of the impacts on local economies when lands are removed from the local tax base. In some cases, organizations have purchased lands for ultimate transfer to the U.S. Forest Service until federal funds come available for acquisition by the Wayne National Forest.

Recreational facilities on State land

The 2008 Ohio SCORP notes that there is, "A decline in participation in outdoor recreation, especially by American youth … all across the country" (ODNR 2008). This trend, combined with reduced budgets, does not suggest a long-term trend towards facility expansion. However, it is unclear as of yet what the impacts will be as Ohioans recreate closer to home due to a rise in energy prices and state, federal and global economies. Table 6h lists facilities on State land.

Table 6h - Recreational Facilities on State Land. Data Source: 2008 Ohio SCORP (ODNR 2008).

Facility type	Measure	Unit	Comment
Campgrounds	73	Areas	Includes 9,436 sites
Shooting Sports	40	Site	
Picnic	198	Areas	Includes 179 shelters, 19 enclosed shelters and 19,506 Picnic Tables.
Swimming	57	Site	
Watercraft Launch	97	Site	
Interpretive/Observation	37	Site	Includes only Nature Centers
All Trail	1,515	Miles	Includes categories below plus "other".
Motorized Trail	48	Miles	
Bridle Trail	874	Miles	
Mountain Bike	271	Miles	
Hiking	1,066	Miles	

Trails

Trail based recreation is a significant source of recreation in Ohio. There is no one comprehensive inventory of trails located on all facilities in Ohio but according to the 2008 Ohio SCORP, trail based recreation is noted as having the second highest mean number of participations and the second highest percentage of household participations (Table 6f; ODNR 2008). The measure reported here will focus on trails that transcend a single property and connect multiple properties, population centers and even other states. This is not to ignore the impact of trails that occur on single properties, as these contribute heavily to the recreational experiences of Ohioans; these trails will be included in the recreational facilities located on state and federal properties. There are 2 national trails that cross Ohio: the North Country Trail and the American Discovery Trail. There are 2 statewide trails that cross or circumnavigate the state in the Ohio to Erie Trail and the Buckeye Trail respectively. There are 63 county trails and 33 community trails that also serve the recreating public. Figure 6n shows the location of recreation trails in Ohio outside of public lands (e.g., state forest, national forest).

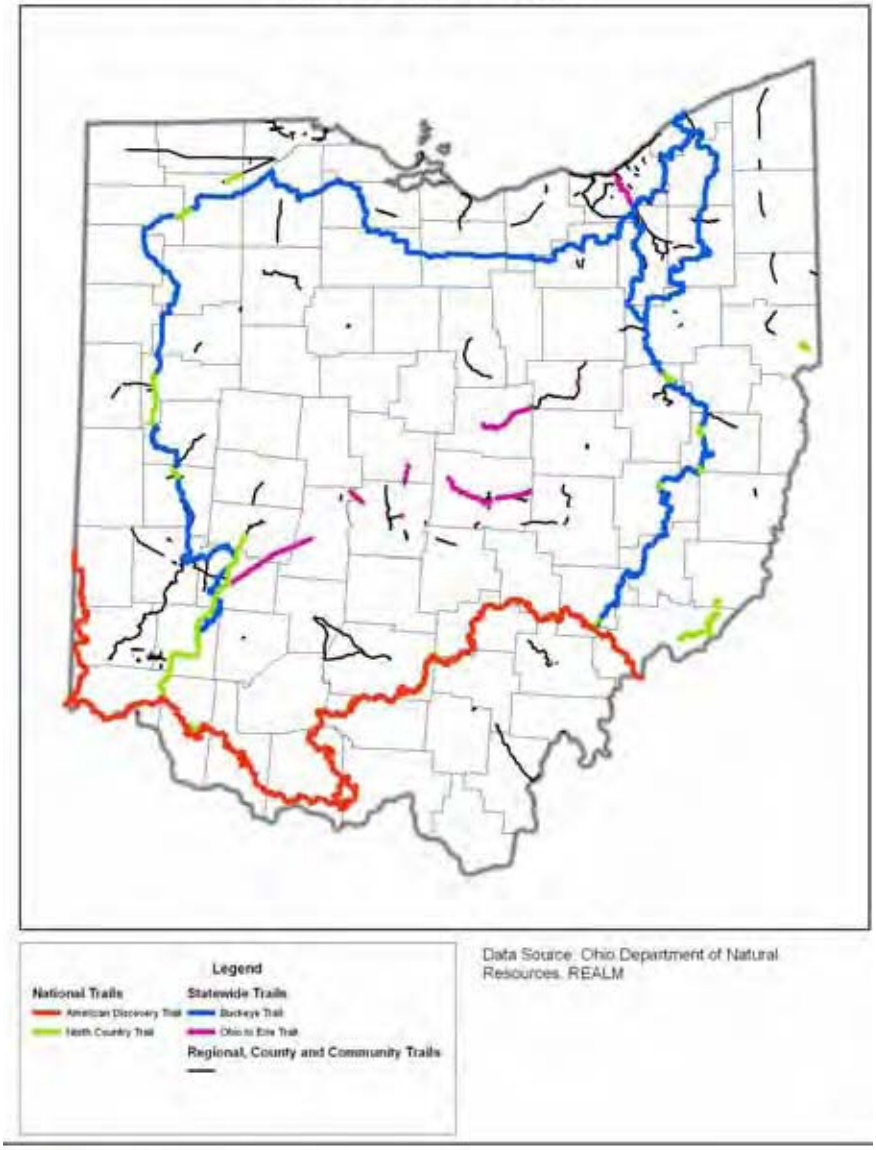


Figure 6n – Map of Ohio's recreational trails. Data source: Ohio Dept. of Natural Resources.

Interest in trails has been growing across the State by both the citizens and the state legislature. This interest resulted in the development of a strategic plan in 2005 called "Trails for Ohioans – A Plan for the Future." Two strategic areas are noted in this plan that will represent action trends: 1) Connecting Trails – to address the finding that many existing trails are discontinuous and not connected or easily accessible; and 2) Private Land and Trails – to address opportunities for trails on private lands or adjacent to private lands have not been maximized because of concerns about liability, privacy, litter, vandalism, theft and other real and/or perceived problems (ODNR 2005).

Campgrounds

According to the 2008 Ohio SCORP, over one-third of Ohio households reported participation in the activity of camping (ODNR 2008). According to the inventory done in support of the 2008 Ohio SCORP, there were 688 campgrounds reported in Ohio with a total of 43,375 sites. These sites were distributed among the following categories, off-highway vehicles, no services, electric only, full service, back-pack, and horse camps.

Recreational facilities in national forests

Numerous recreational facilities are available on the Wayne National Forest in Ohio. The Wayne National Forest is comprised of 244,000 acres, all of which is open for some form of recreation. There are, however, a number of facilities constructed or specifically designated for recreational purposes. Those facilities are enumerated in Table 6i.

Table 6i - Recreational facilities on the Wayne National Forest. Data Source: USDA Forest Service, Wayne National Forest.

Facility type	Measure	Unit	Comment
Campgrounds	11	Areas	250 sites
Picnic	7	Areas	8 shelters
Swimming	1	Site	
Watercraft Launch	7	Site	
Interpretive/Observation	5	Site	
Motorized Trail	121	Miles	
Bridle Trail	79	Miles	
Mountain Bike	88	Miles	Exclusive of ATVs
Hiking	68	Miles	Exclusive of other uses

Indicator 14 - Investments in forest health, management, research, and wood processing.

Significant investments occur in the areas of forest health, management, research, and wood processing in Ohio. Some of the major organizations that are investing in Ohio's forest resources and their management include the USDA Forest Service (Wayne National Forest, State & Private Forestry, and Northern Research Station), the USDA Natural Resources Conservation Service, the US Fish & Wildlife Service, the Ohio Department of Natural Resources (Divisions of Forestry, Wildlife, Soil and Water), the Ohio Environmental Protection Agency, the Ohio Department of Agriculture, the Ohio State University Extension, The Nature Conservancy, the Ohio Forestry Association, Glatfelter, and American Electric Power. Numerous colleges and universities have faculty who are conducting research in Ohio, including the Ohio State University, Ohio University, University of Dayton, and the University of Cincinnati. Descriptions of two federal agencies with significant investments in Ohio's forests follow. The Ohio Division of Forestry also invests significant resources through its various program areas; details about those programs can be found in the Statewide Strategy document.

USDA Forest Service Research funding

The Northern Research Station of the USDA Forest Service has a research laboratory in Delaware, Ohio. While significant research from the Delaware Laboratory is conducted in Ohio, the research is not exclusive to Ohio. Four Research Work Units of the USDA Forest Service have researchers stationed at the Delaware Laboratory. Current work units located in Delaware include: NRS-1 "Ecological and Economic Sustainability of the Appalachian Forest in an Era of Globalization", NRS-2 "Sustaining Forests in a Changing Environment", NRS-4 "Genetics, Biological Control, and Management of Invasive Species" and NRS-12 "Northern Science, Technology, and Applied Results Program (NorthSTAR)." USDA Forest Service researchers receive funding from a variety of sources, including grants from the National Fire Plan (http://www.forestsandrangelands.gov/overview/index.shtml) and the Joint Fire Science program (http://www.firescience.gov/).

USDA Natural Resources Conservation Service

The USDA Natural Resources Conservation Service (NRCS) administers multiple programs that invest in forest and wildlife management in Ohio. Several NRCS programs fund tree plantings on private property including the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP), and the Wildlife Habitat Incentives Program (WHIP). The control of exotic invasive species can also be funded through WHIP. One program that focuses on various forest management practices and encourages such management through landowner incentives is the Environmental Quality Incentives Program (EQIP). Through Forestry EQIP, forest landowners receive incentive payments to complete practices like tree plantings, invasive plant control, grapevine control, crop tree release thinning, and forest management plan development (a new practice in 2010). Figure 6o shows the recent trend for Forestry EQIP funding in Ohio. Starting in 2009, a special forestry EQIP program was established that emphasizes the control of invasive plant species in a 22-county area in southern Ohio over a 3-year period.

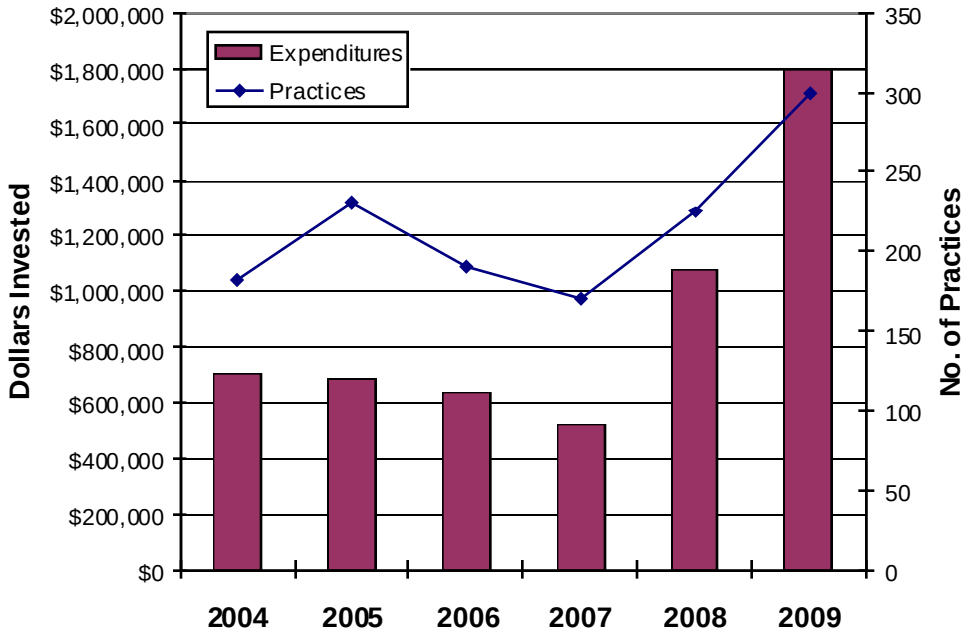
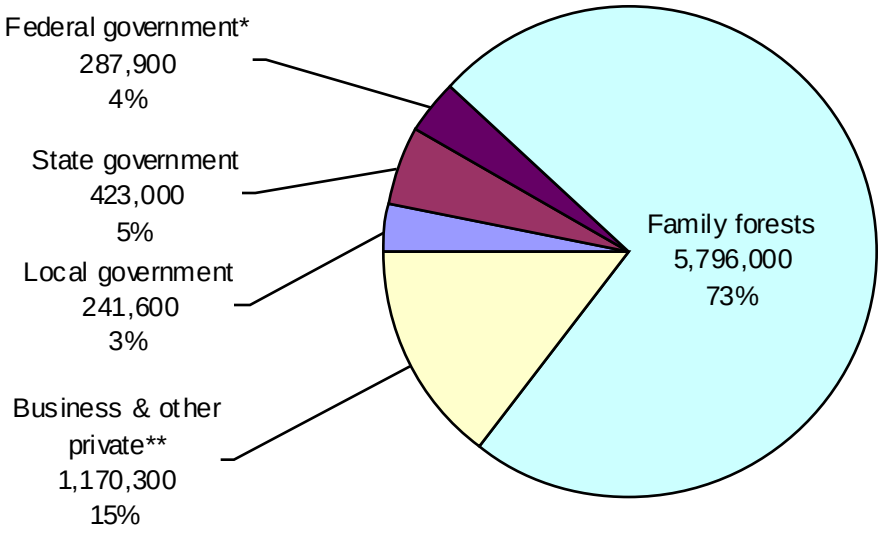


Figure 6o – Annual investment in dollars and number of forestry practices through the Environmental Quality Incentive Program (EQIP) administered by the USDA NRCS.

Indicator 15 – Forest ownership, land use, and specially designated areas.

Forest land ownership

The largest ownership group of forest land in Ohio is the family forest group, which own 73 % of the State's forests. Family forests are non-industrial private forests that are held by family groups. Other private landowners like forest industry, non-governmental organizations, clubs, and corporations hold another 15 % of Ohio's forests, for a total of 88 % of forest land under private ownership. Governments hold the remaining 12 % of forests in the state, as shown in Figure 6p. The USDA Forest Service publication *Ohio Forests: 2006* (Widmann et al. 2009) provides a good overview of the woodland owner survey results on topics like their ownership goals, sources of technical advice, and attitudes towards various forest management topics (like timber harvesting). Some key findings of those surveys are that 60% of family forest acres harvest forest products, 8% of family forest acres have written forest management plans, and 21% of family forest acres have sought management advice (Widmann et al. 2009).



* Includes 227,800 acres in the Wayne National Forest

** Includes corporations, non-family partnerships, tribal lands, non-governmental organizations, clubs, and other non-family groups.

Figure 6p – Ownership of forest land by ownership category, 2006. From *Ohio Forests: 2006* (Widman et al. 2009).

State lands

The State of Ohio owns 423,000 forested acres, or 5 % of forest land in Ohio. Table 6j shows the distribution of forest land managed by each division of the Ohio Department of Natural Resources, which is the state agency that manages the majority of Ohio's state-owned forest land.

Table 6j – State-owned forest land under management by the Ohio Department of Natural Resources (Ohio DNR) by managing Division. Data source: Ohio Department of Natural Resources.

Ohio DNR Division	Acres of Forest Land
Ohio DNR Division of Forestry	191,146
Ohio DNR Division of Wildlife	110,684
Ohio DNR Division of Parks & Recreation	68,093
Ohio DNR Division of Watercraft, Scenic River Lands	361
TOTAL Owned by Ohio DNR	**370,284**

Protected land

The ODNR protected lands database provides the best available data on protected natural areas in the state. To identify protected forest land in Ohio, the ODNR protected lands database was overlaid with the NLCD 2001 forest cover data (for map, see Figure 4c on page 67); the resulting forest area totaled approximately 806,600 acres. The protected lands database includes all ODNR lands (e.g., state forests, parks, wildlife areas, nature preserves), Wayne National Forest, National Park Service lands (e.g., Cuyahoga NP), The Nature Conservancy lands, watershed conservancy

districts, metroparks, and other community forests. While this database covers most lands in the State protected through ownership by natural resource agencies or organizations, some lands, like private lands under conservation easements, are not included.

Private forest land under conservation easements

Comprehensive statewide data have not been compiled on private forest lands in Ohio under conservation easements. The future development of such a dataset would be useful for monitoring and planning. Land trusts hold the majority of forest land conservation easements. The State of Ohio holds a large conservation easement on 12,649 acres of the Raccoon Ecological Management Area in Vinton County and another easement on 436 acres in Muskingum County (see Legacy program description that follows).

Ohio's Forest Legacy Program

The Ohio Forest Legacy Program, administered by the Ohio Division of Forestry, is a federally funded forest land protection program that supports the purchase of conservation easements. To date, the Ohio Division of Forestry has closed only one conservation easement in Ohio that utilized funding through the Forest Legacy Program, a 436-acre property in Muskingum County. As the state lead agency, the Ohio Division of Forestry has concluded that Ohio's Forest Legacy Program (FLP) will be continue to be implemented according to the current Assessment of Need (AON) approved on August 5, 2005, which is hereby incorporated into this document by reference. A copy of the State Lead Agency designation letter, the AON, and the AON approval letter can be found online at: http://ohiodnr.com/Forestry/tabid/5293/Default.aspx . After the completion of this statewide forest assessment document, the Division of Forestry, in consultation with the State Forest Stewardship Coordinating Committee and the USDA Forest Service, will evaluate a potential update to the Forest Legacy Areas. The current AON provides more details about Ohio's Forest Legacy Program. Ohio's Forest Resource Assessment (2010) provides updated data on forest conditions and trends that were reported in the AON. However, no major changes in trends and threats were identified in this assessment that would warrant an update or change to the state's FLP.

Forest land in tax reduction programs

Ohio has two real estate tax reduction programs that are available for forested property: The Ohio Forest Tax Law (OFTL) and the Current Agricultural Use Value (CAUV) programs. Forest landowners must choose between the two programs, as only one tax reduction program can be used on a given parcel of land. The Current Agricultural Use Value program (Ohio Revised Code Sections 5613.30-38) provides reduced real estate tax values based on the production capacity of the soil. The Ohio Forest Tax Law (Ohio Revised Code Sections 5713.22-26) provides a 50 percent real estate tax reduction on forest land that is managed for the purpose of timber production. The Ohio Division of Forestry administers the OFTL program and county auditors administer the CAUV program. Since its establishment in 1925, the Ohio Forest Tax Law program has gone through several changes, with a major change in 1993 when the requirement of following management recommendations and 5-year inspections were added. OFTL cases from 1925 to 1993 are generally referred to as "old law" cases, and those from 1993 to present are called "new law" cases. See the OFTL document in the Appendix for more details of the changes to the OFTL program from 1925 to present. Table 6k shows the number of cases and acres in the OFTL program. Counties in the northeast and southeast regions of the State have the majority of forest land in OFTL, with the top five counties (in terms of acres enrolled) being Ashtabula, Vinton,

Geauga, Hocking, and Athens (Figure 6q). Under the "new law" OFTL program, the annual average gain in active acres has been 3723 acres (averaged from July 1993 to October 2009). Data for the CAUV program are not available, but in general, a significantly higher number of Ohio's private forestlands are enrolled in CAUV than in OFTL, as CAUV provides a much higher tax reduction.

Table 6k – Number of active cases and acres enrolled in the Ohio Forest Tax Law program by version of the program (old law and new law). The data shown are current through October, 2009.

OFTL Version	No. of Active Cases	No. of Acres
Old law – pre-July 1993	2,977	116,902
New law – July 1993 to present	1,475	60,681
TOTAL (Old and New)	4,452	177,583

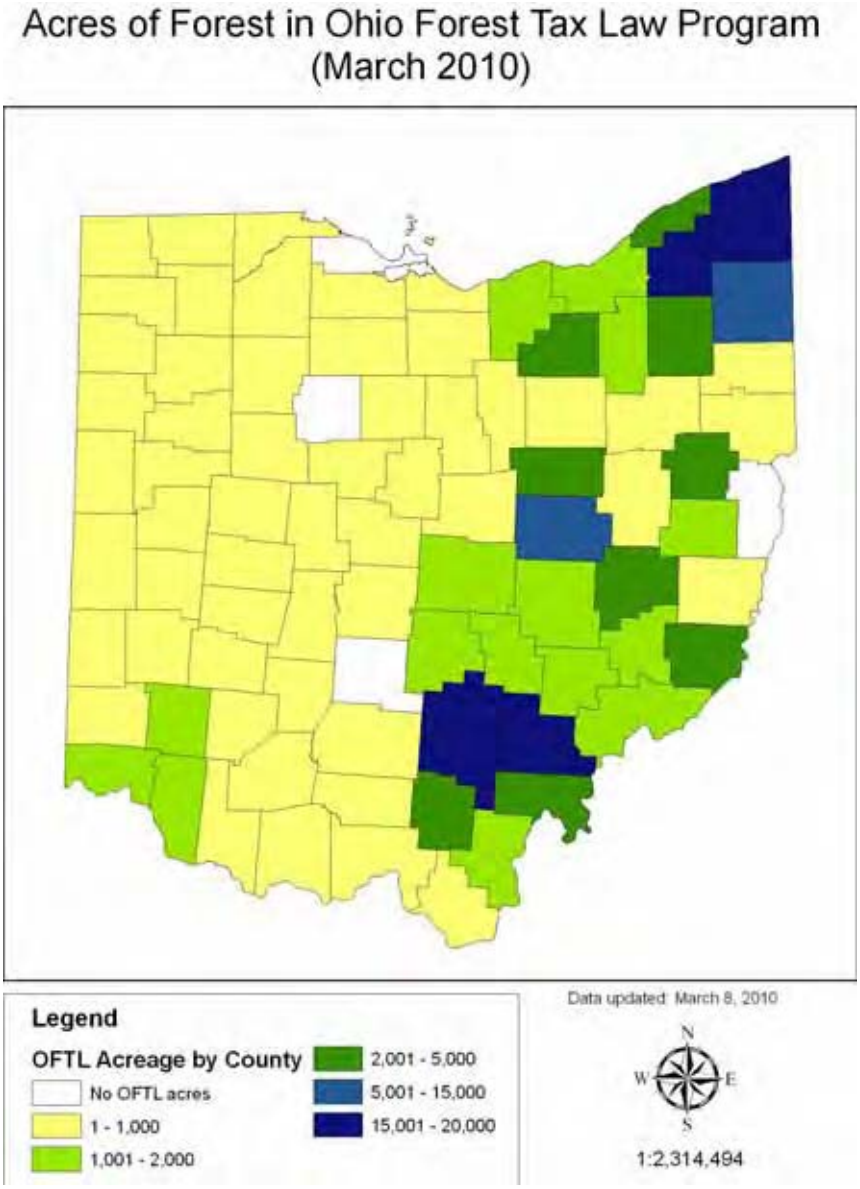


Figure 6q – Acres of forest land actively enrolled in the Ohio Forest Tax Law program by County. Map represents OFTL acreage as of March 8, 2010.

Forest certification

Forest certification systems utilize independent, third-party monitoring and verification to assure compliance with established sustainability standards for forest management. Table 6l summarizes the major certification systems in the United States. North America has experienced significant growth in forest certification over the last five years. This growth has been fueled in large part by increased interest and demand for environmentally friendly paper products and the green building movement. The Forest Stewardship Council (FSC) saw the number of paper-related certificates in the U.S. rise from 3 in January 2003 to 1459 in January 2009. During that same period, the number of FSC certificates related to the green building industry in the U.S. increased from 220 to 987 (FSC-US 2009). Figure 6r shows the annual growth in total FSC chain of custody certificates in the U.S. Government initiatives and programs commonly reference the U.S. Green Building Council's LEED building certification system. Since the LEED system currently only recognizes FSC for certified forest products, much of the green building demand is focused on FSC. However, the Sustainable Forestry Initiative (SFI) has also seen a rapid increase in certificates over the past several years, primarily related to paper products. For example, the number of SFI chain of custody certificates in North America increased from 171 to 527 during a one-year period from March 2008 to March 2009. Ohio has not been left out of these growing markets. The number of Ohio companies holding SFI certificates went from 2 in December 2006 to 24 in March 2009 (Figure 6s); these 24 companies are either printers or manufacturers of paper products. FSC is also prominent in Ohio, with a recent query resulting in 94 Ohio companies with FSC certificates, including a mix of printers, paper manufacturers, and primary and secondary wood products companies (many of which likely supply the green building market).

Table 6l – General overview of forest certification systems in the United States. The three systems that are described are: Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), and Forest Stewardship Council (FSC).

	SFI	ATFS	FSC
Date established	1994	1941	1993
Scope	All forests in North America	Non-industrial private forests in the United States	All forests; worldwide
Certificate length	5 years	5 years	5 years
Monitoring	Annual surveillance audit	Annual surveillance audit	Annual surveillance audit
Product labeling	Yes	No; eligible for SFI or PEFC label	Yes
Group certificate	No	Yes	Yes
LEED recognized	No	No	Yes
No. Ohio companies or individuals with forest management certificates	0	1,612	1
Acres of certified forest land in Ohio	0	290,683	15,549
No. of Ohio companies with chain of custody certificates	22	22 (SFI CoC)	94

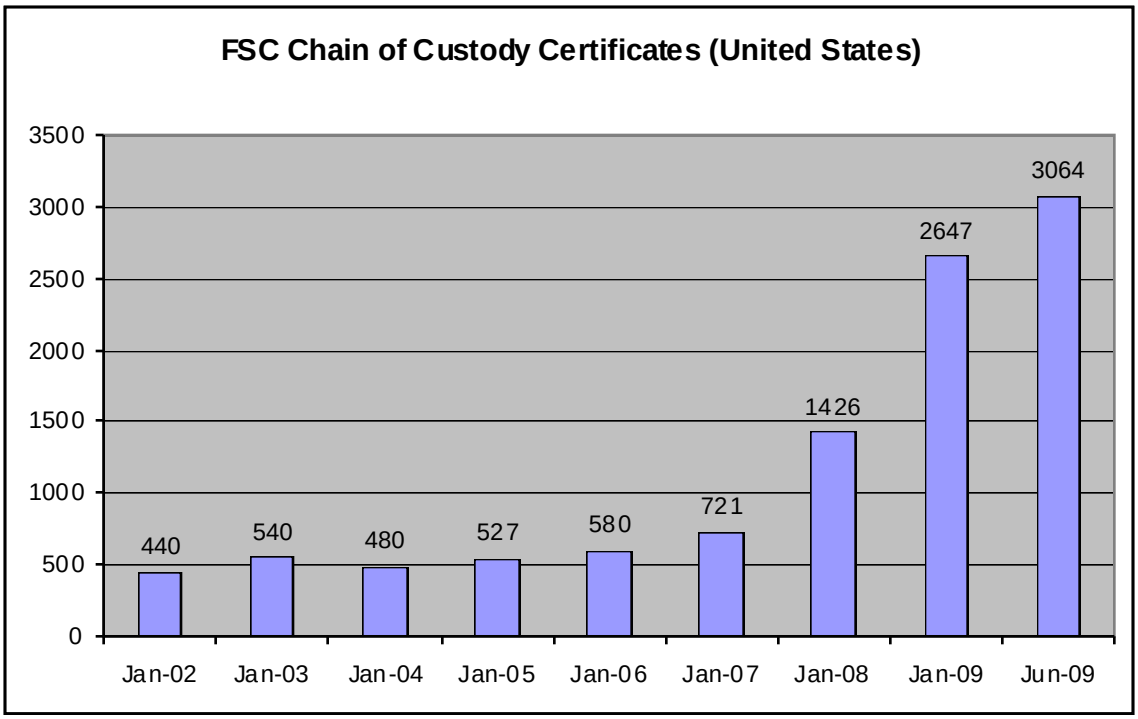


Figure 6r. FSC Chain of Custody certificates in the U.S. from January 2002 through June 2009. Source: http://www.fscus.org/.

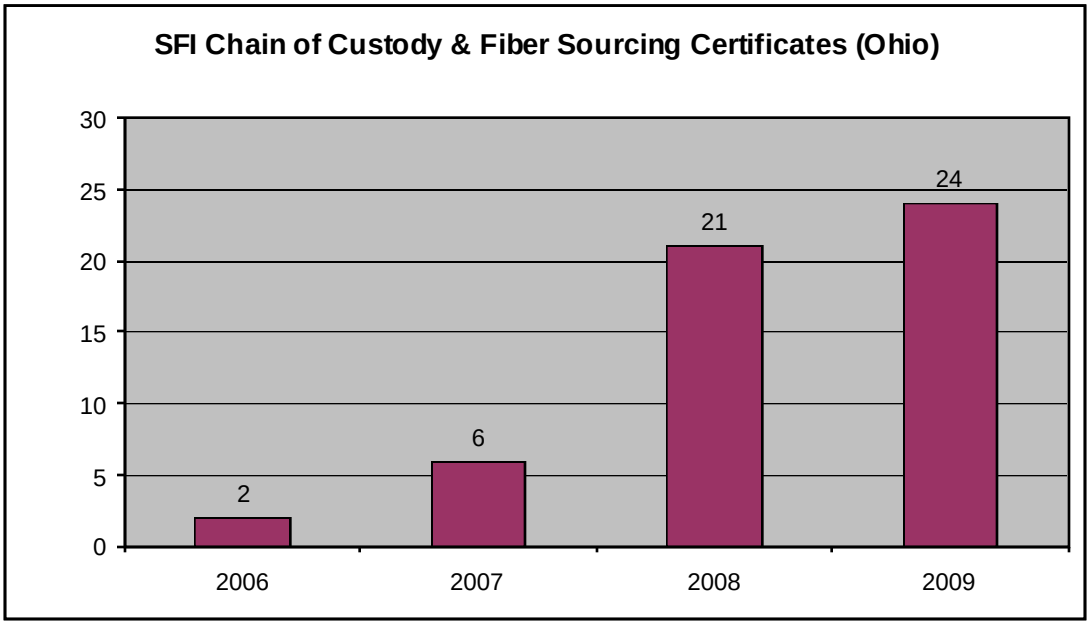


Figure 6s. Increase in SFI Chain of Custody (CoC) and Fiber Sourcing certificates in Ohio from 2006 to 2009 (through March 2009). The data shown are based on certification dates of active Ohio certificates listed on the SFI website (http://www.sfiprogram.org).

Current Certification Efforts in Ohio

Currently, the Ohio Division of Forestry is seeking dual certification of its State Forests under FSC and SFI. The pre-audit/scoping was completed in January 2010, and the main audit should be completed later this year (2010). If successful, all 20 state forests, totaling over 190,000 acres, will be third-party certified by the end of 2010. In 2009, the Ohio Division of Forestry also conducted a feasibility study of implementing a private lands forest certification program in Ohio. The report from that study outlines several viable options for certification of private forest lands in Ohio, including a group certificate of the Division's Ohio Forest Tax Law program. However, currently no private lands certification program has been initiated.

Indicator 16 – Employment and wages in forest-related sectors.

The last decade started off with general economic prosperity in the United States, and ended with a major recession that impacted most people and business in the country, and world, including forest-related sectors. Some of the key triggers of the recession were associated with the housing sector, which has direct links to forest-related sectors based on the construction materials that forests and forest products industry supply. However, within the various forest-related fields, the impact of the recession on employment and wages has varied.

Wood-related products manufacturing

From 2001 to 2008, employment in all wood products manufacturing sectors experienced an overall decline (Table 6m). While the logging sector showed some growth in employment in the first half of the decade, the net change from 2001 to 2008 of both logging and primary wood products manufacturing was over a 33% loss of the employees. Employment losses related to furniture production were still significant, but they netted less of a loss at 21% (Table 6m). Data on wages and number of establishments show a very similar trend to employment, with a consistent decline from 2001 to 2008, with furniture production faring the best (i.e., lowest decline) (Tables 6n and 6o).

Table 6m – Employment in wood products manufacturing by NAICS industrial classifications. NAICS 113 represents logging, NAICS 321 represents primary wood products manufacturing, and NAICS 337 represents furniture production. Data source: Bureau of Labor Statistics, U.S. Department of Labor.

Year	NAICS 113	NAICS 321	NAICS 337
	All Employees		
2001	617	21,180	25,262
2002	674	19,404	23,511
2003	663	18,864	22,804
2004	702	18,335	22,260
2005	634	16,940	21,999
2006	613	16,476	21,297
2007	469	15,730	21,097
2008	403	14,144	19,829

Table 6n – Wages in wood products manufacturing by NAICS industrial classifications. NAICS 113 represents logging, NAICS 321 represents primary wood products manufacturing, and NAICS 337 represents furniture production. Data source: Bureau of Labor Statistics, U.S. Department of Labor.

Year	NAICS 113	NAICS 321	NAICS 337
	Total Wages (thousands $)		
2001	12,589	579,036	768,626
2002	13,110	557,062	747,500
2003	13,433	554,388	747,540
2004	15,347	554,354	759,317
2005	14,301	522,884	760,221
2006	14,412	531,022	746,227
2007	11,703	515,203	785,711
2008	9,993	461,762	744,893

Table 6o – Number of establishments in wood products manufacturing by NAICS industrial classifications. NAICS 113 represents logging, NAICS 321 represents primary wood products manufacturing, and NAICS 337 represents furniture production. Data source: Bureau of Labor Statistics, U.S. Department of Labor.

Year	NAICS 113	NAICS 321	NAICS 337
	No. of Establishments		
2001	147	749	915
2002	143	719	900
2003	142	733	876
2004	129	707	850
2005	126	703	852
2006	118	697	818
2007	108	702	803
2008	94	688	778

Criterion 7 – Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management.

Indicator 17 – Forest management standards/guidelines.

Forest management standards and guidelines are typically composed of scientifically proven silvicultural means to accomplish desirable ends, assembled into policy or recommendations as forest management standards or guidelines. Forest management decisions by their nature have long-term consequences. Management decisions made today can impact the forest for decades. One should note that what is considered to be an acceptable, even beneficial, practice today can be found to be detrimental decades from now. The goal of forest management standards and guidelines is to place some sideboards on the range of potential forest management decisions; discouraging or prohibiting those practices currently believed to be detrimental and encouraging those currently believed to be beneficial. Such standards can be important in the management of natural resources where there are intricate interdependencies among various natural resources.

Types of forest management standards/guidelines

There are a number of forest management standards and guidelines. Where they apply depends on the framework within which they were developed and adopted. Ohio is home-rule State with each jurisdiction/political subdivision having the ability to, within limits, adopt regulations that could include forest management standards or guidelines. There is no comprehensive listing of these regulations. The list below is what is known at this time.

- State forest management manual
- Ohio Forest Tax Law (OFTL)
- American Tree Farm System (ATFS)
- BMPs for Erosion Control for Logging Practices in Ohio
- Sustainable Forestry Initiative (SFI)
- Forest Stewardship Council (FSC)
- Program for Endorsement of Forest Certification (PEFC)
- USDA Forest Stewardship Program

Each of these standards/guidelines is continually evolving. There is increasing interest and application towards the third party certification schemes (SFI, FSC, ATFS, PEFC). There is also increasing interest by local governments (County and Township) of developing zoning ordinances/resolutions to apply some level of standard to forest management.

Voluntary and mandatory standards/guidelines

Most of the forest management standards and guidelines for privately owned/family forests are ultimately voluntary. The programs for family forests listed in the preceding paragraph (which excludes the state forest management manual and the governed state forest lands) are all voluntary in nature. In each of these programs, a landowner voluntarily enrolls and simultaneously agrees to manage to the standards of the program. The landowners can also voluntarily remove their properties from the programs with little or no penalty to the individual landowner.

Monitoring of standards/guidelines

Each of the programs mentioned previously requires some monitoring of standards and guidelines. State forest management requires routine monitoring. The Ohio Forest Tax Law requires that properties be monitored at least every five years for compliance with management plans. The three principle forest certification programs, SFI, ATFS and FSC, require periodic audits for conformance to management standards. Forestry Best Management Practices (BMPs) are voluntary in Ohio, but some monitoring of BMP compliance occurs periodically. For example, members of Ohio's Master Logger program (administered by the Ohio Forestry Association) must permit Logging Standards Council inspectors to review all aspects of their logging operations, including BMP compliance. The USDA Forest Stewardship Program has also recently required plan monitoring on a random basis for adherence to program guidelines.

Indicator 18 – Forest-related planning, assessment, policy, and law.

Since the 1940s, periodic assessments of Ohio's forest resources have occurred through the USDA Forest Service's FIA Unit, with the most recent FIA report evaluated Ohio's forests through 2006. Beyond the scope of the FIA reports, Ohio's last statewide evaluation of forest resources was the 1983 "Ohio Forest Resource Plan," which is summarized in the Appendix. This document represents the first comprehensive, statewide assessment of Ohio's forest resources using the criteria and indicator approach. This assessment has a life expectancy of 5 years, and it will be reviewed and updated at the end of that time period, in conjunction with the accompanying Statewide Strategy document.

State forest planning.

Ohio's State Forests are managed by the Ohio Division of Forestry. The Division of Forestry has detailed descriptions of policies, laws, and guidelines relevant to core state forest management programs in a series of manuals. The Land Management Manual was updated in 2009 and the Law Enforcement Manual was updated in 2008. Each State Forest also has its own plan.

State Forest Management Plans are written plans that explain the work expectations for a five-year period. The plans are guided by the principles set forth in the strategic plan and responsibilities delegated to the Division of Forestry in the Ohio Revised and Administrative Codes. Annual work plans give more detailed work assignments for a given fiscal year. Individual forest managers are responsible for developing these plans with assistance from district and central support staff. They shall be presented to the public at the first available opportunity, typically at the annual open house.

Forest Management Plans

The Forest Management Plan will heavily reference principles set forth in the strategic plan to set the priorities for the five-year period. The purpose of the Forest management plan is to set forth the individual unit's goals that will guide the development of specific projects. Forest Management Plans shall explain in detail an individual State Forest's: history, description in terms of specific features and landscape level importance, general management objectives at the forest level, give more specific information about the land management, fire management, law enforcement, recreation, and operations programs. These plans may be as specific as necessary but do not need to state work at a project level. Forest Management Plans will also incorporate inventory and Growth and Yield data and calculations in order to determine sustainable harvest levels.

Annual Work Plans
The annual work plan should be written primarily from information contained in the forest management plan. Program areas detailed include resource management, recreation, law enforcement, maintenance, wildland fire, employee development, public outreach, and budgets. These plans are more specific and task oriented than are the forest management plans. The plans are intended to be used both internally to set work priorities and personnel goals. The annual work plans should list specific projects, i.e. cruising compartment A-1, marking a 25-acre shelterwood harvest in compartment G-3, presenting fire prevention messages in 3 parades, rerouting 3 miles of the XYZ trail, etc.

Program Integration
Integration across program areas is important to effectively manage the entire forest system and ensure consistency across unit boundaries. An integration team composed of the Chief, Assistant Chief, State Forest Operations, Northern District Manager, Southern District Manager, Land Management Administrator, Fire Administrator, and Law/Recreation Administrator. The integration team meets on an "as-needed" basis to review plans and other projects. The integration team will review forest management plans and annual work plans prior to public release, review the Shawnee Wilderness Area plan update every 10 years, and review public comments from open houses. They will review any expanded recreation proposals recommended at the forest level. They will also review other projects as needed, particularly when they cross unit boundaries and program areas.

Non-industrial private forest planning
The State Forest Stewardship Coordinating Committee is an important advisory group for state-level planning related to non-industrial private forest lands (i.e., family forests). The committee includes representatives from key agencies and organizations across the State with forestry-related interests. Currently, the forest stewardship committee includes representatives from the following groups: the Ohio Division of Forestry, Ohio Division of Wildlife, Ohio EPA, USDA Forest Service State & Private Forestry, USDA Forest Service Wayne National Forest, the Ohio State University, the Ohio Forestry Association, The Nature Conservancy, the Sierra Club, the USDA NRCS and FSA, the Ohio Association of Soil & Water Conservation Districts, the Ohio Tree Farm Committee, Glatfelter, American Electric Power, Redoutey Logging, Dale W. Riddle Forest Products, and the Appalachian Ohio Alliance. Some of the key statewide programs that provide family forest owners with support or guidance include the Forest Stewardship Program, the Forest Legacy Program (discussed in more detail below), the American Tree Farm System, Ohio Forest Tax Law, Ohio Woodland Stewards, U.S. Fish & Wildlife Service's Private Lands program, and several USDA cost-share or incentive programs (e.g., EQIP, WHIP). Some private forest landowner assistance programs are also available at a more localized scale, like some Soil & Water Conservation Districts' forestry and/or wildlife programs and Rural Action programs (http://www.ruralaction.org/). Private forest landowners also benefit from several programs that provide training and guidance to forest products industry and logging companies, like the Master Logger program and the soil and water conservation districts Timber Harvest Plan program.

Future planning for family forests in Ohio could also consider a myriad of other programs or planning tools. One example of a recent effort focused on sustainable forest management on private lands in the Sustaining Family Forest Initiative. They have developed technical resources and a website entitled Tools for Engaging Landowners Effectively (www.engaginglandowners.org/).

Ohio's Forest Legacy Program

The Ohio Forest Legacy Program will be implemented according Ohio's Forest Legacy Program (FLP) Assessment of Need (AON), which was approved by the Secretary of Agriculture on August 5, 2005. The AON includes the approved Eligibility Criteria for the Forest Legacy Areas (FLAs), the Approved FLAs, specific goals and objectives to be accomplished by the Ohio FLP and the process by which the Ohio Division of Forestry, the State Lead Agency, will evaluate and prioritize projects to be considered for inclusion in the FLP. A copy of the State Lead Agency designation letter, the AON, and the AON approval letter can be found on-line at: http://ohiodnr.com/Forestry/tabid/5293/Default.aspx .

National forest planning

Ohio's only national forest is the Wayne National Forest. In the United States, each national forest and grassland is governed by a management plan in accordance with the National Forest Management Act (NFMA). These plans set management, protection, and use goals and guidelines. Monitoring conditions on a Forest ensure projects are done in accordance with plan direction and determine effects that might require a change in management. The current plan for the Wayne National Forest went into effect in 2006, and it will guide natural resource activities on the forest for 10 to 15 years from its effective date. Additional information about forest planning for the Wayne National Forest, including copies of the 2006 Forest Plan and supporting documents, can be accessed online at the Wayne National Forest website (http://www.fs.fed.us/r9/wayne/) or by contacting their Headquarters office at 740-753-0101. A summary of related efforts follows.

Related Planning Efforts for the Wayne National Forest:

- Roads Analysis Process- January 10, 2003
- Social & Economic Assessment - January 2004
- Watershed Assessments - The Wayne NF has completed two watershed assessments. One for Pine Creek and one for the Little Muskingum River. Both assessments are available on a CD or in a hard copy format. Contact the Wayne National Forest Headquarters office to receive a copy in either format.
- Programmatic Biological Opinion from the U.S. Fish and Wildlife Service – Sept. 20, 2001
- Wayne National Forest Recreation Feasibility Report - February 27, 2003
- Wayne NF Five Year Facility Analysis and Program of Work - October 18, 2007

Forest laws and policies

Many laws at the federal and state level relate to forestry and broader natural resource management. Some of the major laws and legal policies that are relevant to forest management in Ohio are listed below with links to websites that provide more information. Ohio Revised Code (ORC) and Ohio Administrative Code (OAC) can be viewed online at: http://codes.ohio.gov/.

Laws that specifically impact management at the Wayne National Forest:

- Organic Administration Act (http://www.fs.fed.us/forestmanagement/aboutus/histperspective.shtml)
- Multiple-Use Sustained Yield Act (http://www.fs.fed.us/emc/nfma/includes/musya60.pdf)
- National Forest Management Act (http://www.fs.fed.us/emc/nfma/index.htm)
- Forest Service Directives (http://www.fs.fed.us/im/directives/)

Other forest-related laws relevant statewide:

- National Environmental Policy Act (http://www.epa.gov/compliance/nepa/)
- Endangered Species Act (http://www.fws.gov/endangered/)
- Clean Water Act (http://www.epa.gov/regulations/laws/cwa.html)
- Clean Air Act (http://www.epa.gov/air/caa/)
- ORC Title 15: Conservation of Natural Resources, including the following chapters:
    - ORC 1501 (Department of Natural Resources)
    - ORC 1503 (Division of Forestry)
    - ORC 1518 (Endangered species)
    - ORC 1519 (Recreational trails)
    - ORC 1531 (Division of Wildlife)
- ORC Title 29: Crimes – Procedure, including:
    - ORC 2909 (Arson and related offenses)
    - ORC 2935 (Arrest, citation, and disposition alternatives)
- OAC 1501:3 (Division of Forestry)
- Ohio's fire laws (http://ohiodnr.com/Portals/18/fire/pdf/OhioFireLaw.pdf)
- Ohio's agricultural pollution abatement program (http://www.dnr.state.oh.us/tabid/8856/Default.aspx)
- Ohio fence law – ORC 971 (http://aede.osu.edu/programs/AgLaw/docs/LineFenceFactSheetApril2009.pdf)
- Ohio drainage law (http://ohioline.osu.edu/b822/index.html)

State forest advisory committees

In addition to the advisory committees described elsewhere in this section, several other state advisory committees support forest planning and policy development in Ohio. The Ohio Revised Code (ORC) established the Forestry Advisory Council to advise the Chief of the Division of Forestry on forestry practices and programs in the state and to assist the Division in promoting cooperation on forestry practices and programs with other agencies, political subdivisions, and private interests (ORC 1503.40). The eight members of the council are appointed by the governor with the advice and consent of the senate, and they represent a diversity of interests, including forest research, private landowners, forest industry, recreation, and the public.

Other state committees that support planning in the state include the State Technical Committee (chaired by the USDA NRCS State Conservationist) and the Mid-Atlantic Interstate Forest Fire Protection Compact (ORC 1503.41). Another statewide committee that is currently being formed is the Ohio Prescribed Fire Council, with The Nature Conservancy leading the effort.

Urban forestry planning

Ohio's Urban Forestry Advisory Committee is a subcommittee of the legislative mandated Forestry Advisory Council of the Ohio Division of Forestry. Its purpose is to serve the urban residents of this state by furthering the objectives of the Urban Forestry Assistance Program. Committee members will advise on the current program and policies, recommend new directions and opportunities, provide feedback on administrative initiatives, help execute some activities and advocate the program's mission. The ten to fifteen member committee will represent a cross-section of user groups and allied urban forestry professions, create their own governing rules and serve under a three year staggered term format. Membership on the committee includes representatives

from the Ohio Department of Agriculture, Ohio Environmental Protection Agency, Ohio Department of Transportation, USDA Forest Service, city foresters, utilities, nursery/landscaping industry, educational institutions, townships, and municipal planning organizations.

Community wildfire protection plans

Community wildfire protection plans (CWPPs) are specific to the community for which they are prepared, but they generally address issues like wildfire response, hazard mitigation, and community preparedness. They are developed at the county or sub-county-level. In 2009, the Ohio Division of Forestry developed a statewide wildfire risk assessment map that identifies communities at risk. In developing CWPPs in Ohio, priority is given to areas that contain more communities at risk to fire. However, several counties with less elevated wildfire risk have developed CWPPs and incorporated them into their emergency management agency's emergency operations plans as hazard specific annexes to enhance response capability and awareness. The Ohio Division of Forestry partners with the county emergency management agency, all fire departments in the county, and the Wayne National Forest, if applicable, on CWPPs. The development of CWPPs is a cooperative procedure where the local perspective is critical to success, because a major component of them is proactive prevention and preparedness measures. Currently, thirteen Ohio communities have CWPPs in place, and another two communities are developing CWPPs. Figure 7a shows Ohio's CWPPs overlaid with communities at risk, as identified in the state wildfire risk assessment.

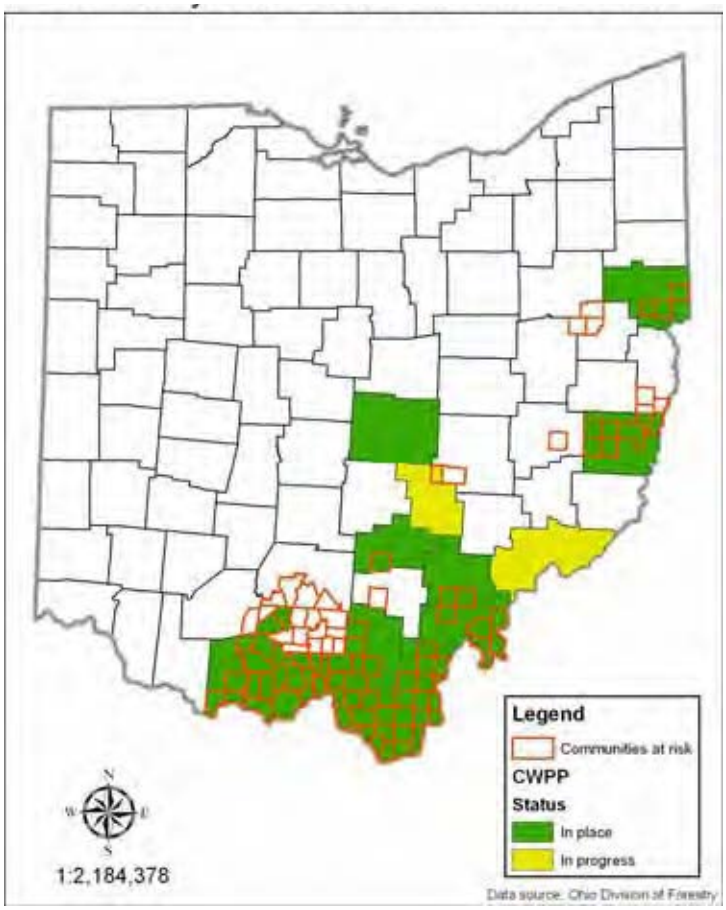


Figure 7a – Community wildfire protection plans (CWPPs) in Ohio (green and yellow areas) and communities identified to be at risk in the statewide wildfire risk assessment (areas outlined in orange). Data source: Ohio Division of Forestry.

Section 3 - Existing and Emerging Benefits and Services

Ohio's forests provide many ecological, economic, and social benefits and services. With 88% of the State's forests in private ownership, Ohio's citizens play an important role in providing these benefits and services. In terms of ecology, forests in Ohio are rich in biodiversity, providing habitat for 350 species of terrestrial wildlife (data source: Ohio Div. of Wildlife) and over 500 species of plants (USDA FIA data). In some forests, over 30 species of canopy trees can be found at one site. The ecological impact of Ohio's forests goes beyond terrestrial ecosystems. Forests play a critical role in maintaining quality aquatic habitat in waters of the State by filtering nutrients and other pollutants, reducing soil erosion, and maintaining cooler water temperatures through shade cover.

Forests also provide extensive economic benefits in Ohio. In 2007, Ohio ranked sixth nationally in GDP from manufacturing of furniture and related products (U.S. Dept. of Commerce). A 2006 study found that Ohio's forest products industry contributes $15.1 billion to Ohio's economy and employs over 119,000 people with annual payrolls of $4 billion (Letson et al. 2006). That total did not include additional inputs to Ohio's economy from wildlife (hunting, fishing, and wildlife watching), nature-based tourism, or non-timber products like maple syrup, Christmas trees, and herbal medicines (e.g., ginseng, goldenseal, black cohosh). Ohio consistently ranks in the top ten nationally for statewide production of these non-timber products.

Finally, Ohio's forests provide a suite of social benefits. They enhance our quality of life and personal health by improving air quality, providing clean drinking water, and sequestering carbon. Urban trees reduce energy costs (Heisler 1986), increase property values (Neely 1988), reduce stormwater runoff (USDA 2003), and have been shown to reduce crime (Kuo and Sullivan 2007). Forests also provide a wide range of leisure and recreational activities to Ohioans, including hiking, hunting, fishing, bird-watching, canoeing/kayaking, horseback riding, and all-terrain vehicle use.

Emerging Benefits and Service

In addition to the forest benefits and services described previously that Ohioans have enjoyed for years, there are some emerging forest benefits and services that are worth mentioning: forest certification and woody biomass for energy. Both of these present opportunities for expanding the services that forests provide in Ohio, but they also warrant further evaluation of the costs and benefits associated with their utilization, from economic, environmental, and social perspectives.

Forest Certification

The topic of third-party certification of sustainable forest management was discussed in detail under Indicator 15 (pages 102-104) of this report. With the demand for certified forest products on the rise and a corresponding increase in number of manufacturing businesses obtaining chain-of-custody certificates, the greatest need in this sector is an increase in certified forest lands. The benefits of forest certification are multi-fold. In terms of forest product manufacturing, certification opens the door to expanded markets. With the comprehensive standards for management that certification systems require, the certification of forest land in Ohio would also likely improve their management in various ecological, socioeconomic, and environmental areas. Forest certification is also an eligibility requirement for most carbon offset programs. The State of Ohio is currently addressing this need by pursuing dual certification of state forests under the SFI and FSC standards, and that is an important first step. However, to fully realize the potential benefits associated with forest certification in Ohio, future certification programs will need to include some of the 6.97

million acres of private forest land in the State. A 2009 private-lands certification study conducted by the Ohio Division of Forestry presented several viable options, including a group certification program under the existing Ohio Forest Tax Law program. Some non-governmental organizations, like the partnership between Rural Action and Mountain Association for Community Economic Development (MACED), are also promoting certification on private forest lands as part of carbon offset programs (see website: http://www.appalachiancarbonpartnership.org/).

Woody Biomass for Energy

Interest in bioenergy has increased significantly in recent years, in response to rising fuel costs, climate change concerns, increasing energy demands, and changes in government policies. The current use and potential future use of woody biomass for energy is described on pages 85-87 of this assessment. Economics and policy will be important drivers of future development of woody biomass energy in Ohio. While interests are high and planning for biomass-fueled power plants has begun, much remains to be done in terms of quantifying potential sources of biomass and ensuring their sustainable use. One current effort is the Mid-Ohio River Valley Woody Biomass Feedstock Zone project (MORWOOD), which is a collaborative effort of the Ohio Division of Forestry, West Virginia Division of Forestry, and the Appalachian Hardwood Center at West Virginia University. The MORWOOD project will develop estimates of woody biomass quantity and availability and organize the woody biomass supply chain to add confidence about the regional supply of large quantities of biomass for future bioenergy projects.

Section 4 - Issues, Threats and Opportunities

To facilitate the creation of this assessment, a steering group was created. This group created a draft list of issues and threats for Ohio's forests. The steering group was comprised of the following individuals.

David Lytle	ODNR-Division of Forestry (State Forester)
Mark Ervin	ODNR-Division of Forestry (Planner)
John Dorka	Ohio Forestry Association (Executive Director)
Mike Reynolds	ODNR-Division of Wildlife
Tom Berger	Natural Resource Conservation Service
Drew Todd	ODNR-Division of Forestry (Urban Forestry)
Andy Dickerson	The Nature Conservancy
Kathy Smith	The Ohio State University

The draft list of issues or threats developed by the steering group was as follows:

- Fragmentation as a result of development (forest trending towards smaller patches of forest interspersed with other land uses)
- Parcelization (forest patches trending towards being divided into ever smaller ownerships)
- Invasive species
- Oak (a change in forest composition trending away from oak forest types)
- Public opinion of forest management
- Public awareness of forest benefits
- Lack of adequate management
- Inadequate funding
- Ability to manage forests (due to political constraints and a loss of forest industry)

The draft issue and threat list was expanded based on discussions at several statewide advisory group meetings, including the Urban Forest Advisory Committee and the State Forest Stewardship Coordinating Committee. A draft list was then provided to a diverse group of stakeholders for their input. Stakeholder input was collected at five regional meetings across the State in December 2009 and January 2010, as well as from a stakeholder survey. Announcements requesting stakeholder input were made through a statewide news release and postcard mailing to known stakeholders. The stakeholder surveys were available online via a link on the ODNR Division of Forestry's website and as a paper version that could be completed and mailed to the ODNR Division of Forestry. A total of 793 stakeholder surveys were collected, and the regional stakeholder meetings had a total of 82 participants. The results from the stakeholder surveys and meetings were compiled and analyzed to produce a second draft list of issues, threats, and opportunities for Ohio's forests. The preliminary results from this assessment including the draft list of issues, threats, and opportunities were also presented to several key partners or groups, including the Ohio Division of Wildlife, the State Technical Committee, the USDA Forest Service, and the US Fish & Wildlife Service. See Appendix A for more details on stakeholder input. Comments from ODNR Division of Forestry staff were then incorporated to develop the final list. The final list of threats and the corresponding list of key issues to be used in the Statewide Forest Resource Strategy follow.

Key Threats to Ohio's Forests:

- Low incentives for private landowners to retain forests &/or manage them sustainably
- Inadequate funding for conservation programs & organizations
- Poor timber harvesting practices on private lands
- Lack of public awareness of forest benefits and services
- Insufficient public land available for recreation
- Lack of comprehensive planning or effective zoning in urban areas
- Water quality impacts of poor land management practices and urbanization
- Impacts to quality of public water supplies
- Change in forest composition trending away from oak forest types
- Loss of biological diversity (rare species or communities are most vulnerable)
- Wildlife habitat loss , especially for early-successional species
- Climate change
- Exotic invasive species (plants and animals)
- Wildfires
- Forest fragmentation and urban development (e.g., parcelization & land conversion)

Key Issues for Ohio's Forests (and associated objectives):

State Issue 1: Sustainable forest management on all forest lands
Objectives: 1.1 - Sustainably manage public forest lands for multiple public benefits
1.2 - Increase the number of private landowners sustainably managing their forestlands

State Issue 2: Public benefits from Ohio's forests
Objectives: 2.1 - Increase public awareness of forest benefits and services
2.2 - Increase recreational opportunities and use of Ohio's forests
2.3 - Enhance Ohio's diverse markets for forest products and services
2.4 - Improve the quality of urban life through proper urban forest resource management
2.5 - Increase funding for forest conservation programs & organizations

State Issue 3: Conservation of soil & water resources
Objectives: 3.1 - Reduce soil and water quality impacts from poor land management practices and urbanization
3.2 - Maintain high quality public water supplies

State Issue 4: Conservation of biological diversity (plants and animals)
Objectives: 4.1 - Promote regeneration of oak-hickory forests
4.2 - Protect Ohio's unique or rare forest plant species and biological communities
4.3 - Maintain habitat for forest-associated wildlife

State Issue 5: Health and vitality of Ohio's forests
Objectives: 5.1 - Monitor and manage for existing and future forest health threats
5.2 - Reduce the impact of exotic invasive species
5.3 - Apply appropriate wildland fire management
5.4 - Manage forests for the impacts associated with climate change

State Issue 6: Forest fragmentation and land use conversion
Objectives: 6.1 - Slow the trend of increasing forest fragmentation and urban development in previously rural forest land
6.2 - Mitigate the impact of forest fragmentation and urban development in forested landscapes

Section 5 - Priority Forest Landscapes

Ohio's approach to identifying priority forest landscapes relies heavily on geospatial analyses. Separate geospatial analyses were used for each of the following land categories: 1) rural lands, 2) urban lands, and 3) wildland-urban interface lands (WUI). Note that these land categories are not mutually exclusive, and it is possible that a certain forest area be included in more than one of these separate analyses. For example, northeastern Ohio has significant areas of forests that occur in urban or suburban areas, and those areas are likely included in a both the rural and WUI maps. Such overlap was allowed because the separate analyses had different goals and may have different future applications.

Rural Lands

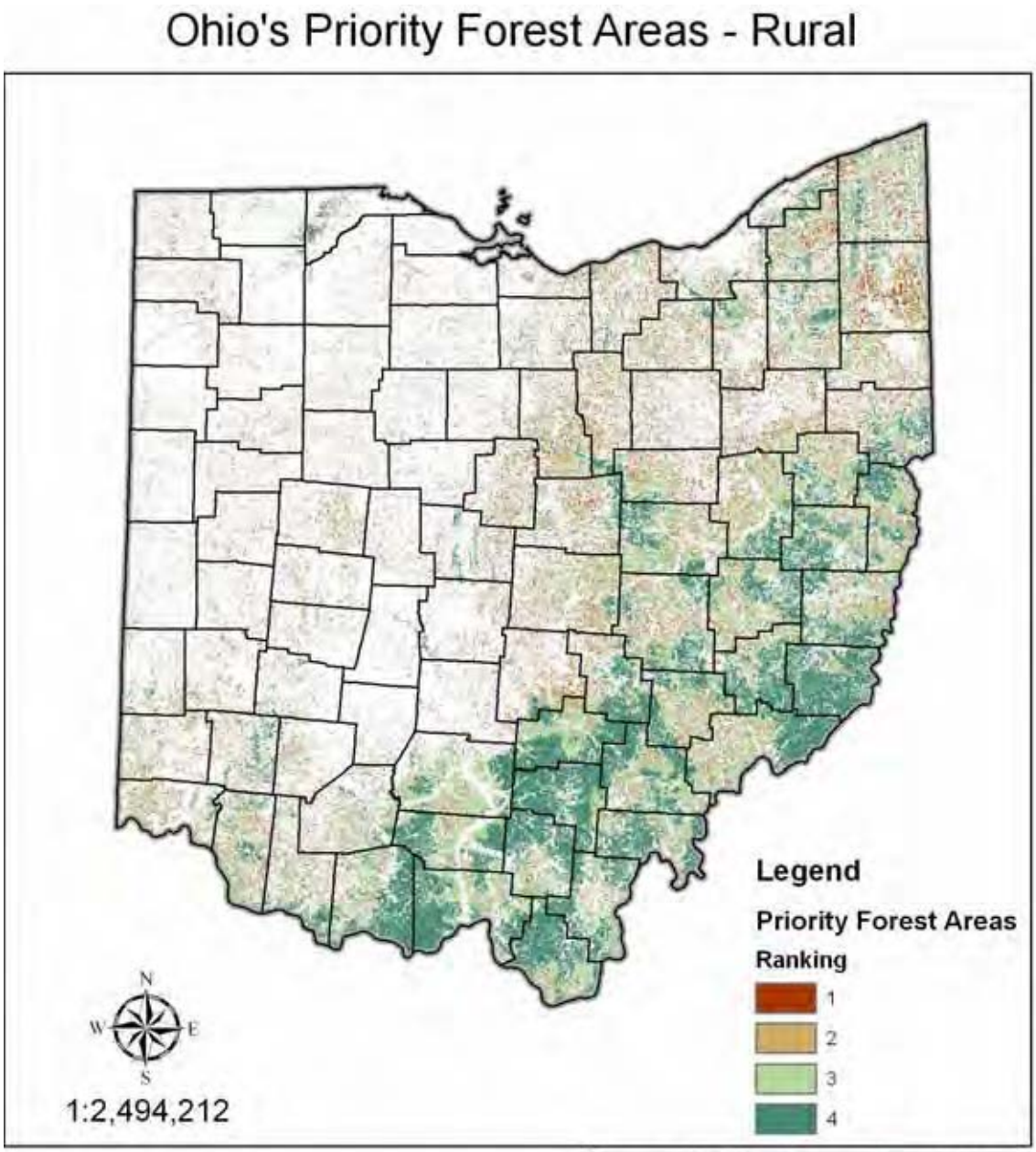
For rural lands, the geospatial analysis used in this assessment builds on the methodology from the previously completed Spatial Analysis Project (SAP) required through the Forest Stewardship Program, which used a weighted overlay analysis of 12 core themes to assess stewardship potential of private forest lands across the state. Public lands were added to analysis to cover all ownerships (public and private land), and the most current data available were utilized for each of the 11 themes (Table A). A more detailed description of each theme is included in the Appendix. The results of the weighted overlay analysis for rural forest lands are shown in Figure A. The dark green areas represent Ohio's priority forest areas, as identified in this assessment (ranking of 4). Large forest blocks with high concentrations of priority forest areas were digitized "freehand" using ArcGIS, and they are identified as priority forest landscapes in this assessment (Figure B).

Forest Legacy Areas

As the state lead agency, the Ohio Division of Forestry has concluded that Ohio's Forest Legacy Program (FLP) will continue to be implemented according to the current Assessment of Need (AON) approved on August 5, 2005. A copy of the State Lead Agency designation letter, the AON, and the AON approval letter can be found online at:
http://ohiodnr.com/Forestry/tabid/5293/Default.aspx . Figure C shows the current approved Forest Legacy Areas.

Table A – Description of them layers used in the geospatial analysis to identify high priority forest areas in Ohio.

Factor / Layer	Description / Data Source
Forest patch	**Forests > 100 ac. in size; NLCD 2001 data (analyzed by Reimann; USDA Forest Service)**
Riparian	**300 ft. buffer around all perennial streams and shorelines; ODNR hydrography data**
Priority watersheds	**12 digit HUC watersheds with the main stems of state scenic rivers and 12 Digit HUC watersheds with Ability to Produce Clean Water (APCW) rankings of 15 or greater; ODNR State and National Scenic River data and USDA Forest Service APCW data (2009)**
Forest pest	**15-mile buffer around confirmed EAB infestations and the "Action" and "State" areas of the gypsy moth slow-the-spread program; Ohio Dept. of Agriculture data (2009)**
Public water supply	**12 digit HUC watersheds that contain surface water intakes for public water supplies; Ohio EPA data (2009)**
Housing change	**Areas that were classified as "rural" in 2000 based on housing density and are projected to remain "rural" in 2030; census-derived data from D.M. Theobald, Colorado State University (2008)**
Wetlands	**Union overlay of wetlands areas from two datasets, as follows; National Wetlands Inventory data (USFWS) and Ohio GAP data (USGS)**
T & E species	**Locations (point and polygons) of threatened and endangered species and other rare communities or geologic sites from Ohio's Natural heritage database were buffered by 300 ft.; ODNR Division of Natural Areas & Preserves data**
Proximity to public lands	**1 mile buffer around public forest lands; ODNR protected lands dataset (includes state lands, metroparks/community forests, and federal lands)**
Slope	**Using statewide Digital Elevation Model, areas with a slope between 5% and 40% were identified to represent economic potential; National Elevation Dataset (USGS)**
Fire risk	**Areas ranked as moderate, high, or very high in Ohio's statewide wildfire hazard map; Ohio Division of Forestry (2009)**



Map developed by the Ohio Division of Forestry. All forest lands in Ohio are ranked based on various data layers related to forest stewardship. Forest areas with a ranking of 4 are classified as Ohio's rural priority forest areas as part of the 2010 Statewide Forest Resource Assessment. Included layers and their assigned relative weights are listed in the table to the right.

Data Element	Weight
Forest Patch	0.16
Riparian	0.11
Priority Watershed	0.11
Public Water Supply	0.11
Proximity to Public Land	0.09
Housing Change	0.09
Wetlands	0.09
Rare Species (T&E)	0.09
Forest Pests	0.06
Slope	0.05
Fire Risk	0.04

Figure A – Ohio's priority forest areas for rural lands. Priority rankings go from 1 to 4 (4=high). Forest areas ranked 4 are considered to be priority forest areas. The corresponding acreages (and percent statewide forest cover) for each ranking level are: 1=1,295,2889 ac. (15% of forest land), 2=778,336 ac. (9%), 3=3,359,226 ac. (40%), and 4=3,039,257 ac. (36%).

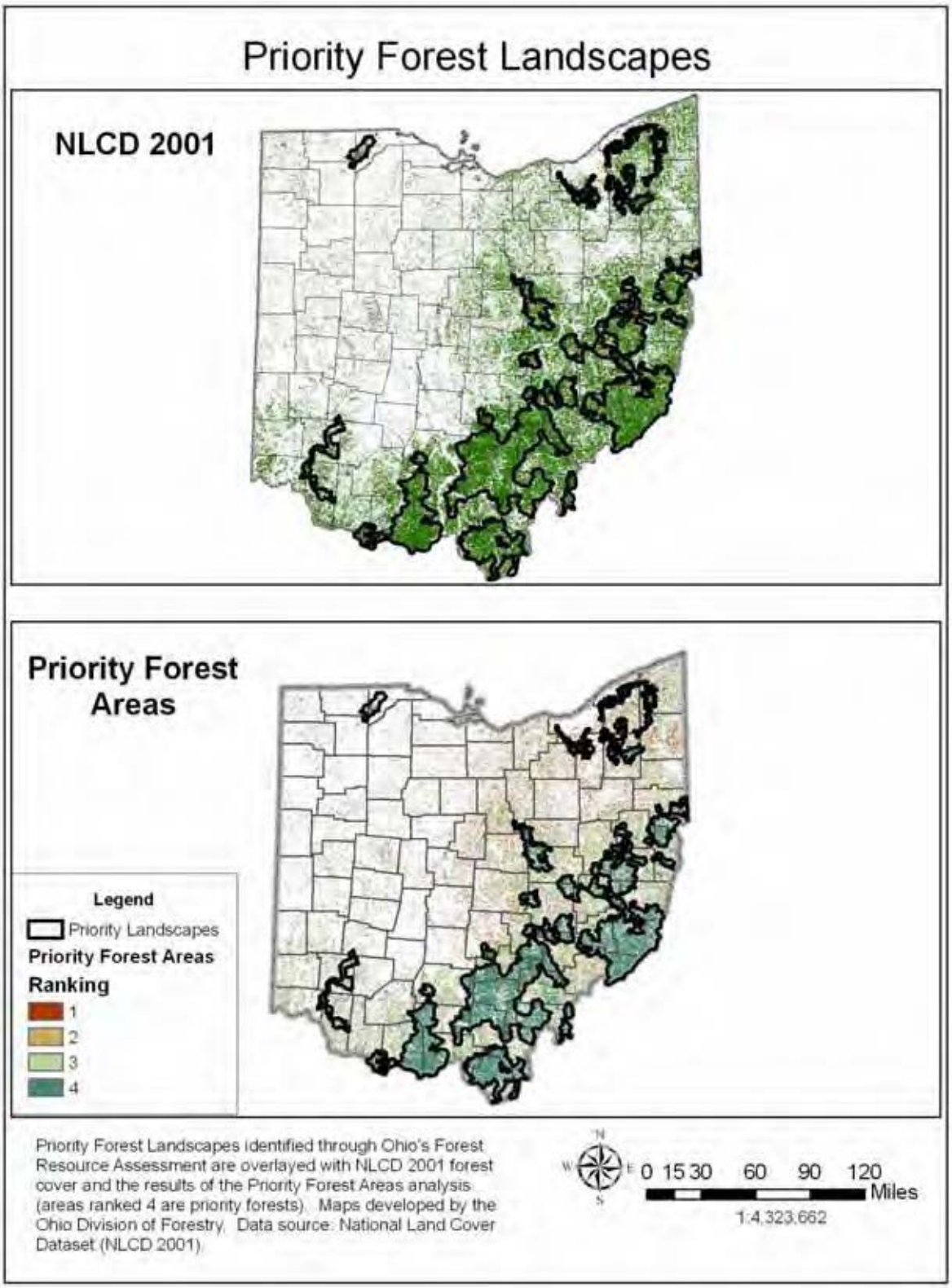


Figure B – Ohio's priority forest landscapes (outlined in black), which represent large forest blocks with high concentrations of priority forest areas from the rural lands analysis (see Figure A).

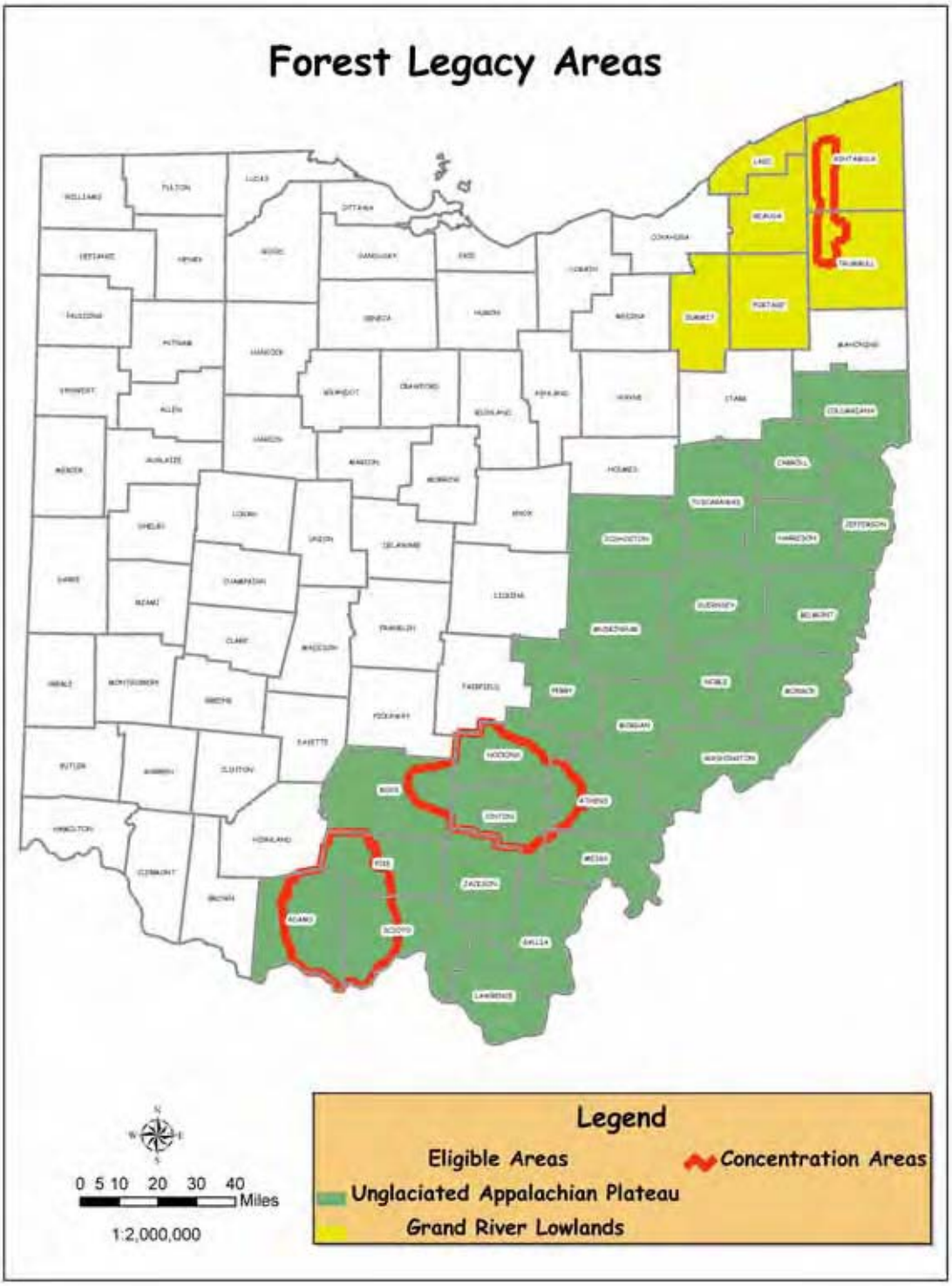


Figure C – Ohio's Forest Legacy Areas.

Urban Lands

The urban lands analysis uses a spatial overlay analysis that has Census-defined places as the unit of analysis. The analysis prioritizes communities for setting urban tree canopy goals using the Maryland Method, a technique that was developed by former Maryland Urban and Community Program Coordinator Mike Galvin. The Maryland Method prioritizes communities with the following characteristics:

- Greater than average population
- Greater than average urbanized area
- Greater than average impervious surface area
- Less than average UTC (Urban Tree Canopy)

Priority urban lands, as identified using the Maryland Method, are shown in Figure D. Air quality non-attainment areas were evaluated as a potential means to further prioritize communities (Figure E). An overlay of the Maryland Method prioritization and air quality non-attainment areas would highlight the counties in and around Ohio's largest metropolitan areas, Cleveland, Columbus, Dayton, Cincinnati, and the Akron-Canton area.

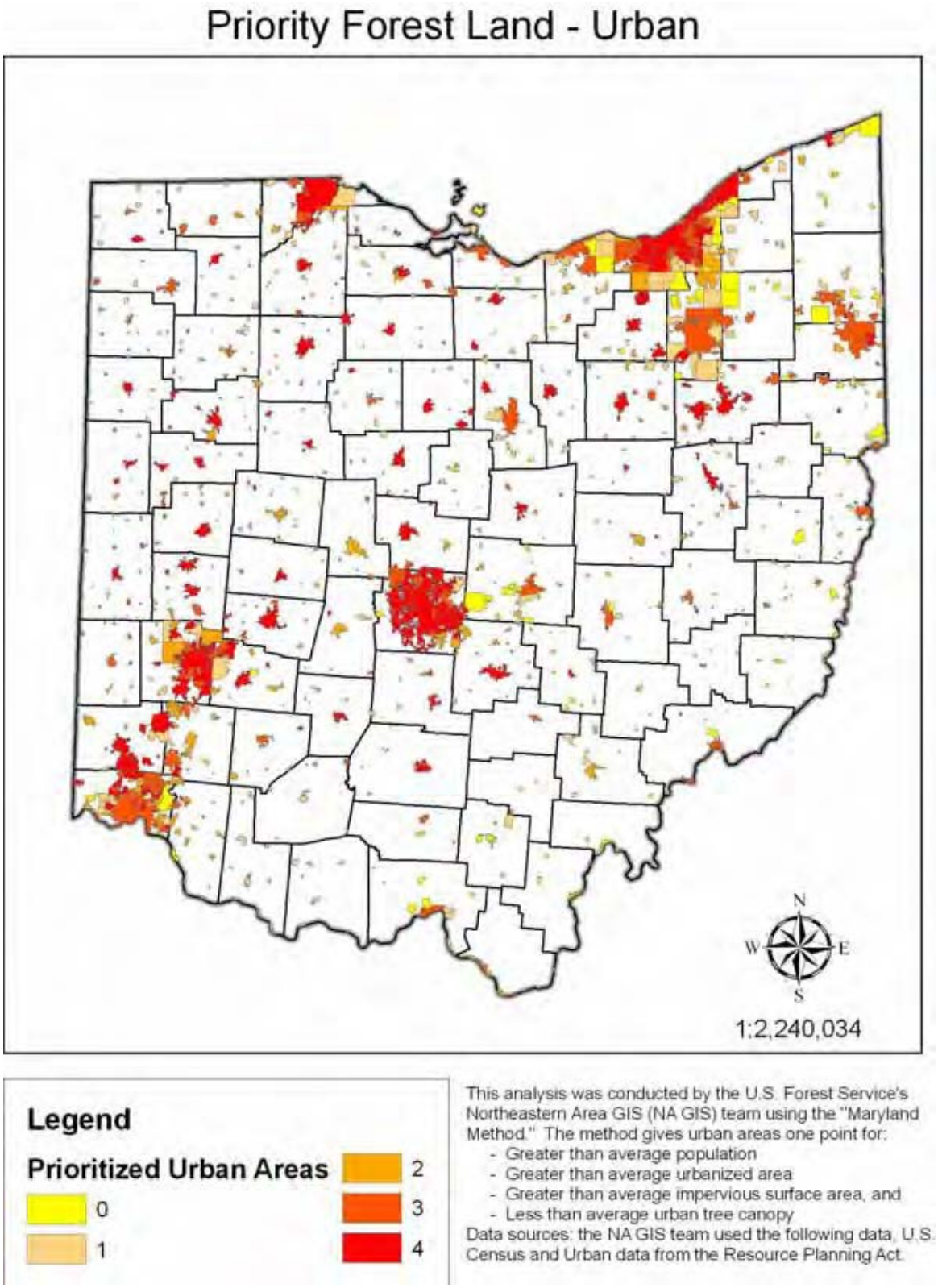


Figure D – Ohio's priority forests for urban lands, as determined using the Maryland Method.

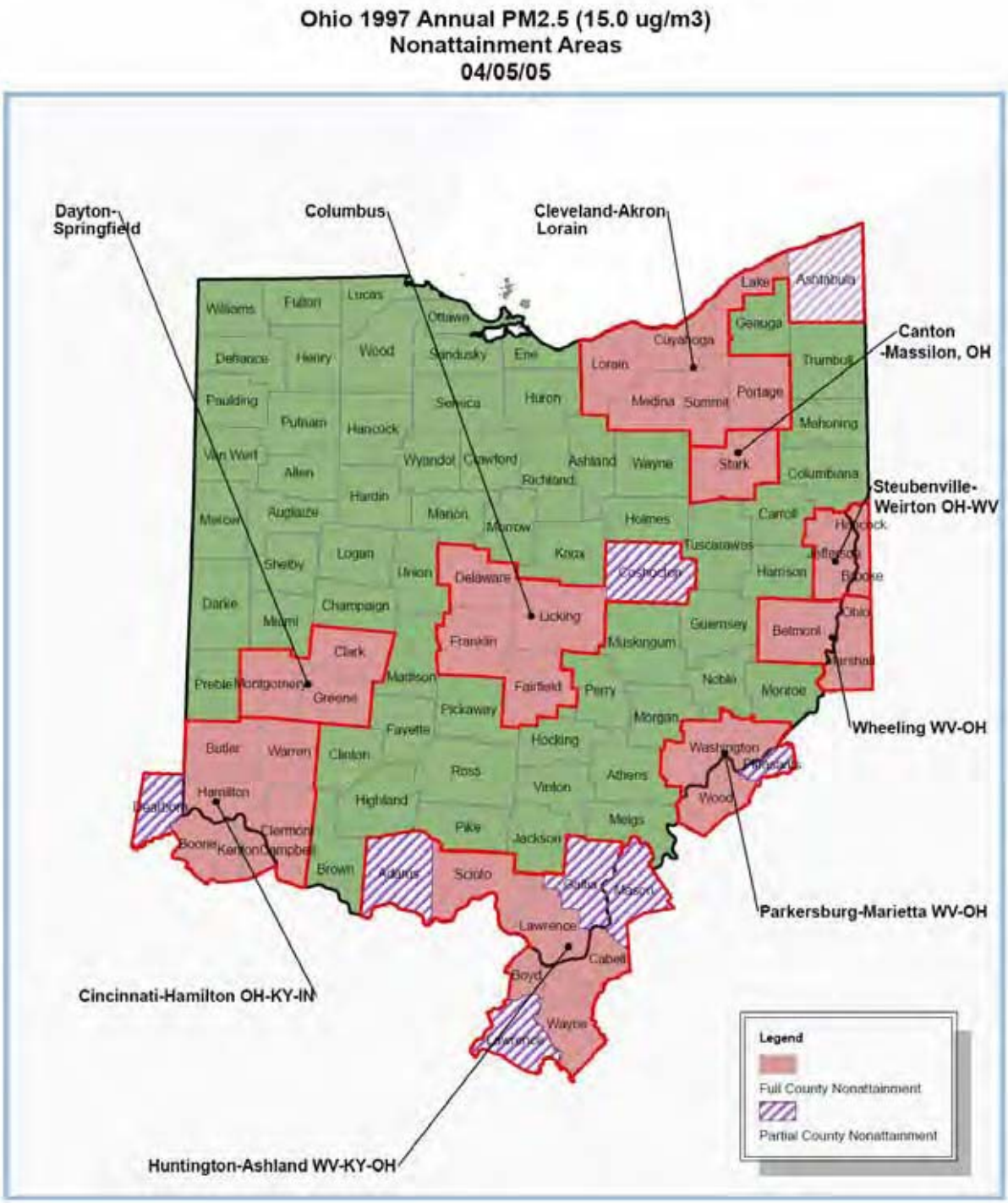


Figure E –Non-attainment areas in Ohio for particulate matter (PM2.5). Data and map are from the Ohio Environmental Protection Agency (http://www.epa.state.oh.us/dapc/general/naaqs.aspx).

Wildland-Urban Interface Lands

The third land category for landscape prioritization is the wildland-urban interface. The wildland-urban interface represents areas that historically were rural, non-agricultural lands (e.g., rural forest land) that are experiencing urbanization or development but still retain many of their wildland characteristics or land cover. Because these areas do not fit nicely into either the rural lands or urban lands analyses, they are considered as a third prioritization category. The base map that was used for this analysis is the Wildland-urban interface 2000 map that was developed by the University of Wisconsin and Oregon State University (Figure 1w under Criterion 1, Indicator 3). Future WUI lands were projected by overlaying land that is projected to change from rural in 2000 to non-rural in 2030 (Theobald unpublished) with forest cover in Ohio (NLCD 2001). Figure F shows an overlay of both of those maps, current WUI (2000) and future WUI. This geospatial representation of current and future WUI will be useful when planning future efforts to address issues associated with the wildland urban interface in Ohio.

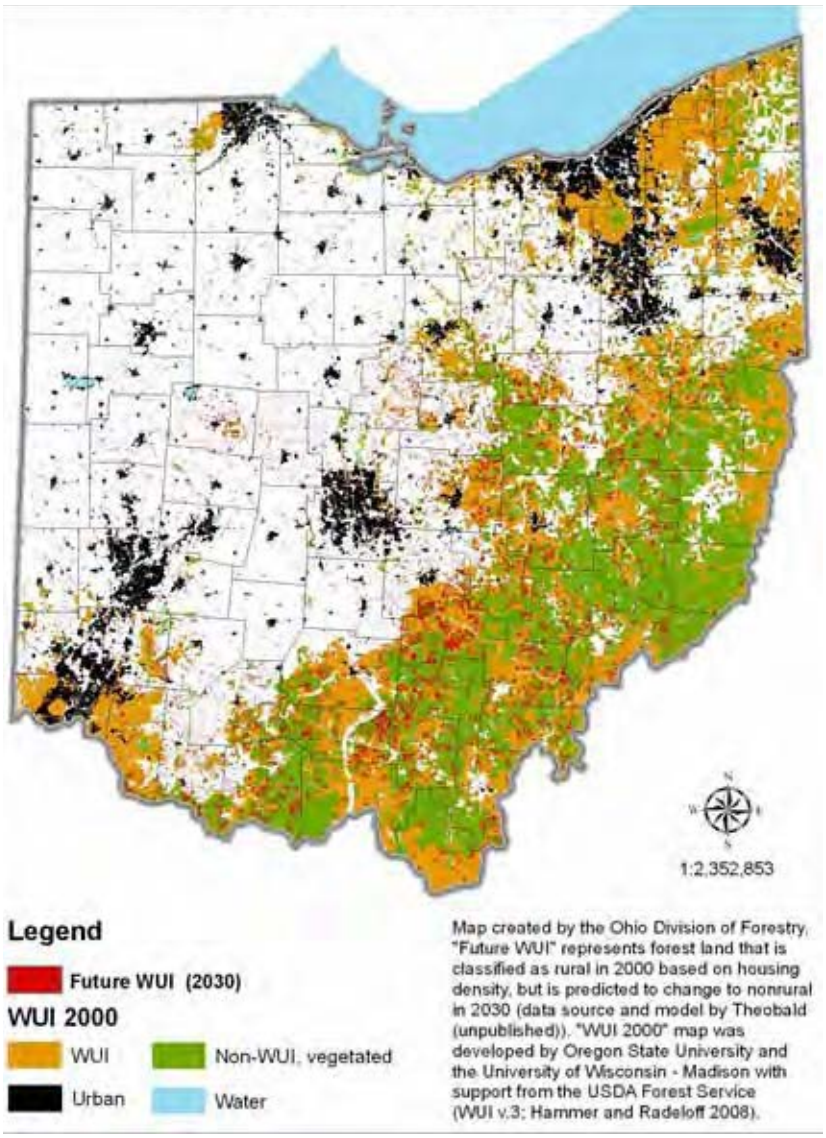


Figure F – Current and future wildland-urban interface forest lands in Ohio. Data and maps are from Hammer and Radeloff (2008) and Theobald (unpublished).

Multi-State Priority Areas and Existing Projects

The priority forest areas and landscapes identified in this assessment will be critical to strategically addressing the statewide forest issues. However, Ohio's forest-related issues are not exclusive to the State; they are shared with other neighboring states and sometimes shared regionally or nationally. To better address forest issues that go beyond political boundaries, the identification of multi-state priority areas is important. However, limitations on time, resources, and information preclude the development of a comprehensive assessment and final delineation of multi-state priority areas for Ohio's 2010 Forest Resource Assessment. The following table lists some existing multi-state projects and proposed multi-state priority areas. Later this year, additional information and maps will be available about the priority forest areas that neighboring states identified in their statewide forest assessment and strategy. Once available, that information will be invaluable for future development of multi-state priority areas. Appendix C includes project briefs for proposed priority areas 6, 7, 8, and 9 in the following table.

No.	Existing or proposed	Name	States	Description
1	Existing	Call Before You Cut	IA, MO, IL, IN, OH, WV	Provides information to private landowners considering a timber harvest
2	Existing	Gypsy moth "Slow the Spread"	NC, VA, WV, KY, OH, WI, IN, MN, IL, MI, IA	Regional integrated pest management program to slow the spread of gypsy moth into uninfested areas
3	Existing	MORWOOD	OH, WV	Two-year project will estimate woody biomass quantity and availability and organize a woody biomass supply chain for future bioenergy projects
4	Existing	Appalachian Regional Reforestation Initiative	KY, MD, OH, PA, TN, VA, WV	Planting high value hardwood trees on reclaimed coal-mined lands in Appalachia, and increasing survival and growth of planted trees
5	Existing	Mid-Atlantic Fire Compact	WV, VA, OH, PA, DE, NJ, MD	Supports regional fire programs
6	Proposed	Upper Ohio priority area	OH, WV, PA, KY	Take an "all lands" approach to conserving, connecting, and restoring the Appalachian forests of the Upper Ohio River, which support a robust forest products industry and a rich diversity of flora and fauna while providing clean drinking water and recreational opportunities
7	Proposed	Ohio River Basin priority area	IL, IN, OH, KY, TN, AL, GA, NC, VA, WV, PA, MD, NY	Address multiple issues affecting forests in the project area including climate change, dynamic relationships between forests and people, energy development, loss of forest industries, and conservation education (map in Figure G)
8	Proposed	Appalachian Initiative priority area	NY, PA, WV, OH, MD, VA, KY,TN, NC, SC, GA, AL	Focuses on the Mid-Atlantic and Southern portions of the Appalachian mountains, which offer a multitude of benefits and forest conservation challenges (map in Figure G)
9	Proposed	Great Lakes Basin priority area	MN, MI, WI, IL, IN, OH, PA, NY	Protect the Great Lakes watershed and multiple resources that it provides (map in Figure G)
10	Proposed	Indiana bat conservation	MI, IN, IL, OH, PA, MO	Indiana bat conservation in the hardwood region

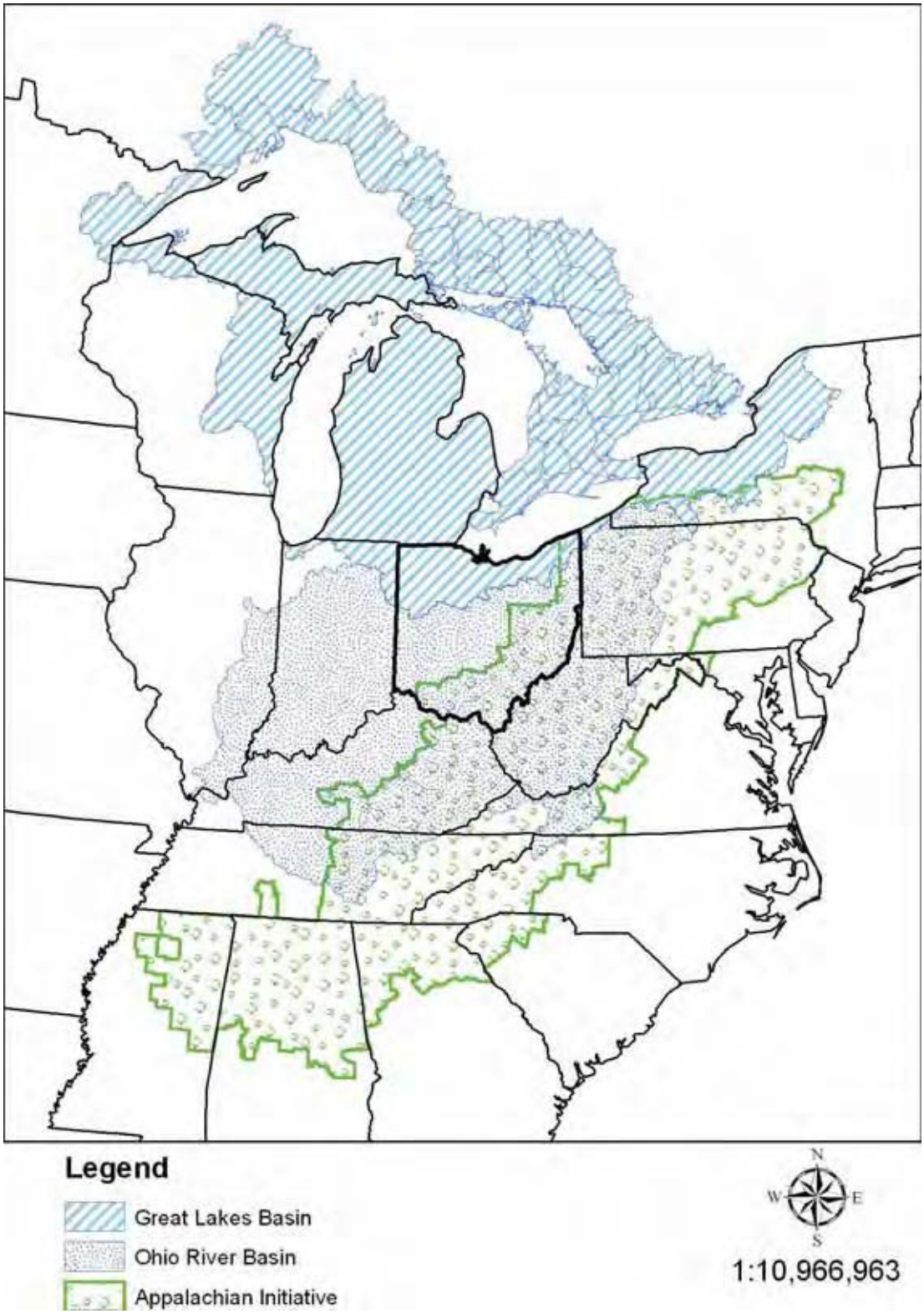


Figure G – Three proposed multi-state priority areas that include Ohio: the Great Lakes Basin, the Ohio River Basin, and the Appalachian Initiative. Maps and project briefs (in Appendix C) were developed by the USDA Forest Service, Northeastern Area State & Private Forestry Office.

Summary

The Food, Conservation, and Energy Act of 2008 (the 2008 Federal Farm Bill) requires each state to complete a Statewide Forest Resource Assessment and Statewide Forest Resource Strategy to continue to receive funds under the Cooperative Forestry Assistance Act. This Forest Resource Assessment represents the first statewide, comprehensive forest resource assessment in Ohio since 1983. The findings of this document will be integrated into the accompanying Forest Resource Strategy document. The Forest Resource Strategy also considers and complements other existing strategic plans including the Ohio Comprehensive Wildlife Conservation Strategy (released in 2005), the Statewide Comprehensive Outdoor Recreation Plan (2008), and local community wildfire protection plans. The combined documents, called the Forest Resource Assessment and Strategy (FRAS), can be considered as a pilot for this integrated approach to evaluating and managing Ohio's forest resources. These documents will be living documents that will be amended and updated as new data become available, and they have an expected life expectancy of 5 years before the first major review/update.

The purpose of the combined FRAS documents is to provide a basis upon which future strategic directions and actions can be evaluated and selected. It is to be used by the Division of Forestry and its partners to marshal limited resources towards addressing identified forest issues and threats. It will also help ensure that future resources are focused on important landscape areas with the greatest opportunity to address shared management priorities and achieve meaningful outcomes.

Forest Conditions and Trends

Forest conditions and trends for the State of Ohio were assessed using a framework of criteria and indicators that was developed to assess the sustainability of forests in the northeastern United States. The key findings under each criterion follow.

Criterion 1: Conservation of Biological Diversity

Forest Land

- The total area of forest land in Ohio has stabilized over the past two decades and is currently approximately 31% of total land cover.
- Most heavily forested areas are in the unglaciated, southeastern part of state.
- Ohio's forests are becoming denser (majority are moderately to fully stocked) and less open (i.e., more shaded).
- Per capita forest land is decreasing, particularly around urban/suburban areas.
- The area of reserved forests has doubled in recent decades to almost 204,000 acres in 2006.

Urban Forests

- Ohio is experiencing significant urbanization/development. Detailed data on urban tree canopy cover are lacking, but a large-scale analysis found the statewide average urban tree canopy cover in urban areas to be 19.8%.
- Eighty-four percent of Ohio's population lives in communities that are actively managing their urban forests or in the process of developing urban forestry mgt plans.

Forest Type and Age

- In general, the relative dominance of oaks and hickories is decreasing while maples and yellow poplar are increasing.
- Ohio's forests are maturing, with significant increases in the sawtimber size class and significant decreases in the seedling/sapling size class.
- Currently, 88.3% of Ohio forests are between 20 and 100 years in age. Young forests (under 20 years of age) and old forests (over 100 years of age) are under-represented in the state at 8.3% and 3.3%, respectively.

Forest Land Conversion and Fragmentation

- Ohio's forests are fragmented and additional fragmentation is occurring; the largest forest patch sizes and areas of forest interior occur in southern and eastern Ohio, mostly in unglaciated Appalachian area.
- Eighty-eight percent of Ohio's forests are privately owned, and 73% are family forests; the size of family forests is decreasing (avg. parcel size decreasing) with the majority of family forests being under 50 acres in size.

Forest-Associated Plant and Animal Communities and Species of Concern

- Many of Ohio's forest-associated wildlife are doing well, such as the wild turkey that has shown significant population growth over the past decade or two. The primary threat to forest wildlife in Ohio is habitat loss. Development is a major driver of habitat loss, as it causes increased fragmentation and the conversion of forests to non-forests. Other threats to wildlife include invasive species and loss of early successional habitat due to forest succession.
- Ohio's forests support 350 species of terrestrial wildlife and over 500 species of plants. Ohio has 16 species of federally listed threatened and endangered wildlife species and 6 federally listed plant species.
- Forest-associated bird species were evaluated by grouping species by their preferred forest successional stage. Most birds that utilize mid- and late-successional forests appear to have stable or increasing populations (with some exceptions), but populations of early-successional species are experiencing a more notable decline.
- Detailed trend data are lacking for forest communities. Some important and/or rare communities in need of protection include oak savannas, various wetland communities, and forest with old growth characteristics. Critical habitat for threatened and endangered plant and animal species are also high priorities for protection.

Criterion 2: Productive Capacity of Ohio's Forests

- Ohio's forest continue to experience a positive net change in volume (net change of 160 million cubic feet annually; growth outpaces removals). However, several oaks species have a growth to removal ratio of around 1:1, while maples and poplar are over 2:1 (growth to removal). This trend could amplify the previously noted trend of declining relative dominance of oaks (to the benefit of maples and poplars).
- For removals, 65% are from timber harvesting and 32% are conversion to non-forest land. Three percent is conversion to reserved forests (i.e., forests that prohibit timber harvesting).

Criterion 3: Maintenance of Ecosystem Health and Vitality

- The mortality rate in Ohio's forests increased slightly form 0.6 to 0.9% of inventory volume. This trend is consistent with the overall maturing of Ohio's forests that was discussed previously.
- Over the past 7 years (2003-2009), Ohio averaged 636 wildfires, burning an average of 3736 acres. Most of Ohio's forest land falls under the Fire Regime Condition Class of III, which indicates a high departure from reference vegetation conditions.
- Generally, precipitation is well distributed throughout the year in Ohio, but droughts occur, on average, twice per decade. During droughts, trees are at increased risk of fire and insect and disease damage, and they may have decreased growth and low survival during tree plantings.
- The current major insect and disease threats to Ohio's forests include: EAB (67 counties quarantined), gypsy moth, hemlock woolly adelgid, and hardwood decline (particularly oaks). Several other insects or diseases of concern have either been recently observed or have the potential to become established in Ohio, including the *Sirex* wood wasp, bacterial leaf scorch, beech bark disease, and sudden oak death.
- Current and future climate change are likely to have various impacts on Ohio's forests, including shifts in plant hardiness zones and species ranges, increased forest productivity which may be offset by increased stressors (e.g., summer droughts, expanded invasive plants and diseases, and decreased air quality), and delayed spring tree plantings due to wet spring conditions.
- The *Climate Change Tree Atlas* (Prasad et al. 2007; available online: http://www.nrs.fs.fed.us/atlas/tree/) offers useful information on potential changes in suitable habitat for various important tree species due to climate change.
- Invasive plants are a major threat to Ohio's forest ecosystems. Fragmentation facilitates the expansion of invasive plants, and they often respond positively to disturbance. Better mapping is needed of the current distribution of Ohio's invasive plant species.

Criterion 4: Conservation and Maintenance of Soil and Water Resources

- When compared to neighboring states, such as Pennsylvania and West Virginia, Ohio's soils are of similar or higher quality.
- Approximately 10% of Ohio's forests have commitments to soil and water conservation; represented in that number are "protected" forest lands held by local, state, or federal governments and NGOs, as well as private lands enrolled in the "new law" OFTL program.
- Riparian forest cover in Ohio is relatively stable, although of concern, perennial streams are generally declining in forest cover, with the southeastern part of the state showing much of that decline.
- Similar to riparian forest cover, the percent forest cover by watershed has been stable at the statewide scale. However, several watersheds along the Ohio River in southeastern Ohio have gained forest cover across the watershed but lost forest cover along perennial streams.
- Water quality varies across watersheds in the state. The principal causes of impairment of Ohio's forested watersheds are related to landscape modification from agricultural land use and urban development. Acid mine drainage is another source of water pollution.

Criterion 5: Maintenance of Forest Contribution to Global Carbon Cycle

- The greatest stores of carbon in forests are in southeast and northeast Ohio, with most of the carbon in live trees and soil.
- 66% of the forest carbon in live trees occurs in oak-hickory forest types, with the next most common forest type being maple-beech-birch at 21.6% of carbon.
- The average amount of carbon per area of forest has not changed significantly over the past 6 years, even with the maturing trend that forests are experiencing.

Criterion 6: Maintenance and Enhancement of Long-term Multiple Socioeconomic Benefits to Meet the Needs of Society.

Production and Value of Wood Products

- The Gross Domestic Product (GDP) for wood-related industries in Ohio has been relatively stable over the past decade, with furniture prices showing a gradual increase. Timber prices in Ohio, however, have declined significantly since 2005.
- Ohio is regularly one of the top 15 states for wood products and furniture manufacturing.
- The total volume of roundwood harvests in Ohio was similar between 1989 and 2006, but the proportion of sawlog harvests increased during that time while pulpwood harvests decreased.
- Oak continues to be the dominant species harvested, although its relative dominance has decreased. The harvest of other species, like maple and yellow poplar, has increased.
- Economics and policy are driving the development of energy production from woody biomass. Planning for biomass-fueled power plants is underway but further analyses are needed to quantify potential sources of biomass and evaluate their sustainable use.
- Eighty-one percent of logs utilized by Ohio sawmills were harvested in Ohio, indicating that Ohio's wood products industry meets the majority of its demand using local (in-state) sources.
- The recent trend for international exports of wood products from Ohio shows relative stability with a down year in 2009.

Non-timber Forest Products

- Some important non-timber forest products in Ohio are maple syrup, ginseng, and Christmas trees. In recent years, Ohio ranked 6th among states for annual production of maple syrup and ginseng, and 9th for Christmas trees.
- Of Ohio's various non-timber forest products, maple syrup has the greatest economic value (almost $3.8 million in 2008).

Outdoor Recreation

- Public forest lands in Ohio are used for a variety of recreational activities, including hiking, camping, wildlife watching/photography, and trail riding (horses, mountain-bikes, ATVs). Nationally, Ohio continues to rank poorly for per capita outdoor recreation acreage.

Investments

- Significant investments are being made in forest health, management, and research in Ohio. One important program that supports management on Ohio's private forest lands is the USDA Environmental Quality Incentive Program (EQIP), which invested $1.8 million in 2009.

Forest Ownership, Land Use, and Special Designations

- Eighty-eight percent of Ohio's forest land is privately owned with the largest ownership category being family forests, which represent 73% of the state's forests.
- The State of Ohio owns 5% or 423,000 acres of forest land in Ohio, with the Ohio Department of Natural Resources owning the majority of that area.
- A total of 806,600 acres of forests are protected by ownership from land use conversion, including local, state, and federally-owned government lands, as well as lands owned by non-governmental organizations like The Nature Conservancy. An additional 13,000 acres are protected through conservation easements held by the Ohio Division of Forestry.
- The Ohio Division of Forestry administers the Ohio Forest Tax Law program, which offers a property tax reduction for private forest lands that are maintained as forests. The program allows timber harvesting but does not allow clearing of forests for land-use conversion. Currently, over 177,000 acres of forest lands are enrolled in the Ohio Forest Tax Law program.
- Third-party certification of sustainable forest management has grown significant in the United States. The four primary certification systems with potential in Ohio are the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), and Program for the Endorsement of Forest Certification (PEFC). Currently, the only system that is widely used in Ohio is ATFS. However, the Ohio Division of Forestry is pursuing certification of all state forests under FSC and SFI.

Employment and Wages

- The general trend for employment and wages in wood-related manufacturing in Ohio in the past decade has been a significant decline. From 2001 to 2008, both logging and primary wood products manufacturing had a net loss of over 33% of employees.

Criterion 7: Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

- In general, forest management standards in Ohio are voluntary. Some programs provide incentives for landowners to encourage good management, such as the Ohio Forest Tax Law program and the USDA Environmental Quality Incentive Program.
- Numerous laws and policies guide planning and management of Ohio's forests. Government agencies that manage public forest lands have protocols for developing and updating management plans. Several statewide committees and advisory councils provide input into planning and forestry program administration. Three statewide committees that help guide forestry-related work by the Ohio Division of Forestry are the Forestry Advisory Council, the Forest Stewardship Committee, and the Urban Forestry Advisory Committee.

Data Gaps

As forest conditions and trends were evaluated for this statewide assessment, several gaps in available data were identified. Improving or expanding the available data to fill some of these gaps would facilitate a more comprehensive assessment of forest resources in the future and could lead to increased success in implementing the statewide strategies. A list of some of the data gaps that were encountered during this assessment follows.

- Location of old forests (forests with old growth characteristics) and their land area coverage
- More detailed data on urban tree canopy and better coverage of urban areas across the state
- Location of conservation easements on private forest lands and their land area coverage
- Higher quality maps of wildland-urban interface
- Updated land cover dataset (i.e., NLCD 2001 data are becoming outdated)
- Statewide maps of critical habitat for threatened and endangered species (US Fish & Wildlife Service has initiated this work)
- Improved inventory of state and federally-listed species and rare biological communities
- Improved mapping of plant communities in forest ecosystems (e.g., using data on herbaceous plants and shrubs, such as the Phase 3 FIA plots)
- Improved mapping of invasive plant distributions across the state
- Improved data on ginseng harvesting and production (including information on how crop was grown (e.g., wild grown vs. wild simulated))
- Data on production or sale of additional non-timber forest products that are not currently tracked, such as berries, mushrooms, nuts (e.g., walnuts), and other medicinals (e.g., black cohosh, bloodroot)
- Improved data on carbon pools and opportunities for increased carbon storage in the state
- Quantification of ecosystem services that Ohio's forests provide

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Appendix

Appendix A

Ohio's Forest Resource Assessment & Strategy: Summary of Stakeholder Input

Regional Stakeholder Meetings

Five Regional Stakeholder meetings were held in December 2009 and January 2010 at the following locations and dates:

- Findlay, Ohio; ODNR Office, 952 Lima Ave., Dec. 16, 2009
- Akron, Ohio; ODNR Wildlife Office, 912 Portage Lakes Dr., Dec. 18, 2009
- Columbus, Ohio; ODNR Office-Fountain Square, 2045 Morse Rd., Building E-1, Jan. 5, 2010
- Dayton, Ohio; Cox Arboretum, 6733 Springboro Pike, Jan. 13, 2010
- Athens, Ohio' ODNR Office, 360 E. State St., Jan. 19, 2010

Total attendance at the stakeholder meetings was 82 people. Participants had diverse affiliations, including Ohio Tree Farm System, National Park Service, US Forest Service-Wayne NF, Five Rivers Metroparks, Hamilton County Park District, Clermont SWCD, NRCS-RC&D, Rural Action, Buckeye Forest Council, Save our Shawnee Forest, OSU Extension, The Nature Conservancy, The Holden Arboretum, The Wilderness Center, Ohio Horseman's Council, Sierra Club, County Auditor's Association, local bicycle clubs, local officials, woodland interest groups, forest landowners, and concerned citizens.

At the meetings, participants were divided into small groups of 4 to 6 people, and each group was asked to come up with the top five issues, threats, or opportunities for Ohio's forests. Results of these group discussions are summarized on the following page.

Results from the groups discussions at the Regional Stakeholder Meetings:

Group Discussions: What are the top 5 Issues, Threats, or Opportunities for Ohio's Forests?	Response Count
Fragmentation/change in ownership or land use	9
Insufficient resources - funding for conservation, support for landowners/communities	8
Education/public awareness	7
Exotic invasive species	5
Low incentive to retain/manage private forests	5
Conservation of biological diversity	4
Urbanization / parcelization	3
Woody biomass for energy (discussed as a threat)	3
Carbon markets	2
Property tax policy	2
Urban tree management	2
Wildlife habitat loss	2
Water quality / BMPs	2
Climate change	1
Deer overpopulation	1
Economic value of forests	1
Ecosystem services (e.g., air quality)	1
Forest certification	1
Inadequate funding for land acquisition or conservation easements	1
Insects & disease	1
Lack of recreation areas/opportunities	1
Lack of stakeholder involvement	1
Encourage legislation for tree/canopy preservation	1
Emphasis on new infrastructure vs. maintaining existing infrastructure	1
Plant poaching - non-timber forest products	1
Use of prescribed burning (as a threat)	1
Quality of forest (timber, biodiversity, T & Es, invasives)	1
Species composition - oak regeneration/mgt. practices, invasive species	1

Stakeholder Surveys

In addition to the regional meetings, stakeholder input on Ohio's key forest issues was also provided through surveys. A total of 748 stakeholder surveys were completed online and an additional 45 surveys were submitted through the regular mail or turned in at the stakeholder meetings, for a total of 793 surveys submitted. Results from the three core questions from the surveys are presented on the next few pages.

Question 2:

For the following list of potential issues and threats to Ohio's forests, please check the column that best respresents your level of concern.	**Average ranking**	**Response Count**
Conservation of soil & water resources (e.g., Best Mgt. Practices)	4.482	787
Wildlife habitat loss	4.463	784
Conservation of biodiversity (plants & wildlife)	4.444	790
Fragmentation of forests and/or conversion of forests to nonforestland	4.439	785
Parcelization and/or urbanization	4.356	772
Inadequate funding for conservation programs/organizations	4.334	785
Protecting public water supplies	4.306	782
Insects and disease (including invasives like emerald ash borer & gypsy moth)	4.282	787
Low incentives to retain forests &/or manage them sustainably	4.250	781
Sustainable use of forest resources	4.212	782
Decline in reforestation	4.142	780
Inadequate funding for land acquisitions or conservation easements	4.104	787
Public awareness of forest benefits & services	4.101	772
Invasive plants	4.075	788
Change in forest species composition (e.g., less oak)	4.028	785
Poor timber harvesting practices	3.977	775
Lack of adequate forest management	3.919	775
Climate change	3.902	784
Public opinion of forest management	3.709	774
Availability of land for public recreation	3.701	786
Change in land ownership (e.g., inter-generational transfer)	3.549	779
Uncoordinated delivery of conservation programs	3.478	781
Timber theft/trespass	3.448	776
Decline in timber quality	3.434	783
Insufficient technical support/resources for landowners/communities	3.422	782
Overpopulation of white-tailed deer	3.412	787
Property Tax Policies/Programs (e.g., Ohio Forest Tax Law, Current Agricultural Use Value)	3.335	782
Loss of fire-dependent species/communities	3.325	775
Urban tree management (e.g., hazard trees, storm damage)	3.318	780
Sustaining Ohio's forest product industry	3.315	781
Uncertainty about the credentials of forestry professionals	3.186	780
Control of wildfires (fire suppression)	3.157	785
Insufficient number of trained loggers	3.001	779
Poor timber markets	2.798	771
Other (specify and include level of concern)		188

Question 3:
For the following list of potential issues, threats, and opportunities for Ohio's forests, please check the column to the right that best describes how important you feel each is.

	Average ranking	Response Count
Conservation of soil & water resources (e.g., Best Mgt. Practices)	4.519	649
Wildlife habitat loss	4.488	623
Conservation of biodiversity (plants & wildlife)	4.451	656
Protecting public water supplies	4.408	639
Fragmentation of forests and/or conversion of forests to nonforestland	4.320	647
Insects and disease (including invasives like emerald ash borer & gypsy moth)	4.293	646
Sustainable use of forest resources	4.284	633
Inadequate funding for conservation programs/organizations	4.233	647
Low incentives to retain forests &/or manage them sustainably	4.232	637
Public awareness of forest benefits & services	4.211	640
Parcelization and/or urbanization	4.210	638
Invasive plants	4.126	642
Decline in reforestation	4.107	647
Inadequate funding for land acquisitions or conservation easements	4.050	646
Availability of land for public recreation	3.987	680
Change in forest species composition (e.g., less oak)	3.947	664
Climate change	3.893	655
Lack of adequate forest management	3.887	635
Enhancing urban tree cover	3.852	644
Poor timber harvesting practices	3.787	628
Public opinion of forest management	3.771	638
Uncoordinated delivery of conservation programs	3.598	632
Change in land ownership (e.g., inter-generational transfer)	3.564	652
Urban tree management (e.g., hazard trees, storm damage)	3.513	630
Insufficient technical support/resources for landowners/communities	3.472	640
Property Tax Policies/Programs (e.g., Ohio Forest Tax Law, Current Agricultural Use Value)	3.460	639
Overpopulation of white-tailed deer	3.456	642
Timber theft/trespass	3.400	633
Loss of fire-dependent species/communities	3.368	638
Sustaining Ohio's forest product industry	3.345	632
Carbon sequestration/markets	3.340	670
Decline in timber quality	3.302	643
Forest certification	3.295	638
Control of wildfires (fire suppression)	3.182	648
Uncertainty about the credentials of forestry professionals	3.164	633
Insufficient number of trained loggers	2.969	639
Poor timber markets	2.889	633
Other (specify and include level of concern)		73

Question 4:
For the following list of issues, threats, and opportunities for Ohio's forests, what are the five most important. Please rank the most important ones from 1 to 5 (1 being the most important), by checking the number to the right. Only your top five should have numbers checked.

	Average ranking	Response Count
Conservation of biodiversity (plants & wildlife)	2.425	275
Wildlife habitat loss	2.888	269
Fragmentation of forests and/or conversion of forests to nonforestland	2.975	237
Conservation of soil & water resources (e.g., Best Mgt. Practices)	2.876	202
Climate change	2.351	194
Availability of land for public recreation	2.619	181
Insects and disease (including invasives like emerald ash borer & gypsy moth)	3.237	156
Protecting public water supplies	2.901	141
Low incentives to retain forests &/or manage them sustainably	3.423	123
Invasive plants	3.310	113
Sustainable use of forest resources	3.340	100
Decline in reforestation	3.444	99
Inadequate funding for conservation programs/organizations	3.323	93
Parcelization and/or urbanization	3.215	93
Inadequate funding for land acquisitions or conservation easements	3.086	81
Change in forest species composition (e.g., less oak)	3.052	77
Enhancing urban tree cover	3.121	66
Overpopulation of white-tailed deer	3.456	57
Lack of adequate forest management	2.981	54
Public awareness of forest benefits & services	3.358	53
Property Tax Policies/Programs (e.g., Ohio Forest Tax Law, Current Agricultural Use Value)	3.082	49
Poor timber harvesting practices	3.609	46
Carbon sequestration/markets	3.152	46
Change in land ownership (e.g., inter-generational transfer)	2.762	42
Urban tree management (e.g., hazard trees, storm damage)	3.415	41
Sustaining Ohio's forest product industry	3.767	30
Public opinion of forest management	3.793	29
Insufficient technical support/resources for landowners/communities	3.640	25
Decline in timber quality	3.545	22
Uncoordinated delivery of conservation programs	3.136	22
Poor timber markets	3.500	18
Control of wildfires (fire suppression)	3.389	18
Timber theft/trespass	3.235	17
Loss of fire-dependent species/communities	3.500	10
Uncertainty about the credentials of forestry professionals	3.000	10
Forest certification	3.222	9
Insufficient number of trained loggers	3.200	5
Other (specify and include level of concern)		41

For the "Other" category on Question 2 (a total of 188 responses), the most commonly expressed concerns follow. Responses for the "Other" category in Questions 3 and 4 on the survey mirrored those of Question 2.

- Clearcutting (a mix of responses, with some supporting the practice and some protesting it)
    - Those for the practice often mention wildlife habitat (e.g., grouse)
    - Those against it, describe it as a destructive practice
- Prescribed burning
    - Most comments related to the practice were negative (e.g., questionable practice)
- Need to focus on non-motorized or low-impact recreation on public lands
- Logging on public lands
    - Primarily listed as threat, although some recommend increased logging to create wildlife habitat
- Lack old growth forests and need to protect/promote them
- Insufficient trail access on public forest lands
    - Most comments are specific to mountain biking or horseback riding
- Concerns about the impacts of using woody biomass for energy
- Lack of attention to non-timber forest products
- Lack of early successional habitat
- Highgrading during timber harvests (as a threat)
- Need for increased assistance for private landowners to support sustainable forest management
- Concerns about air quality and water quality
- Damage from coal mining and other mineral and gas extraction practices

On the survey, participants were asked to provide their affiliation. A summary list of the affiliations that were provided on the surveys follows.

Affiliation	Number
None	179
Sierra Club	113
Citizen/resident	85
Other	75
Urban/Community Forestry	54
Trail User	42
Governmental-Natural Resource Agency	39
Forest Landowner	36
College/University (includes Extension)	32
Other Environmental Advocacy Groups	29
Ruffed Grouse Society	25
Tree Farmer	23
Buckeye Forest Council	16
Professional Foresters	16
Other Wildlife or Hunting Group	10
Non-Governmental Organization-Natural Resource Mgt.	8
Forest Industry	6

"Additional Comments" from the Stakeholder Surveys:

1. Clearcuts and large-scale prescribed burning are questionable practices carried out in our public forests. We are lacking evidence to demonstrate that these destructive practices are necessary, and would like detailed analysis to prove otherwise. 2. Prioritize opportunities for low-impact recreation in our forests, such as hiking, camping, birding or paddling. 3. Work to reduce forest fragmentation and protect the biodiversity of the forests. 4. Increase assistance to private landowners who want to maintain their forest for future generations.
All this is hopeless unless we reduce human population.
As a forest owner and carpenter who uses native wood in all my buildings and furniture, I recognize the value and sustainability of wood. I, along with a majority of the public, would like to see what limited public lands there are maintained as biological / recreational reserves and not industrial forest. Though many cuts are considered sustainable, they will not recover in yours or my lifetimes. This will exclude these areas from tourism . Face it nobody likes to hike in a clear cut.
as a horse owner and landowner in Adams co I hope we use the public lands wisely so the trails and beautiful for the future riders and users
Camping fees in OH state parks are extremely high. Prohibitive for many young families. Check camping fees for Mohican State Park...outrageous! Fees should be standardized throughout the state!
Cincinnati Urban Forestry Dept. could be a valuable partner.
Clearcuts and large-scale prescribed burning are questionable practices carried out in our public forests. We are lacking evidence to demonstrate that these destructive practices are necessary, and would like detailed analysis to prove otherwise. Additionally, Prioritize opportunities for low-impact recreation in our forests, such as hiking, camping, birding or paddling. Work to reduce forest fragmentation and protect the biodiversity of the forests. And finally, increase assistance to private landowners who want to maintain their forest for future generations.
Considering using public forests as fuel for biomass should be categorically rejected!
Continue to have open trail use of resources for hikers, mountain bikers, and designated horse areas
It was good to meet you yesterday. Sorry that I couldn't be there for the entire meeting. I likely have some inconsistencies in my survey responses. Oh well... by the way, I performed a similar role to your's in 1980 with the first Statewide Forestry Resource Plan. It is interesting to reflect upon the differences and similarities of the perceived issues from then and now. Thanks for the opportunity to participate.
Do appreciate and use the state parks for hiking and camping. You are doing a good job in maintaining the campgrounds. Believe in keeping wildlife habitats.
DoF has some dedicated professionals and often does valuable work with meager funding. I appreciate your efforts!. I just wish the agency didn't prioritize resource extraction above other values. Furthermore, you need to implement a formal public comment process into the timber sale program.
don't have computer so email doesn't get checked often
Forests are not just profit potentials but the very preservation of our water, soil, wildlife and clean air. They should be treated as such.
Forests are part of a complex of land and water resources that make Ohio unique. The forests should be preserved and increased with greater effort on restoration of native species, preservation of water resources, habitat for animals and recreation. The State must coordinate with local government to create a plan that benefits rural and urban areas and reduces conflicts by making stream corridors and scenic resources part of the urban landscape. The monetary value of a forest experience is difficult to quantify but we all know the value of scenic wooded areas and the restful experience of natural areas. Our current national anxiety has been created by our seclusion away from the benefit of natural areas. Beautiful Ohio is not just a song.
glad you are doing this. forests are more important that people realize.
good luck in preserving our most important resource
Good luck with the development process.
Good luck.

Survey comments continued
Good survey
Have the Paul Bunyon show at Hocking college again
How often is this Forest Resource Assessment & Strategy prepared?
I am a nature photographer and writer I am willing to help in any way. The wildlife and land are the most important things to save.
I am a rabid tree-hugger ;)
I am a professional artist. I can do pro bono work to help with any cause.(Ie Posters, flyers, campaigns etc..)
I am convinced that cutting programs and manpower will in no way improve the forests of our beautiful state. Thank you
I am interested in these areas, but cannot assist, because of other responsibilities, other than trying to education young citizens about the important of topics discussed here (I am an educator)
I am not a professional, just an interested retired citizen.
I am opposed to prescribed burning except as needed to maintain small natural prairies such as Buffalo Beats. I am particularly concerned about the impact of April burns on the herb layer, most of which is not adapted to fires at that time of year. April burning is also a threat to turkey nests. I am not convinced that these fires are needed, and I fear that they are doing a lot of harm to the native herbaceous plants and small animals that can't escape them. I would also like to see far less logging in the state forests. With so little public land per capita in this state, the highest priorities for the state forest system should be biodiversity conservation and low-impact recreation. There is more than enough privately owned woodland in Ohio to meet the needs of the state's timber industry.
I appreciate the opportunity and look forward to working with you. I also plan to attend the meeting on January 5th at Fountain Square.
I believe that an educational component for children would be an important aspect of raising public awareness. The Cuyahoga Valley Environmental Education Center is a great model, but other ideas could include more outreach to schools, girl and boy scouts, etc. Also, community art teachers can partner in this project through developing forest-centered art projects, exhibitions, etc. I work at a community arts center, and there are many of these throughout the state.
I believe the American Chestnut Foundation is an excellent organization, with a very strong plan for re-introducing the American Chestnut Tree, the benefits of which are too numerous to ignore. Please take a leadership role in the process to re-introduce these amazing trees in Ohio.
I believe that the Division needs a marketing strategy to promote the benefits of forest management. My link to this was through the Ohio Sierra Club. This has always been the weakness of the Division. Work with OFA, loggers chapters as a united front/voice to get the message out. Thanks!
I did not like the way some of the questions were repeated. It seemed suspicious, somehow. I think this survey should be preceded by a list of issues and conflicting viewpoints/interests so that citizens can make more informed decisions about their answers.
I feel that the ethical issues and potential benefits associated with genetic engineering is fast approaching. It would behoove Ohio forest experts to begin a dialogue on this subject.
I filled out a hard copy a couple of weeks ago and have searched all over for it. I hope this isn't too late.
I have concerns about biomass electric generation. This may cause excessive forest harvesting and has limited energy potential on a sustained basis. Biomass energy should not be incentivized by the government. Wind and solar have much more potential with lower resource damage. We should seek to develop these sources first and foremost, along with improving efficiencies.
I heard about this survey vie Van Buren, Wendi. She is a long time contact with your department and a valued asset to our programming work here. Just wanted to pass that along to you, you have good people working for you.
I just filled out a survey for a study of private woodland owners conducted by OSU extension which might have useful background/complementary data for this project.

Survey comments continued
I just want to thank you for ANY and ALL efforts to save our forests, for ALL the wildlife. And, the truth is; (because of my compassion for ALL reptiles) when I see a forest, the first thought I always have is, "there is an untouched area where ALL wildlife, (especially reptiles) are living undisturbed and in peace". To me, that is VERY important!
I love the forests we have here in Ohio. I'm just afraid we are losing them.
I oppose logging in the state forests and the use of biomass from state forest lands to replace coal-fired power plants. Biomass projects should get their fuel from sustainably managed private lands. We need a legal and regulatory framework for making sure forest lands are managed sustainably.
I oppose the use of our forests as fuel for biomass in upcoming conversions of coal fired power plants – I am an engineering professor and the science does not support this. I oppose logging in our public forests - let nature run its course. I also oppose the use of prescribed burns in our forests - it has some advantages but not sufficient to warrant its use.
I think ODNR should work very closely with the poultry industry. I do not think ODNR is working with the poultry industry at all. I want ODNR to use bird manure a lot. It doesn't have to smell.
i think something needs done soon before it is too late and the grouse have dimminished
I think that forests should be managed for public enjoyment of wildlife/recreation. Forests should not be auctioned off to private logging companies for profit. They are OUR forests, and should serve our interests.
I understand that tree planting on old mines has not worked very well in the past, but if the cold hardy lob lolly works at my place i feel any tree is better than all the grass that is planted.
I was concerned in your presentation in Athens by the misleading chart that showed the percentage gain in trees of 29" dbh when there was no provision of data about how many trees are in this class. For example, a gain of 10 trees if there were only 3 to start is a big gain but obviously meaningless. What is the actual number of trees in this class? Thank you for your reply.
I was disappointed that the public meetings concerning this topic are not held on weekends.
I would like to help in issues you have brought up, but do not know where to look.
I would like to see more attention paid to NTFP in National Forest plans.
I would like to see more mountain biking opportunities in Ohio's forests.
I would love to provide whatever assistance I can to help solve some of these important issues.
I would really like to see the horseback riding trails continue to be available to the public.
If CAUV is severely diminished, landowners like me who have 232 acres and keep the lands free from parceling and non-agricultural use, won't be able to afford to keep these pieces of woodland.
I'm glad to see this survey.
In the future please send copies of surveys and correspondence on paper to the address given above. (Computer access is limited.)
In this time of job loss, we could certainly put people back to work managing our forests and moving away from the one age group forests we now have.
increase area managed as wilderness no more logging no use of forest as biomass for energy spend more controlling invasives acquire more forest, reducing fragmentation manage for biodiversity
Is there any chance for replenishment of the natural resources that were already harvested?
It is long past due for Ohio to implement a holistic forest protection strategy. I hope this effort will produce more than just a report on some politician's shelf.
Jeremey Scherf has been an outstanding resource. He is knowledgeable, professional and always willing to help.
keep doing what you do
Keep 'em wild!
Keep up the good work, the Division of Forestry does a wonderful job
Keep up the great work at the ODNR Division of Forestry!

Survey comments continued
Landowners will need educational assistance and monetary assistance to make any progress against these invasive plants.
Less logging, fewer roads, more hiking trails.
Let's have better, more timely information on public mtgs that have serious bearing on forestry matters. We had about 15 hours notice on the Athens meeting. A constructive effort.
manage forest for an immediate improvement in the grouse population in southern ohio with longterm plan to sustain levels of the late 70's early 80's population for all generations.
My wife and I drive from WV to ride Ohio trail systems. While in Ohio we frequent food establishments, stores and buy gas. The Ohio economy can benefit from attracting Mountain Bikers, hikers and other out door enthusiasts.
n/a
no
None.
Offering tea in addition to coffee would be nice - not everyone is coffee dependent.
Ohio has a National State Park which I discovered only recently. When asking others if they knew of it, the majority said "No". It just seemed quite interesting that as a life-time resident of Ohio, I had no knowledge of it, until recently.
Only wish the results will be followed up on to see a genuine desire to make our forests and land better
Our forests are an important part of climate regulation and provide environmental services as well as play a critical role for human physical and mental health. Our forests should not be used for forest paper products or biomass to electricity projects. We are at a critical tipping point with regard to climate crisis and the stresses that our forests are enduring. Ohio forests should be preserved for these services and future generations.
our forests are not cash cows to be slaughtered for profit they are our ecological history for preservation
Please keep horse trails in your state parks. Many people from different states come there to ride.
Please make it a priority to promote low-impact recreational activities in Ohio's forests.
Please preserve our forests and wilderness. It is our heritage and hope for the future. Thank you.
Please put ruffed grouse habitat at the top of your priority list. The wonderful game birds are almost gone, and the state has reallly just sat back and let it happen. I go to MI every fall. They at least have tried to manage for the ruffed grouse. I think we have enough deer and deer habitat for now!
PLEASE SAVE OUR FOREST!!! I AM NOT A FANATIC, BUT I WOULD LOVE IT IF THEY LAST SO THAT MY NEPHEW'S CHILDREN AND THEIR CHILDREN CAN KEEP BREATHING OXYGEN MADE BY OUR TREES, PLANTS AND GRASSES.
Please support policies that allow access for hiking and biking trails in Ohio forests. These trails allow people to experience the beauty of Nature and will increase their desire to protect and preserve Ohio's forests. Please open up more Ohio public land for hikers and bikers!
Please support policies that allow access for hiking and biking trails in Ohio forests. These trails allow people to experience the beauty of Nature and will increase their desire to protect and preserve Ohio's forests. Please open up more Ohio public land for hikers and bikers!
Please work with the factions of government that allow "development" and convince them of the unhealthy aspects of clear cutting--flooding, wildlife habitat loss and the loss of the aesthetic value of trees. Plus, they provide the planet with oxygen.
Public opinion, perception, and involvement are key.
retaining and acquiring conservation lands is of utmost importance.
Since one can't go back to make a change without starting totally over again, I would be interested to know how much DOF spent to have this survey designed. Pages of the same questions over and over that are designed to give DOF multiple ways to interrupt the answers to continue excessive cutting and burning and exploiting the small amount of State Forest that is held by the people of Ohio.

Survey comments continued
Small game habitat stamp or upland habitat stamp, ODNR has made nothing but excuses and no action until the ruffed grouse population has become almost extinct.
support: • Low impact recreation; • Protecting the biodiversity of the forest; • Reducing forest fragmentation. And that you oppose: • The use of our forests as fuel for biomass in upcoming conversions of coal fired power plants – more information on this will be posted to our web-site soon; • Logging in our public forests;
Thank you for all you do.
Thank you for allowing my opinion to be heard. Let's bring back Ohio's native forests.
Thank you for asking the public what we think should be prioritized. This act alone is a wise and appreciated effort.
Thank you for doing this survey.
Thank you for the opportunity to input and thanks for all your efforts in serving our community and others.
Thank you for the opportunity to participate in this planning process. For examples of very successful, sustainable, multi-use trail projects, look at the work Athens Bicycle Club has done at Lake Hope and Strouds Run state parks.
Thank You for the opportunity to voice our opinion.
Thank you for this opportunity to comment--
Thank you for your consideration!
Thank you for your continued efforts.
Thank you for your good work! Do the right thing.
Thank you for your time,
thank you very much for your time, I have your e-mail
Thanks for all you do, and for being open to public input!
Thanks for getting this assessment out. I was really pleased to see it.
Thanks for the opportunity to comment
Thanks for the opportunity to get involved.
Thanks for the opportunity to provide input Good luck with the process. Forests are an under-appreciated resource in this state.
Thanks for the outreach for comments.
Thanks for your efforts - this is an important job!
Thanks! Keep us posted. We have a lot of men and women who need the forest to thrive.
The assessment meeting in Columbus on 1/5 was excellent. However, somewhere in this process you have to get timber industry involvement. I did not see anyone from industry present at this meeting.
The Division of Forestry should not only be worried about economic tree species like oak. I do understand the natural benefit of oaks in a forest, but I believe that the department tries to maintain this species more for the economic benefit with the timber industry than it does for the benefit of the ecosystem. Prescribed burning in the East and Midwest has not had any significant scientific evidence that it does what it is intended to do. It is a very destructive practice and kills many species of plants and wildlife. The practice of circular prescribed burns by dropping fire pellets from the air while ground crew light a circular perimeter to keep the fire contained is absolutely unnecessary. While large species of wildlife may be able to flee and jump the fire rings, smaller species that nest on the ground like some bird species, or turtles, snakes, salamanders, insects, and rare and endangered lichen and plant species are all destroyed by the fire with no exit for escape. This practice should be stopped. Thank you.
The Division of Forestry Urban Forestry Department has been a critical part of our city's ability to manage our urban forest. Logan has a working tree commission because of the hard work of Ann Bonner.
The earth is vital to all, we need to get more folks interested in keeping our resources available to share.
the forests are to be protected not to be bought and sold, they are really irreplaceable and our children and grandchildren deserve to experience them too

Survey comments continued
The FRAS is a good start.
The public has no clue as to the value of forests. People don't care about nature. Ohio needs a bottle and can law to prevent littering on roads and parks. I KNUW, you can't legislate morality and common sense, but maybe money can talk to this issue. Students at all levels need to have data on this matter. They need data on C2, diversity, water supply, wildlife, wood burning, littering, carelessness. Biology courses and probably history at all levels should include this data!
This was a very thought-provoking survey and the long, detailed questions were challenging but I enjoyed them. They were helpful in clarifying the complexity of the inter-related issues.
Trees are very important to me and anything I can do to help to add them and care for let, I will
We have plenty of parks for hiking, bicycling. I would like to see more trails for motorized vehicles such as the Hatfield Mcoy system in West Virginia
we need taxation to do the job…nothing else is working…corporations do not care,……banks do not care…
We need to increase the protected lands, water and species for future generations. This not only for preservation but as recruiting tool for citizens and companies looking at expanding into Ohio. Closing of State forests and Parks is a poor option.
We really need to preserve our forests to keep the carbon-oxide levels low and to prevent the carbon-oxide levels at least even with the oxygen levels.
We should continue to work hard to preserve the natural beauty of this state.
Will coordinate the results with the OHC and its' membership. Good Survey
#2 Forest certification - threat to landowner We would be grateful to show our Power Point to the Division of Forestry leaders. We are working with County Auditors on a plan now. "Woodland Owners Tax Incentive Plan".
NOTE: There are several comments throughout the survey, please refer to hardcopy. We need to focus on Ailanthus and honeysuckle in both rural and urban settings. We need a state law to eradicate ailanthus. Please visit Stone Church Horse Trails and Camp to see just how destructive ailanthus can be to our native forests. If you , DNR, does not understand Ailanthus please study it. The division of forestry has very few service foresters. very few. However, the division of wildlife has a game protector law officer in every county-88 of them. How many foresters does DNR have? But, if it were not for the forests & proper forest management there would be no game to hunt. When the wildlife people need more money they just raise fees for licenses and issue more fines for violations. Forestry has no such cash cow! The Division of Wildlife needs to share some of its money with forestry. Please note that in addition to the Tree Farm System. I am also a participant in the cooperative hunting program. 88 Game Wardens? Never seen one. Foresters? See one every year. What's wrong with this picture?
#4 Poor timber harvesting - time of & hygrading #4 wildlife habitat loss - (riparian areas)
1) need to support forest industry & private sector 2) Be skeptical of pc statements & lack of supportive science on issues like global climate change, less politics more science for decision making.
Al Gore started out by calling it global warming, now their calling it climate change. I do understand the forest resource community stands to benefit from possible carbon sequestration/markets through cap and trade legislation. The attached article sums up my personal feelings.
biomass - cutting forests to burn in power plants is the greatest threat
Do not believe controlled burning is a viable solution for any of Ohio forests.
Education to the general public is key for gaining support for forestry and conservation programs. Most people are unaware what management of our natural resources means to ohio and as a citizen of Ohio. Also would like to see NRCS programs expand to include more exotic/invasive species control.
I am very concerned how the private timber cutters rape and butcher the forests with no oversight or restrictions.

Survey comments continued
I would like to see changes to the tax laws as I understand them to provide incentives for private land owners to protect their forests whether they sustainable log or do not log but protect for biodiversity of wildlife and plants. Provide tax value as well for mature and old growth forests if land owners do not want to log. To have assistance to landowners for invasive plant management.
Issue 2: Natural forest species composition is determined primarily by climate. Forests are natural ecosystems. Issue 8: Ohio forests 2006, pages 33-36 says there are increasing numbers of trees. There is no decline in reforestation. Issue 9: Ohio Forest 2006, pages 52-53 says timber quality is increasing. There is no decline in timber quality. Issue 13: Most insects and diseases are part of the natural forest ecosystem. The concern is population inbalances such as reduced pollinators or outbreaks of leaf predation. Issue 14: The issue is insufficiently trained loggers. I think there are plenty of loggers - anyone with a chainsaw - but many need additional training. There probably need to be state laws regulating safety, skills and knowledge. Issue 16: Invasive species, not just invasive plants. Issue 18: There are no fire-dependent species or communities in Ohio. None. The Amendments to Cooperative Forestry Assistance Act of 1978 specifically mentions the following threats to forests as being national priorities for private forest conservation: 1. catastrophic wildfires 2. hurricans 3. tornados 4.windstorms 5. snow or ice storms 6. flooding 7. drought 8. invasive species 9. insect or disease outbreak 10. development Only numbers 8 and 9 are incompletely mentioned in the survey The Amendments also specifically mention issues enhancing public benefits. Some of in the survey. Ones which are not are: 1. air quality 2. forestry-related jobs 3. production of renewable energy 4. wildlifre 5. wildlife corridors Subtitle A Sec 8007 Sec 13A "(c) Priority " The Secretary shall give priority for funding to States for which the long-term state-wide forest resources strategies submitted under section sA(a)(2) will best promote the national priorities psecified in section 2(c)." Funding is competative and is based on how well a strategy promotes the national priorities. Most of those national priorities were not even mentioned in the survey presented to the public for comment. How meaningful, then is such an incomplete survey. Unrelated to the federal law requirements for FRAS for applying for federal funding, here are some other issues and threats and opportunties to consider for trees and forests in Ohio: 1. mineral exploitation, removal 2. overharvesting of forest resources, poaching, illegal taking. 3. ORV use 4. compaction of soil 5. lack of protection for rare and endangered species 6. removal of forest nutritiion in addition to logs 7. destructive forest practices such as clearcutting, hi-grading and burning 8. anthropocentric perception and orientation and approach to forests. 9. lack of enforcement of laws related to activites on forest land. 10. lack of public awareness of state forestry program and operations. 11. lack of participation in forestry planning (public) 12. incomplete pricing of forest products and services including false pricing, lack of honest pricing, exclusion of externalities, goverment subsidies. 13. ingnorance, greed, short-term exploitation. 14. consideration of forest use for academic research, inspiration, spiritual, meditative, psychological, aesthetics ,beauty, stress relief relaxation, enjoyment, education, teaching 15. lack of government laws, policies and programs. 17. state laws permitting the DOF to keep some of the revenues from state and land timbering. Time permitting, I will submit additional comments relating to critiques of the FRAS survey, the federal law requiring FRAS and the FRAS public meeting I attended.
It could be easier for people to partner or participate if there were a bit of a list more specifiec. Several communications with interested parties could lead closer to goal. How can we more consistently take better care (manage) of the trees most likely to affect us aesthetically and physically?
large % of forest in private landowner so improvements to that.
May be a need for wood pellet industry in Ohio to harvest smaller imperfect trees too much storm damage trees are going to waste.

Survey comments continued
NOTE: Several comments throughout the survey - see hard copy. Thanks for the opportunity to comment. Fundamentally flawed national theme. #3 "Enhance Public Benefit" - Won't work in the long run if forest benefits are looked at after satisfying the public. (our current standard of living made possible by a healty ecosystem and cant ??? in its absence.) Fundamentally flawed economic theory - You can't have continued unlimited economic growths when this growth is soley dependent on limited national resources. (stable population zero growth the only solution). The big picture, as I see it, shows us that ecosystems are collapsing throughout the world. The collapses are not due to natural phenomena. Human overpopulation and consumption are responsible. For this reason, I believe that management practies shouldn't contribute to or multiply the stress damage that is already self evident. Disease, exotics, insect damage, are symptoms that would not exist if the health of the forest were maintained. Unfortunately I am not overly optimistic that anything will change for the better as a result of State action. I've seen too many expamples in my life where "knowing better does not translate to doing better. Current practices are often in violation of law as that civilians must follow but routinley voilated by the state. ex. prescribed fires violating air quality laws & water quality laws, ex. I can't possess a great horned owl or even a feather, but clearcutting routinely destroys the nests, birds and habitat. ex. I can pay the state for a permit to possess an amphibian or reptile. The state can burn these at will. I've seen this first hand. This seems like the state must destroy the forest to save it.
Note: A double check mark and/or a double circle identifies this subject item in my opinion as exptremely important to the ongoing sustainability of private woodland owners, and their forests.
The ohio Division of Wildlife has promoted large population of deer for their own benefit resulting in significant forest damage as well as crop and urban damage.

Meetings with Key Partners & Statewide Committees

In gathering input from stakeholders for the statewide forest resource assessment and strategy, the previously described regional meetings and stakeholder surveys had diverse representation from across the state on key forest issues. However, the Ohio Division of Forestry also held separate discussions on the assessment and strategy at meetings with a few key partner organizations and at several statewide committees with a natural resource or forestry focus (list follows). Many of the Division's key partners are represented on the various statewide committees. Discussions at these meetings covered various topics related to the statewide forest assessment and strategic planning, but they focused on the following: 1) ensuring accurate and current data in the assessment, 2) identifying key forest issues and statewide strategies, and 3) identifying or expanding partnerships to implement those strategies.

Meeting Dates and Organizations Represented:

- February 17, 2010: U.S. Fish & Wildlife Service, Ecological Services Ohio Field Office; U.S. Forest Service, Wayne National Forest; U.S. Forest Service, Northern Research Station (Delaware Laboratory)
- March 3, 2010: U.S. Forest Service Northern Research Station (Delaware Laboratory)
- March 11, 2010: The Nature Conservancy in Ohio
- April 5, 2010: Ohio Division of Wildlife

Statewide Committees and Dates When Assessment and Strategy Discussed:

- State Technical Committee: November 12, 2009, April 8, 2010
- Ohio Forest Stewardship Committee: November 30, 2009, April 9, 2010
- Urban Forestry Advisory Committee: December 11, 2009
- Forest Advisory Committee: January 22, 2010

Appendix B

Geospatial Analysis: Rural Lands Methodology

Ohio's Statewide Forest Resource Assessment 2010
Completed by the Ohio Department of Natural Resources, Division of Forestry

Discussion of the Analysis Process

All analyses were completed using ArcGIS 9.3 (ArcView license level) and Spatial Analysis Extension tools. Data used in analyses were acquired from multiple sources (see Table B1). After acquisition, each data set needed to be prepared in some way. Some final data sets used in the analysis were derived from original datasets. A complete discussion of each data set follows.

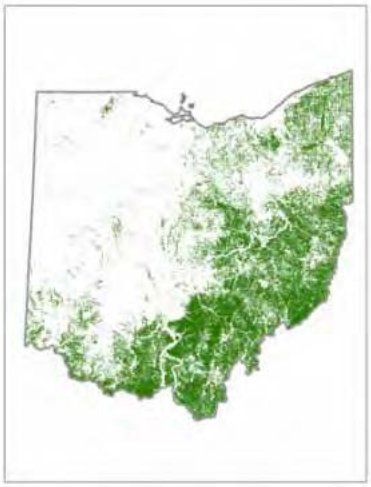
Table B1: Data Sources

Data Layer	Data Source
Forest Patch Size	Derived from datasets prepared by Riemann, USFS NRS (2009) based on NLCD 2001.
Riparian Corridor	Derived from ODNR hydrography data
Priority Watershed	Derived from ODNR state and national scenic rivers and USDA FS Ability to Produce Clean Water data (2009)
Forest Pests	Ohio Department of Agriculture (2009)
Public Water Supply	Derived from Ohio EPA (2009)
Change in Households	Derived from census data – D.M. Theobald, Colorado State University (2008)
Wetlands	Derived from USFWS National Wetlands Inventory and Ohio GAP data (2008)
TES Species	Derived from ODNR Natural Heritage Database (2009)
Proximity to Public Land	Derived from ODNR public ownership layer (2008)
Slope	Derived from USGS DEM (2006)
Wildfire Risk	ODNR Forestry (2009)

Forest Patch Size

Forest patch size is intended to place a priority on forest patches of a certain size threshold. For the purposes of the Ohio analysis, forest patches of 100 acres or greater were selected. To accomplish this, the nrs_psizerc dataset developed by Riemann was utilized. An explanation of the dataset follows:
nrs_psizerc – an nrs-wide 30m dataset of forest by patch size class
This is a dataset of NLCD 2001 forestland labeled by patch size class. Patches are made up of forest pixels adjacent by a side (vs. by a corner).

- 1 = < 50 acres (202350 sq. m)
- 2 = 50 – 100 acres (404700 sq. m)
- 3 = 100-500 acres (2023500 sq. m)
- 4 = 500-1000 acres (4047000 sq. m)
- 5 = 1000-5000 acres (20235000 sq. m)
- 6 = 5000-10000 acres (40470000 sq. m)
- 7 = 10,000-50,000 acres (202350000
- 8 = > 50,000 acres



Steps taken to prepare the dataset for use in the overlay analysis included extracting value classes 3 through 8 to include only forest patches of 100 acres and greater, and reclassifying the resulting dataset, where remaining forested cells received a value 1, all other cells were assigned a value 0.

Riparian Corridor

Riparian corridors are high priority forests for proper management because of the important role that they play in water quality and wildlife habitat, both in stream and near stream. A priority area for riparian forests was derived from a statewide hydrology vector dataset (streams) available from the Ohio Department of Natural Resources which was derived from USGS data. The value area shown consists of a 300 foot buffer around all perennial streams and shorelines. For analysis, the layer was converted to a raster and all cells within the 300 foot buffer were assigned a value 1, all other cells were assigned a value 0.

Priority Watershed

The priority watershed layer is comprised of two components: subwatersheds (HUC 12) containing Ohio designated scenic waterways, and subwatersheds in Ohio containing a value >= 15 as determined by the USDA Forest Service Ability to Produce Clean Water analysis (December 2009). For analysis, the layer was converted to a raster and all cells within the priority area were assigned a value 1, all other cells were assigned a value 0.

Forest Pests

This layer depicts areas of concern regarding forests pests in Ohio. This layer was constructed using Ohio Department of Agriculture emerald ash borer data and gypsy moth data. First, XY coordinates for all confirmed EAB infestations in OH (as of December 22, 2009) were displayed, and a 15 mile buffer around each point was constructed. To this was added the "action" and "state" portions of the current ODA gypsy moth STS area. The combination of these two components constituted the forest pest value area. For analysis, the layer was converted to a raster and all cells within the area of concern were assigned a value 1, all other cells were assigned a value 0.

Public Water Supply

The public water supply layer used was developed by the Ohio Division of Forestry for the 2008 Spatial Analysis Project.

Explanation follows:

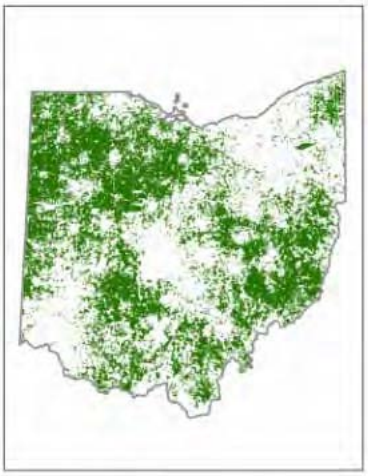
Public water supply is intended to give added weight to areas that surround surface water intakes. Forests in these areas can positively influence water quality through there filtration and uptake of pollutants. Sub-watersheds were selected that contain surface water intakes. This was a restricted data set acquired from the Ohio Environmental Protection Agency. Watersheds were intersected with the point layer and the resultant watersheds were converted to a raster with the intersecting watersheds receiving a value 1 and all others receiving 0.

RESTRICED DATASET – NO IMAGE

Change in Households

The housing change layer used was developed by Ervin for the 2008 Spatial Analysis Project. Explanation follows:

Change in households is intended to reflect housing density. A classification used in a U.S. Forest Service publication, "Forests on the Edge" used a projection of housing units per hectare in the year 2030. The data were classified into urban, suburban, exurban and rural. For the purposes of this project, the areas projected to remain rural in the year 2030 will serve as the priority areas. This analysis, performed by D.M. Theobald at Colorado State University was developed using Census data and a model that predicts future population densities. This data layer has been commonly used in this analysis in other states across the United States and is considered the best data set for use in this analysis.



Code	Housing Units/Ha (*1000)	Range Classification
1	<=1	Rural
2	1 -8	Rural
3	9 - 15	Rural
4	16 - 31	Rural
5	32 - 49	Rural
6	50 - 62	Rural
7	63 - 82	Exurban
8	83 - 124	Exurban
9	125 - 247	Exurban
10	248 - 494	Exurban
11	495 - 1454	Exurban
12	1455 - 4118	Suburban
13	4119 - 9884	Urban
14	9885 - 24711	Urban
15	24712 - 9999999	Urban

Wetlands

Digital National Wetlands Inventory shapefiles originally compiled at 1:24,000 scale by the U.S. Fish and Wildlife Service together with the Ohio GAP land cover data set were used as the source for this layer. Wetland areas were selected from these layers, and a union overlay was employed to merge the sets together. For analysis, the layer was converted to a raster and all cells within identified wetlands were assigned a value 1, all other cells were assigned a value 0.

Natural Heritage (Threatened & Endangered Species)

Recorded occurrences of threatened and endangered plant and animal species were extracted from the Ohio Department of Natural Resources - Division of Natural Areas and Preserves, Natural Heritage Database (11/10/2009). All occurrences (both point and polygon features) were buffered by 300 feet. For analysis, the layer was converted to a raster and all cells within the 300 foot buffer zone were assigned a value 1, all other cells were assigned a value 0.

RESTRICTED DATASET – NO IMAGE

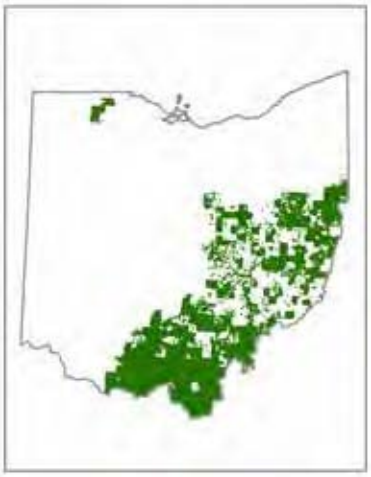
Proximity to Public Land

The proximity to public land layer used was developed by Ervin for the 2008 Spatial Analysis Project.
Explanation follows:
The proximity of private forest land to public land is considered important as government already has an investment in the public lands and management of these proximate private lands can have an influence on the public lands. A private land holding was considered proximate if it was within one mile of a public land holding. A public land vector file was established, buffered by the one mile distance and converted to a raster with the buffered area given a value of "1" and all other areas "0". The data source was acquired from ODNR (Protected_lands9a_sps83.shp) and all ODNR lands, federal and metro park system lands were used in the analysis. The referenced dataset is the best (only known) dataset of public land at this time and as such was deemed the most appropriate for use in this analysis.

Slope

This is the slope layer that was utilized in the November 2006 Ohio Methodology Forest Stewardship SAP.
Explanation follows:
Slope in this analysis is used as a proxy variable for economic potential of forest areas. Forests occupying areas of certain slope classes are considered to be economically feasible to manage. In the Ohio analysis, slopes of less than 40% are considered to be manageable by the most common logging equipment (rubber tired skidders). Slope of less than 5% was screened out as it was assumed that much of this land has been converted to agriculture.
A statewide 30 meter Digital Elevation Model (1:24,000 scale source) from the National Elevation Dataset (USGS) was used to select areas where slope is between 5% and 40%. Percentage slope was derived from the Ohio 30 meter Digital Elevation Model (DEM) raster file using the Spatial Analyst "Surface Analysis" tool, at a cell size of 30 and named SlopePer30. A complete merged DEM of the state of Ohio was downloaded from the Ohio metadata explorer.

Wildfire Risk



This layer depicts wildfire hazard across Ohio. Areas containing a value 1 are those that are determined to be of moderate, high, or very high wildfire hazard according to a July 2009 wildfire hazard assessment conducted by ODNR Division of Forestry. The analysis combined values from three layers: Wildland-Urban Interface, wildfire occurrence (measured by township), and wildfire acres burned (measured by township).

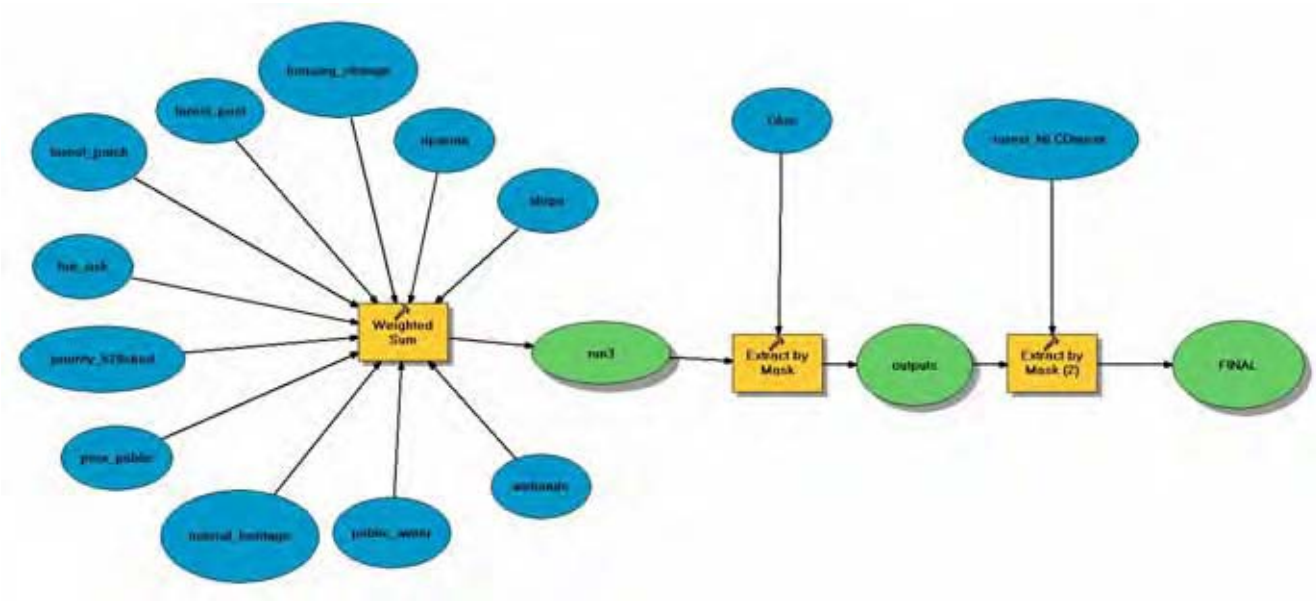
Spatial Overlay Analysis

Using the datasets described above, a weighted sum analysis was performed in ArcGIS 9.3 Model Builder. Table B2 provides weighted value information. Two additional operations were performed within the model (Figure B1). First, an extract operation clipped the resulting raster to the Ohio boundary, and a second extract operation masked out all land not classified as forested in the NLCD 2001 dataset.

Table B2: Layer Criteria and Weighting

Criteria	**Value (%)**
Forest Patch Size	16
Riparian Corridor	11
Priority Watershed	11
Public Water Supply	11
Change in Household	9
Wetlands	9
Natural Heritage	9
Proximity to Public Land	9
Forest Pests	6
Slope	5
Fire Risk	4

Figure B1: FRAS Model used in evaluation calculation.



Appendix C

Potential Multi-State Priority Areas and Projects

Appalachian Region, Multi-State Priority Area

Developed by the USDA Forest Service, 10/16/09

1. General Area/Boundary Description

The Appalachians are among the oldest mountains on Earth. They extend almost 2,000 mi from the Canadian provinces of Newfoundland and Labrador in the northeast, southwestward to Alabama in the U.S. They include the White Mountains in New Hampshire, the Green Mountains in Vermont, the Catskill Mountains in New York, the Allegheny Mountains primarily in Pennsylvania, the Blue Ridge Mountains in Virginia and North Carolina, the Great Smoky Mountains in North Carolina and Tennessee, and the Cumberland Plateau extending from West Virginia to Alabama. Their highest peak is Mount Mitchell in North Carolina.

The Appalachian Region discussed in this summary focuses more on the Mid-Atlantic States and south, more so than the Appalachians that extend into New England region. The region (see map below) is a 205,000-square-mile area that follows the spine of the Appalachian Mountains from southern New York to northern Mississippi. It includes all of West Virginia and parts of 13 other states including Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia.

2. Major Landforms

The Northern **Ridge and Valley Province** is a physiographic province of the larger Appalachian division and is also a belt within the Appalachian Mountains extending from southeastern New York through northwestern New Jersey, westward into Pennsylvania and southward into Maryland, West Virginia, Virginia, Tennessee, Georgia and Alabama. They form a broad arc between the Blue Ridge Mountains and the Appalachian Plateau physiographic province (the Allegheny and Cumberland Plateaus). These mountains are characterized by long, even ridges with long, continuous valleys in between.

The **Appalachian Plateau** (or Allegheny Mountains) is the western part of the Appalachian Mountains, stretching from New York to Georgia and Alabama. From the east the escarpment that forms the edge of the plateau has the appearance of a mountain range. However, technically it is an eroded plain of sedimentary rock not mountains. A large portion of the plateau is a coalfield formed during the Pennsylvanian Period (320 to 286 million years ago). The surface of the plateau slopes gently to the northwest and merges into the Interior Plains.

The northern-most regions of both provinces were glaciated. This section is less hilly and lacks the rugged quality of the unglaciated landscape. Evidence of the region's glacial past includes bogs, kettle lakes, and a landscape marked by small hills of sand and gravel called "kames." Today, the area is marked by smaller tracts of forests, ranging from a few acres to hundreds of acres.

A major attraction to the area is the Appalachian Trail. It is the nation's longest marked footpath, at approximately 2,178 miles and was designated in 1968 as the first national scenic trail. It crosses six national parks and numerous local state parks and forests; six national forests; and 14 states. More than 2,000 rare, threatened, endangered, and sensitive plant and animal species are located near or around the trail route. Thousands of people use the trail -- most just for short day hikes or an overnight backpacking trip. Others set out for weeks or months on the trail. Hundreds of people each year hike the entire length of the trail in one season.

3. Forests and other ecological attributes

The Appalachian Region is divided into four major physiographic provinces, which will be described here. For additional information on fauna, climate, disturbance regimes and land uses, see Addendum A.

A. **Northern Ridge and Valley** (includes MD, NC, NY, PA, VA, WV, and VA)

This section is a series of parallel, southwest to northeast trending, narrow valleys and mountain ranges (high ridges) created by erosion of tightly folded, intensely faulted bedrock. The eastern boundary is the Great Valley low land; the western boundary is a steep, high ridge, the Allegheny Front. Some of the strip-mined lands exhibit hummocky or gouged topography. Elevation ranges from 300 to 4,000 ft.

Because much of this area lies in the rain shadow of the Allegheny Mountains Section, vegetation conditions are drier. Kuchler types are mapped as Appalachian oak forest, oak-hickory-pine forest, and some northern hardwoods forest. Before arrival of the blight that decimated the chestnut, it was the dominant species in this Section. Oaks now dominate and generally red and white oaks occur on more productive, moderately moist sites. Eastern white pine can occur with white oak on the lower portions of slopes. Scarlet and black oaks are more common on drier sites. On the driest sites, oaks are mixed with pitch, table-mountain, or Virginia pines. The latter can also occur as pure stands.

B. **The Blue Ridge Mountains** (includes PA, MD, WV, VA, NC, GA, and TN)

The **Blue Ridge** is a physiographic province of the larger Appalachian Mountains range. The northern half is narrow, about 14 miles wide but broadens to 70 miles in its southern half. The mountain range starts at its southern-most portion in Georgia, and terminates in south-central Pennsylvania. To the west of the Blue Ridge, between it and the bulk of the Appalachians, lies the Great Valley, which is bordered on the west by the Ridge and Valley province. Elevation ranges from 1,000 to over 6,000 feet. Local relief ranges from 500 to 1,000 feet. Mt. Mitchell, the highest point in eastern North America (6,684 feet) occurs here.

Within the Blue Ridge province are two distinct sections: the Shenandoah in the northern section and the Great Smoky Mountains in the southern section. The Blue Ridge also contains the Blue Ridge

Parkway, a 469-mile long scenic highway that connects the two parks and is located along the ridge crestlines along the Appalachian Trail.

Kuchler classified vegetation as Appalachian oak forest, southeastern spruce-fir forest, and northern hardwoods. Forests are dominated by oaks, consisting of black, white, and chestnut oaks that are found on dry mountain slopes; pitch pine is often a component along ridge tops. Yellow-poplar, red maple, northern red oak, and sweet birch dominate the valleys and moist slopes. Smaller sections of forests between mountains are dominated the hardwood-pine cover type of scarlet, white, blackjack, and post oaks and shortleaf and Virginia pines. Table-mountain pine, a fire-dependent species with serotinous cones, occurs on dry ridge tops where fire was historically more common. Eastern white pine dominates small areas of the Blue Ridge escarpment joining the Southern Appalachian Piedmont Section. Mesic sites at higher elevations (4,500 feet) are occupied by northern hardwoods (e.g., sugar maple, basswood, and buckeye); drier sites are dominated by northern red oak. Red spruce and Fraser fir are found above altitudes of about 5,000 to 6,000 feet.

C. Northern Appalachian Plateau **(Allegheny Mountains –** includes PA, MD, and WV)

This Section is a dissected plateau with high, sharp ridges, low mountains, and narrow valleys. It has broad, northeast to southwest trending folds in the bedrock. Elevation ranges from 1,000 to 4,500 feet, with a few peaks higher, notably Spruce Knob (4,861 feet), the highest point in West Virginia. Local relief generally ranges from 1,000 to 2,500 feet.

The Allegheny Mountains can be placed in four broad forest type groups: red spruce, northern hardwoods, mixed mesophytic, and oaks. Red spruce is usually found above 3,500 feet and includes stands of American beech and yellow birch. The northern hardwood group features sugar maple occurring with beech and black cherry. The mixed mesophytic species are red oak, basswood, white ash, and yellow-poplar. The productive, diverse cove hardwoods are included in this group. Oak sites occur mostly on foothills, but are much less common in this Section than in the Northern Ridge and Valley Section.

D. **Cumberland Mountains** (western and eastern coalfields of WV, Black Mountain section of KY, and southern Cumberlands in KY)

This section contains mountains and dissected uplands. Landforms are mainly low mountains where less than 20 percent of the area is gently sloping. Elevation ranges from 2,000 to 2,600 feet.

Kuchler classified vegetation as mixed mesophytic forest, Appalachian oak forest, and northern hardwoods. The predominant vegetation is hardwoods with a mixture of pine. Existing forest types consist of oak-hickory; white, black, scarlet, and blackjack oaks; and common hickories including mockernut and pignut.

4. Landownership Characteristics

The majority of the Appalachian region's timberland is privately owned, most of it in small lots of fifty acres or less. Several landowners own 1,000 or more acres throughout the region, and 5 and 10-acre tracts are becoming common and wide spread.

Agriculture, urban and suburban clusters, mining areas, and other features are interwoven into the landscape. Absentee ownership and secondary homes are prevalent with many properties owned by people who reside in the more populated eastern coast.

5. Population attributes

About 24.8 million people live in the 420 counties of the Appalachian Region; 42 percent of the population is rural, compared with 20 percent of the national population. In the past, the Region's economy was based mostly on extraction of natural resources and manufacturing. The modern economy is gradually diversifying, with an emphasis on services and widespread development of tourism, especially in more remote areas where there is no other viable industry. Coal remains an important resource, but it is not a major provider of jobs, with the exception of, perhaps, West Virginia. Manufacturing is still an economic mainstay but is no longer concentrated in a few major industries.

Because of crop failures on mountain farms, grazing came to dominate the area, and its influence continues. Farmers often created open grassy areas, called sods, by cutting the timber, removing the logs, and burning the slash. From 1880 to 1920, major logging and sawmilling denuded the landscape. Fires raged throughout the forests, laying soils open to erosion. Today, extractive industries prevail, along with a traditional mountain culture. However, a more recreation-oriented lifestyle has emerged to cater to the needs of urban dwellers from East Coast metropolitan areas.

The Appalachians are crisscrossed with major interstates including I-40, I-59, I-64, I, 68, I-70, I-75, I-76 (Pennsylvania Turnpike and its northern extension I-476), I-77, I-78, I-79, I-80, I-81, I-84, I-85, I-86, I-87, and I-90. These road systems bridge the urban and rural areas of the region, posing threats to the landscapes. Major development has occurred along all of these interstates and creates problems for forest management, resulting in fragmentation and parcellation, and additional issues with forest health and invasive species. For example, emerald ash borer has spread because of the major travelways between states.

Tourism, in general, generates $26 billion per year in direct revenue to the States within the region.

Human population growth and the demand for natural resources are impacting the landscapes. Pollution, contaminants, and landscape changes related to human activities threaten the integrity of the region’s water resources.

6. Communities/Major Population Centers

Georgia – Dalton, Rome
Kentucky – Berea, London, Pikesville, Williamsburg
Maryland – Cumberland
New York – Binghamton, Elmira
North Carolina – Ashville
Ohio – Athens, Zanesville
Pennsylvania – Erie, Harrisburg, Pittsburgh, Scranton-Wilkes Barre
South Carolina – Greenville
Tennessee – Chattanooga, Johnson City, Kingsport, Knoxville

Virginia – Blacksburg, Covington, Lexington
West Virginia – Beckley, Charleston, Huntington, Parkersburg, Morgantown, Wheeling

About 24.8 million people live in the 420 counties of the Appalachian Region; 42 percent of the Region's population is rural, compared with 20 percent of the national population.

7. Water Resources

The Appalachians contain tens of thousands of miles of headwater streams and are the headwaters of major, national rivers. The major rivers of the 11-state area include Allegheny, Delaware, Greenbrier, James, Kanawha, Monongahela, Muskingum, Potomac, New, Ohio, Scioto, Shenandoah, Susquehanna, and Tennessee.

Streams are most active in the spring due to frequent rainfall and snowmelt. Many smaller streams dry up in the summer and are not recharged until October to November. The **Northern Ridge and Valley Section** includes the headwaters of the Potomac and Greenbrier Rivers. Streams are generally more alkaline and productive than in the Allegheny Mountains. The **Appalachian Plateau** contains headwaters of the Cheat and Greenbrier Rivers, which eventually feed through other tributaries into the Ohio River, and the Allegheny and Monongahela Rivers which form the Ohio in Pittsburgh. Streams are generally more acidic and less productive than in the Northern Ridge and Valley Section. Wetlands are scarce in both sections.

Parts of the region have the highest rates of atmospheric acid deposition in the Unites States, resulting in acidic streams. This is compounded by acid mine drainage from abandoned mine lands.

Over 31 percent of the stream miles are in poor condition based on a fish Index of Biotic Integrity or aquatic insect indicators.

8. Major Forest Conservation Challenges

- The headwaters of the Chesapeake Bay and Ohio River were formed in the region and have major water quality issues ranging from sediment and nutrient pollution to water withdrawl for oil and gas exploration. Stream degradation and water quality impacts from flooding, increased impervious surface and pollutants from cars, homes, and businesses continues to increase.
- Abandoned mine lands occur throughout the region and continue to contribute sedimentation and other pollutants into various water bodies. Without reforestation they will continue to erode and pollute waters with acidic drainage.
- The Marcellus shale region within the Appalachians has increased gas exploration, is impacting water resources, and contributes to forestland disturbance and fragmentation.
- Competition with invasive and exotic species is impacting forests. Species of significant concern include, but are not limited to hemlock wooly adelgid, beach bark disease, emerald ash borer, gypsy moth, Asian long-horned beetle, tree of heaven, Japanese stiltgrass, and garlic mustard.
- Keeping forests in forests through sustaining traditional timber markets and developing non-traditional markets is an ongoing challenge.
- With the majority of land use in forests and private ownership, biomass, carbon trading, ecosystem services, and carbon credit issues need to be introduced into this region.

- Conservation education programs across the region are inadequate for the magnitude of the benefits, issues and trade-offs related to forest conservation. The ultimate outcome is greater integration of the benefits of forest cover, forestry, and natural resource conservation into public education and public policy decisions. The need for public understanding of the importance of forests, and the trade-offs involved when forest cover is degraded or removed is critical. The lack of understanding of the local and global trade-offs stemming from degraded forest cover, results in a lack of support for natural resources issues and adverse decisions for forests.
- Water resources need protected for the nearly 25 million area residents, and for public water uses downstream from the headwaters of this region, e.g. Chesapeake Bay.
- Conservation of the natural landscape important to wildlife habitat. Many landscape-scale habitat areas and wildlife corridors necessary for wide-ranging animals are unique to the region and will need protection from fragmentation.
- Protection of critical long-term ecological health of the region.
- Retention of green space for outdoor recreation, as an important living filter/buffer between growing urban areas.
- Protection of the region's attributes to ensure its economic viability and livability.
- Suburban sprawl threatens the drinking water supply, forests, farms, wildlife habitat, historic, recreational, and scenic resources.

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Addendum A:
Major Landform Descriptions and Other Attributes of the Appalachian Region

I. <u>**Northern Ridge and Valley**</u> <u>(includes MD, NC, NY, PA, VA, WV, and VA)</u>

Geomorphology. This section is a series of parallel, southwest to northeast trending, narrow valleys and mountain ranges (high ridges) created by erosion of tightly folded, intensely faulted bedrock. The eastern boundary is the Great Valley low land; the western boundary is a steep, high ridge, the Allegheny Front. Some of the strip-mined lands exhibit hummocky or gouged topography. Elevation ranges from 300 to 4,000 ft.

Soil Taxa. Soils are derived from heavily-weathered shale, siltstone, sandstone, cherty limestone, and limestone.

Potential Natural Vegetation. Because much of this area lies in the rain shadow of the Allegheny Mountains Section, vegetation conditions are drier. Kuchler types are mapped as Appalachian oak forest, oak-hickory-pine forest, and some northern hardwoods forest. Before arrival of the blight that decimated the chestnut, it was the dominant species in this Section. Oaks now dominate and generally red and white oaks occur on more productive, moderately moist sites. Eastern white pine can occur with white oak on the lower portions of slopes. Scarlet and black oaks are more common on drier sites. On the driest sites, oaks are mixed with pitch, table-mountain, or Virginia pines. The latter can also occur as pure stands.

Wildlife/Fauna. The black bear is the largest carnivore of the area. White-tailed deer are abundant and can have a major impact on understory flora. The endangered Virginia big-eared bat and Indiana bat are associated with the karst areas of the region. Bird species are diverse and include a wide variety of both residents and neo-tropical migrants. Game birds include ruffed grouse and wild turkey. In recent years bald eagles have increased in the area, and falcons have been reintroduced. Brook trout occur at higher elevations, with smallmouth bass, rock bass, minnows, and darters at lower elevations. Amphibians and reptiles are abundant. Insect life is highly diverse. Some butterfly and moth species are still being identified. In recent years, gypsy moth has become established and is affecting forests.

Climate. Mean annual precipitation is generally 30 to 45 inches. In the transition zone with the Allegheny Plateau, rainfall may range as high as 60 inches. Approximately 20 percent falls as snow, with 30 percent at elevations above 3,500 feet. Mean annual temperature is approximately 39 to 57 degrees F. The growing season ranges from 120 to 180 days, with local variation.

Disturbance Regimes. Fire was used extensively by Native Americans. Major historical disturbances include grazing from about 1780 onward and extensive logging from 1880 to 1920. Many logging operations were followed by fire. Since the 1930's, many fires have been suppressed through Federal and State agency efforts.

Land Use. Farming, grazing, and hay production are common on river flood plains and in the nutrient rich limestone valleys. On forested sites, timber production is an important industry. This Section receives light but extensive recreation pressure for fishing, hunting, camping, and hiking. Canoeing and rock climbing occur in certain areas. Settlements tend to be small and dispersed.

II. **The Blue Ridge Mountains** (includes PA, MD, WV, VA, NC, GA, and TN)

Geomorphology. The **Blue Ridge** is a physiographic province of the larger Appalachian Mountains range. The northern half is narrow, about 14 miles wide but broadens to 70 miles in its southern half. The mountain range starts at its southern-most portion in Georgia, and terminates in south-central Pennsylvania. To the west of the Blue Ridge, between it and the bulk of the Appalachians, lies the Great Valley, which is bordered on the west by the Ridge and Valley province. Elevation ranges from 1,000 to over 6,000 feet. Local relief ranges from 500 to 1,000 feet. Mt. Mitchell, the highest point in eastern North America (6,684 feet,) occurs here.

Within the Blue Ridge province are two distinct sections: the Shenandoah in the northern section and the Great Smoky Mountains in the southern section. The Blue Ridge also contains the Blue Ridge Parkway, a 469-mile long scenic highway that connects the two parks and is located along the ridge crestlines along the Appalachian Trail.

Soil Taxa. Soils are generally moderately deep and medium textured. Boulders and bedrock outcrops are common on upper slopes. Colder soils are typically present at elevations above 4,800 feet. Soils receive adequate moisture for growth of vegetation throughout the year.

Potential Natural Vegetation. Kuchler classified vegetation as Appalachian oak forest, southeastern spruce-fir forest, and northern hardwoods. Forests are dominated by oaks, consisting of black, white, and chestnut oaks that are found on dry mountain slopes; pitch pine is often a component along ridge tops. Yellow-poplar, red maple, northern red oak, and sweet birch dominate the valleys and moist slopes. Smaller sections of forests between mountains are dominated the hardwood-pine cover type of scarlet, white, blackjack, and post oaks and shortleaf and Virginia pines. Table-mountain pine, a fire-dependent species with serotinous cones, occurs on dry ridge tops where fire was historically more common. Eastern white pine dominates small areas of the Blue Ridge escarpment joining the Southern Appalachian Piedmont Section. Mesic sites at higher elevations (4,500 feet) are occupied by northern hardwoods (e.g., sugar maple, basswood, and buckeye); drier sites are dominated by northern red oak. Red spruce and Fraser fir are found above altitudes of about 5,000 to 6,000 feet.

Wildife/Fauna. Many species of small mammals and birds with northern or boreal affinities reach their southernmost range in the Blue Ridge. These include the New England cottontail rabbit, northern water shrew, rock vole, northern flying squirrel, Blackburnian warbler, and saw-whet owl. This Section supports the largest diversity of salamanders in North America. Most species are found in the central and southern subsections, where topographic relief is greater, peaks are more isolated, and higher rainfall occurs. Isolated populations of the green salamander and bog turtle are found in the southernmost subsection.

Climate. Average precipitation is 40 to 50 inches but ranges up to 60 inches on the highest peaks. Along parts of the southern Blue Ridge escarpment bordering the Southern Appalachian Piedmont Section, rainfall averages over 80 inches, the highest in the eastern U.S. Precipitation is about equally distributed throughout the year and relatively little occurs as snow. Mean annual temperature is 50 to 62 degrees F and ranges from 38 degrees F in January to 76 degrees F in July. The growing season lasts 150 to 220 days, but varies according to elevation and the influence of local topography.

Disturbance Regimes. Fire, wind, ice, and precipitation are the principal causes of natural disturbance. Fire caused by lightning is more prevalent in some areas, especially in the vicinity of

Grandfather Mountain. Tornadoes are uncommon, but localized "micro-bursts" of intense winds are more prevalent, which cause small patches of trees to be up-rooted, especially on mountain slopes. Winter ice storms are common at mid-to-high elevations and intense rainstorms have been known to cause localized scouring and erosion of drainage channels, followed by siltation, sedimentation, and flooding downstream. The chestnut blight caused considerable disturbance to the composition of most forest stands from 1920 to 1940. Gypsy moth has caused a major impact because of the dominance by oaks.

Land Use. About 35 percent of the area is in agriculture and urban development, mostly in broad valleys between major mountain ranges. Hunting, hiking, and trail biking are major forest recreational uses. Two national parks were authorized in 1926, the Great Smoky Mountains (517,014 acres) in western North Carolina and Shenandoah (193,000 acres) in northern Virginia. The parks are connected by the 469 mile-long Blue Ridge Parkway, which follows the highest ridge lines. Limited high-quality water supplies, waste disposal, and air pollution have caused concern about the pace of future development.

III. **Northern Appalachian Plateau (Allegheny Mountains –** includes PA, MD, and WV)

Geomorphology. This Section is a dissected plateau with high, sharp ridges, low mountains, and narrow valleys. It has broad, northeast to southwest trending folds in the bedrock. Elevation ranges from 1,000 to 4,500 feet, with a few peaks higher, notably Spruce Knob (4,861 feet), the highest point in West Virginia. Local relief generally ranges from 1,000 to 2,500 feet.

Soil Taxa. Soils are derived from heavily weathered shales, siltstones, sandstones, and limestone.

Potential Natural Vegetation. The Allegheny Mountains can be placed in four broad groups: red spruce, northern hardwoods, mixed mesophytic, and oaks. Red spruce is usually found above 3,500 feet and includes stands of American beech and yellow birch. The northern hardwood group features sugar maple occurring with beech and black cherry. The mixed mesophytic species are red oak, basswood, white ash, and yellow-poplar. The productive, diverse cove hardwoods are included in this group. Oak sites occur mostly on foothills, but are much less common in this Section than in the Northern Ridge and Valley Section.

Wildlife/Fauna. The black bear is the largest carnivore. White-tailed deer are abundant and can impact understory flora. Elk were reintroduced in Pennsylvania around 1913 and are also found in New York. Varying (snowshoe) hare, red squirrel, and the endangered northern flying squirrel are associated with the red spruce vegetation zone above 3,500 feet. Elsewhere gray and fox squirrels and smaller mammals are more abundant. Bird species include a wide variety of both residents and neo-tropical migrants. Ruffed grouse and wild turkey are prominent game species. Brook trout are found at higher elevations, with smallmouth bass, rock bass, minnows, and darters at lower elevations. The Cheat minnow is listed as a sensitive species, and some minnow and darter species in the New River basin are endemic. Amphibians and reptiles are abundant. The threatened Cheat Mountain salamander is found on high elevation red spruce and northern hardwood sites. New butterfly and moth species are still being identified. Gypsy moth is established in this Section.

Climate. Precipitation averages 45 to 60 inches per year; about 20 percent of this is snow (30 percent at higher elevations). Mean annual temperature is approximately 39 to 54 degrees F. The growing season ranges from 140 to 160 days, with local variation.

Disturbance Regimes. Erosion is the primary disturbance agent; however, within the last three years gas extraction has increased. In the pre-European settlement era, fire was not a significant element of change because of the relatively high precipitation. The current forest was largely shaped by logging and associated fires from about 1880 to 1920. In some areas, notably those in the red spruce zone above 3,500 feet elevation, some areas burned so severely that soil was removed to the bedrock. These areas are now stunted forests with blueberry understories. Gypsy moth is established in this Section. Its effect may be less than on the Northern Ridge and Valley Section, because oak is less extensive here. The western-most section is characterized by livestock operations and crop farming, and much of the region has been mined for bituminous coal. It also contains the highest reserves of natural gas. The potential reserves from the Marcellus Shale formation have increased exploration in Pennsylvania and West Virginia causing concern for water quality and forest fragmentation. The average well site usually requires five acres and various miles of access roads. In areas of high potential gas concentrations there may be as many as one drilling site for every 160 acres. These disturbances will impact fragmentation and the way forests are managed. In addition, hundreds of thousands of gallons of water are used for the fracturing process that releases the gas. Waste water may contain heavy metals, salts, and other gases including radon gas. Treating the waste water can be difficult and expensive.

Land Use. Timber harvesting of high-valued hardwoods is a major industry. Agricultural pastures and hay meadows are common on river and stream flood plains and on limestone soils. Recreation use is relatively light but extensive, and includes hunting, fishing, camping, and hiking. Tourism is a growing industry. Settlements are small and dispersed. Strip-mining for coal has been and continues to be an important activity in some parts of this Section.

IV. **Cumberland Mountains** (western and eastern coalfields of WV, Black Mountain section of KY, and southern Cumberlands in KY)

Geomorphology. This section contains mountains and dissected uplands. Landforms are mainly low mountains where less than 20 percent of the area is gently sloping. Elevation ranges from 2,000 to 2,600 feet.

Soil Taxa. Soils have formed in material weathered from sandstone, siltstone, and shale on nearly level surfaces.

Potential Natural Vegetation. Kuchler classified vegetation as mixed mesophytic forest, Appalachian oak forest, and northern hardwoods. The predominant vegetation is hardwoods with a mixture of pine. Existing forest types consist of oak-hickory - white, black, scarlet, and blackjack oaks; common hickories include mockernut and pignut.

Wildlife/Fauna. White-tailed deer occurs throughout much of this Section. Black bear is present in many areas. Red fox and gray fox are widespread, as is the bobcat. Several species of squirrels and a number of smaller rodents inhabit the forest floor. The turkey, ruffed grouse, bobwhite, and mourning dove are the major game birds in various parts of this Section. Neo-tropical songbirds are abundant.

Climate. Precipitation averages 40 to 47 inches; snow averages about 35 inches. Mean annual temperature averages 45 to 50 degrees F. The growing season lasts 140 to 160 days.

Disturbance Regimes. Fire has probably been the principal historical source of disturbance. Climatic influences include occasional summer droughts and ice storms. Strip mining for coal has disturbed about 5 percent of the area.

Land Use. Natural vegetation has been cleared for agriculture on most of the area.

Great Lakes, Multi-State Priority Area

Developed by the USDA Forest Service, 10/23/09

1. General Area/Boundary Description

Lakes Superior, Michigan, Huron, Erie, and Ontario contain 18% of the world's fresh surface water. The Great Lakes Watershed is bounded by the Province of Ontario to the north, and the US states of Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, and New York to the west, south, and east.

2. Major Landforms

Carved, smoothed and filled by glaciers, the Great Lakes Basin contains a variety of landforms. In the north, thin, acidic soils support coniferous forests in the cold climate. The Canadian (Laurentian) Shield has eroded to form gently rolling hills. To the south, soils become thicker and more fertile. A warmer climate supported deciduous forests before the pressures of agriculture and urbanization predominated.

The Great Lakes Basin drains 200,000 square miles of land in both the US and Canada. It has over 10,000 miles of shoreline including more than 35,000 islands. Its natural habitats include:

- wetlands - 300,000 acres of coastal wetlands,
- sands – the world's largest collection of freshwater sand dunes,
- islands – the world's largest freshwater island system, and
- alvars - 95% of the world's alvar system. Alvars are unique communities characterized by shallow soils over linestone/marble bedrock with distinct vegetation.

The Great Lakes provide approximately 4.2% of the US drinking water. They are essential to commerce, trade and transportation of goods. They link to both the Atlantic Ocean, via the St. Lawrence River and the Gulf of Mexico via the Illinois and Mississippi Rivers. Recreational vessels are also able to reach the Hudson River through the Erie Canal. One-third of all recreational boats in the US are registered in the Great Lakes Basin. The Great Lakes support a $1 billon recreational fishing industry and over $35 billion annually in general recreation and tourism.

3. Forest & other ecological attributes

Kuchler vegetation types in the region include, or are adjacent to, Great Lakes pine forest, Great Lakes spruce forest, Northern hardwoods, oak savannah, maple-basswood, elm-ash, beech-maple, and conifer bog.

From the US Forest Service Fire Effects Information System (http://www.fs.fed.us/database/feis/kuchlers/k095/all.html)

Annual precipitation ranges from 20 inches (500 mm) in northwest Minnesota to 35 inches (890 mm) in Lower Michigan. The average annual precipitation for most of the

region is about 30 inches (760 mm). About 56 percent of it falls between May and September. Average annual snowfall along Lake Superior is greater than 100 inches (2,540 mm), but less than 50 inches (1,270 mm) in central and southern Michigan. Average annual temperatures are about 40 degrees Fahrenheit (4 deg C), but temperatures can break 100 degrees Fahrenheit (38 deg C) and minus 50 degrees Fahrenheit (-45.5 deg C). The coldest month is usually January. The growing season varies from 181 days in east-central Wisconsin along Lake Michigan to 50 days in northwest part of Michigan's Upper Peninsula. In the North the growing season is generally longer near Lake Michigan and shorter inland

The Nature Conservancy had identified the Great Lakes region as "critical" to the hundreds of millions of birds that migrate through North America each year.

4. Communities/Major Population Centers

Approximately 80 cities, in eight states are situated directly on, or near, the shores of the Great Lakes. Thirty-five (35) million Americans live, work, or recreate in the Great Lakes region.

Major US population centers include:

Lake Erie: **Cleveland, OH, Toledo, OH, Sandusky, OH, Akron, OH, Ashtabula, OH, Erie, PA,** Buffalo, NY

Lake Huron: Alpena, MI, Port Huron, MI, Bay City, MI

Lake Michigan: Chicago, IL, Gary IN, Green Bay, WI, Traverse City, MI

Lake Ontario: Rochester, NY

Lake Superior: Duluth, MN, Sault Ste. Marie, MI, Marquette, MI, Superior, WI

Land Area within Great Lakes Basin, by State.

	State	Total State Acres	State Acres In Basin	Percent of State Land in Basin
	OH	26,419,482	7,427,868	28.12%
	PA	28,996,194	385,401	1.33%
	IL	36,055,506	51,162	0.14%
	IN	23,162,639	2,255,404	9.74%
	MI	37,298,236	37,257,510	99.89%
	MN	54,016,543	3,980,878	7.37%
	WI	35,950,567	11,035,975	30.70%
	NY	32,261,807	13,059,966	40.48%
Totals		**274,160,974**	**75,454,164**	**27.52%**

Source: US EPA Great Lakes National Program, 2009.

5. Major Conservation Categories, defined by US EPA and Environment Canada

- Coastal Zones
- Aquatic Habitats
- Invasive Species
- Contamination
- Human Health
- Biotic Communities
- Resource Utilization
- Land Use-Land Cover Changes
- Climate Change

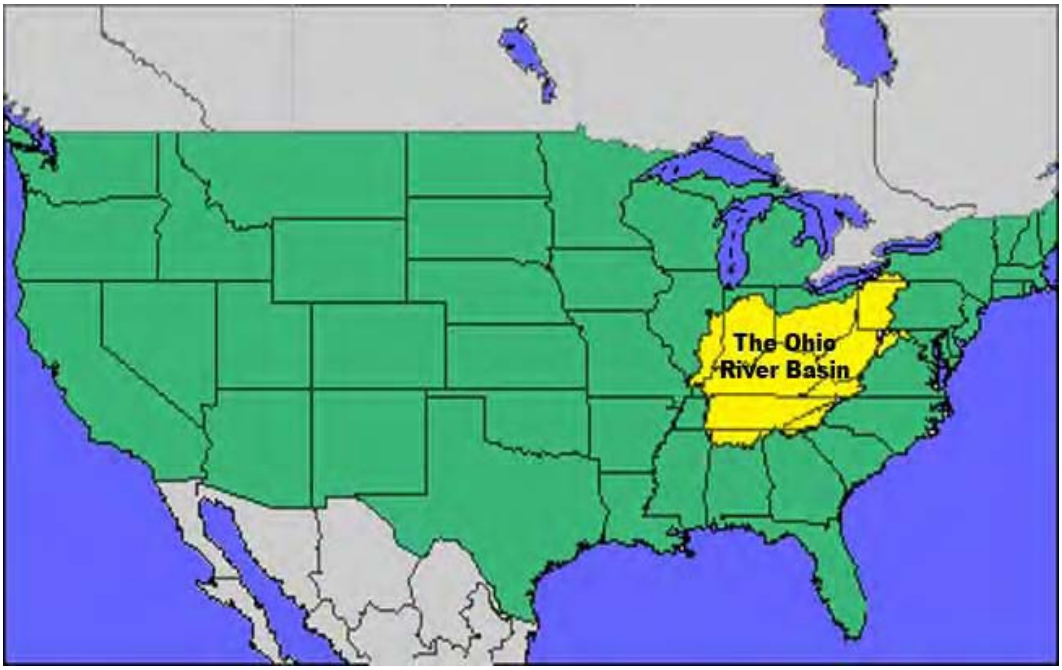
6. Regional Organizations – Partial Listing

US EPA Great Lakes National Program – including:

Great Lakes Atlas	www.epa.gov/glnpo/atlas
Great Lakes Binational Program	www.binational.net
International Joint Commission	www.ijc.org
Council of Great Lakes Governors	www.cglg.org
Great Lakes Commission	www.glc.org
Great Lakes Fisheries Commission	www.glfc.org
Northeast-Midwest Institute	www.nemw.org
Great Lakes Research Consortium	www.esf.edu/glrc
National Wildlife Federation Great Lakes Office	www.nwf.org/greatlakes
Lake Michigan Federation	www.lakemichigan.org
Great Lakes United	www.glu.org
Council of Great Lakes Industries	www.cgli.org
Great Lakes Environmental and Molecular Sciences Center	www.greatlakesdecisionsupport.org
Great Lakes Inter-Tribal Council	www.glitc.org

Ohio River Basin, Multi-State Priority Area

Developed by the USDA Forest Service, 10/16/09



Location

The Ohio River is 981 miles (1582 km) long, starting at the confluence of the Allegheny and the Monongahela Rivers in Pittsburgh, Pennsylvania, and ending in Cairo, Illinois, where it flows into the Mississippi River[1] and eventually the Gulf of Mexico. The Ohio River passes through or is adjacent to the states of Illinois, Indiana, Kentucky, Ohio, West Virginia, and Pennsylvania.[2] Portions of New York, Virginia, Maryland, Tennessee, North Carolina, Georgia, Alabama, and Mississippi are also within the Ohio River Basin. Major tributaries flowing into the Ohio include (from upstream to downstream) the Muskingum, Kanawha, Guyandotte, Big Sandy, Scioto, Licking, Great Miami, Kentucky, Green, and Wabash Rivers.[3] A complete list of tributaries is available at http://www.orsanco.org/images/stories/files/orrg/Tribs.pdf.

Physical Geography

The land in the Ohio Basin can be divided into essentially three basic parts, corresponding to the Basin's three major physiographic provinces. The Appalachian Plateau in the eastern portion is characterized by rugged topography resulting largely from the erosion of flat-lying rocks. The permeable sand and gravel deposits in the valleys of the drainage system provide moderate

[1] http://www.orsanco.org/index.php/river-facts
[2] http://creekconnections.allegheny.edu/Modules/On-LineActivities/Watersheds/OhioRiverWatershed.pdf
[3] http://www.fws.gov/orve/stratplan.html

groundwater supplies. The area has extensive forest cover, generally poor quality soils, narrow valleys, steep stream gradients, flash floods during the rainy season, and low stream flows during dry seasons.[4]

The Central Lowlands physiographic province occupies the northwestern third of the Basin and is the result of several glaciations. Glaciers covered most of the area in recent geologic history, and left soil deposits which are now some of the richest agricultural lands in the Basin. The topography is flat to slightly rolling and the drainage pattern has been significantly altered from its condition prior to glaciation. In some instances, buried pre-glacial streams provide extensive groundwater resources.[5]

The Interior Low Plateau physiographic province in the southwestern third of the Basin is dominated by limestone rock which covers most of this region. This has resulted in the rolling terrain forming the Lexington Plains and Bluegrass regions where farming dominates. Areas of local rugged relief are forested, their soils thin. Groundwater has the typical variability of limestone areas.[6]

Biological Resources

The Ohio River ecosystem bisects three regions of the Deciduous Forest Formation of eastern North America: the Mixed Mesophytic Forest Region (upper basin, roughly upstream of Portsmouth, Ohio), the Western Mesophytic Forest Region (lower basin from Portsmouth, Ohio, to Paducah, Kentucky), and the Mississippi Alluvial Plain Section of the Southeastern Evergreen Forest Region (lowermost portion of the basin from Paducah, Kentucky, to Cairo, Illinois).[7]

The mixed mesophytic and western mesophytic forests have been classified broadly as a tulip poplar-oak region. The dense, mixed mesophytic forest contains a fair abundance of two indicator species, white basswood and yellow buckeye, in a total group of 15 to 20 dominant species. The western mesophytic forest is marked by a transition from extensive mixed mesophytic communities in the east to extensive oak and oak-hickory communities in the west. The western mesophytic forest is less dense, has few dominants, and usually lacks the two indicator species of the mixed mesophytic forest.[8]

The rich flora and fauna of the ecosystem reflect its diverse physiography and unique geologic past. The Fish and Wildlife Service has identified many "Trust Resources" in the Ohio River basin, including many federally listed endangered and threatened plants, mussels, fishes, birds and mammals; waterfowl and other migratory water birds; and neotropical migratory land birds.[9] Examples can be found at http://www.kwalliance.org/Portals/3/Evans_Ohio%20R%20summit_1Aug2008.Part2.pdf.

The unusually rich and diverse fauna found in the ecosystem is the product of a multitude of biotic and abiotic factors which have evolved over time. Throughout geologic time, changes in such factors as topography, climate, and geomorphology have formed, modified, and eliminated habitats and consequently have had a profound effect upon the distribution of the faunal assemblages in the ecosystem. Due to the ecosystem's central geographical location in the eastern United States, some

[4] http://www.fws.gov/orve/stratplan.html
[5] http://www.fws.gov/orve/stratplan.html
[6] http://www.fws.gov/orve/stratplan.html
[7] http://www.fws.gov/orve/stratplan.html
[8] http://www.fws.gov/orve/stratplan.html
[9] http://www.fws.gov/orve/stratplan.html

species with northern affinities and others with southern affinities occur in the ecosystem in addition to those common to the central region of the country.[10]

Land Use Patterns

Land use in the Ohio River Basin is a mix of urban/industrial, row crops/intensive agriculture, pasture and forested. These patterns are graphically portrayed at http://www.orsanco.org/images/stories/files/orrg/BasinlandusemapUSGS.pdf.

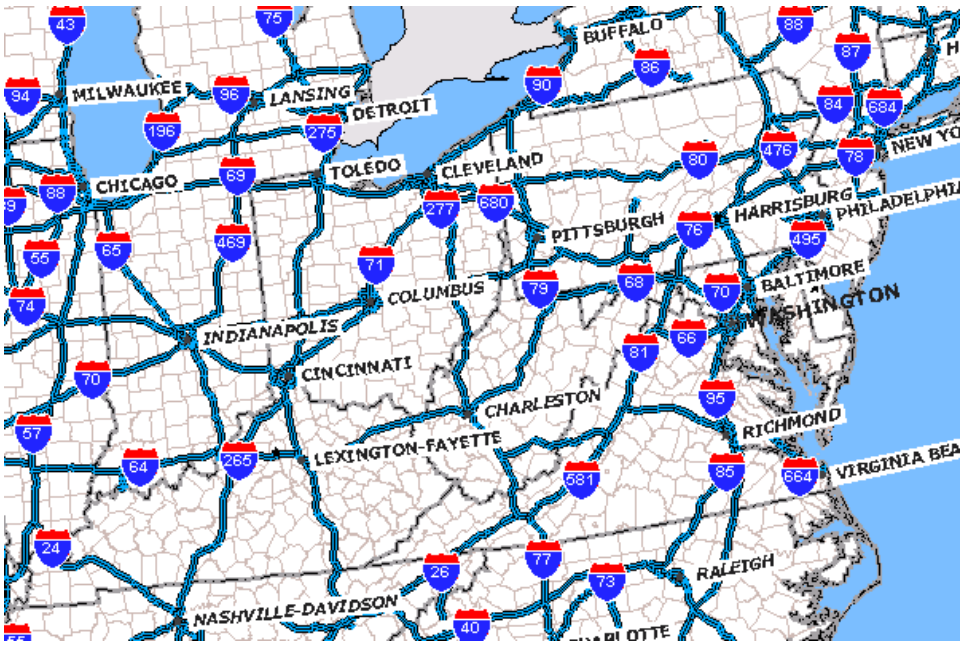
Economic Influence

The Ohio River plays an important role in the economic fabric of the region. There are over 1,000 manufacturing facilities, terminals, and docks in the Ohio River Basin that shipped and received tonnage in 1998. The Port of Pittsburgh includes 41 miles of the Ohio River, 91 miles of the Monongahela River, and the entire 72 navigable miles of the Allegheny River. The port shipped and received almost 53 million tons of commodities in 1998, making it the largest port in the Ohio River Basin and the largest inland port in the United States. The port of Huntington is the next busiest in the basin and ranks 3rd among the nation's inland ports.[11]

Major Highway Systems

The Ohio River Basin, and the states served by the Northeastern Area S&PF have, generally speaking, access to well-developed major highway systems (Figure 1).[12]

Figure 1. Interstate Highways



Population Dynamics

[10] http://www.fws.gov/orve/stratplan.html
[11] http://www.ccpa-ohioriver.com/ Ohio River Basin Profile
[12] http://hepgis.fhwa.dot.gov/hepgis_v2/Highway/Map.aspx

Approximately 25 million people, or nearly 10% of the U.S. population, live in the Ohio River Basin.[13] A detailed, state by state description population dynamics within the Ohio River Basin was developed by the Ohio River Sanitation Commission and is available at Basin Population.[14]

Table 1. Cities and Towns along the Ohio River[15]

Metro area	Population
Pittsburgh	2.3 million
Cincinnati	2.2 million
Louisville	1.8 million
Evansville	350,000
Huntington	290,000
Parkersburg	160,000
Wheeling	145,000
Weirton-Steubenville	132,000
Owensboro	112,000

The U.S. Census Bureau uses definitions of metropolitan and micropolitan statistical areas developed by the U.S. Office of Management and Budget to describe population centers. The term "Core Based Statistical Area" (CBSA) is a collective term for both metro and micro areas. A metro area contains a core urban area of 50,000 or more population, and a micro area contains an urban core of at least 10,000 (but less than 50,000) population. Each metro or micro area consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core. Maps of metro and micro areas are available for all states, including OH, WV, and PA.[16]

Population densities are highly variable within the Ohio River Basin reflecting the broad range of uses. Maps portraying population densities for forested and non-forested for all states can be obtained at http://www.fs.fed.us/ne/fia/studies/LDS/index.html.

The Ohio River Basin population is expected to grow, with housing density increases expected to be moderate throughout a good deal of the region.[17] Concomitant with increases in housing and population are demand for energy resources, water and improved infrastructure, as well as the diminishment of ecosystem services.

Water Resources & Issues

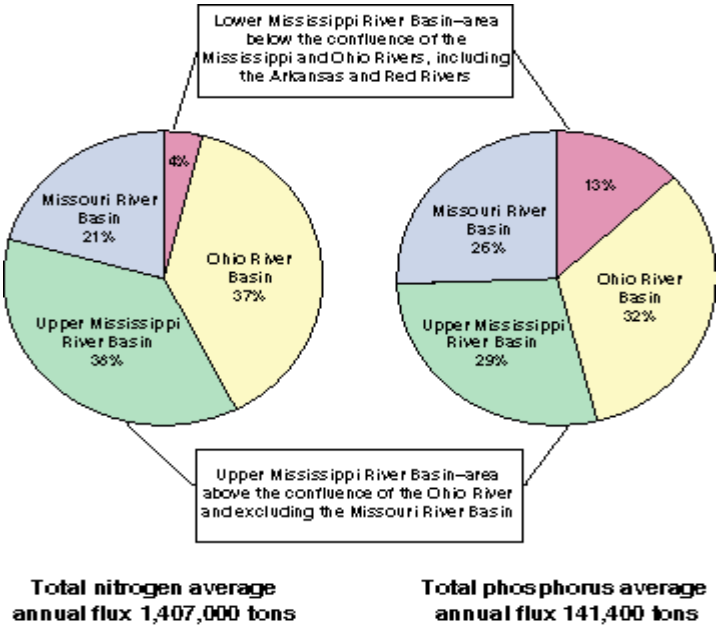
The Ohio River is a direct source of drinking water for more than three million people.[18] A number of issues have been identified relating to water quality issues in the basin. Issues identified by Ohio River

[13] http://creekconnections.allegheny.edu/Modules/On-LineActivities/Watersheds/OhioRiverWatershed.pdf
[14] http://www.orsanco.org/index.php/basin-population
[15] http://en.wikipedia.org/wiki/Ohio_River#Cities_and_towns_along_the_river
[16] Ohio http://ftp2.census.gov/geo/maps/metroarea/stcbsa_pg/Nov2004/cbsa2004_OH.pdf
West Virginia http://ftp2.census.gov/geo/maps/metroarea/stcbsa_pg/Nov2004/cbsa2004_WV.pdf
Pennsylvania http://ftp2.census.gov/geo/maps/metroarea/stcbsa_pg/Nov2004/cbsa2004_PA.pdf
[17] http://www.fs.fed.us/projects/fote/reports/fote-6-9-05.pdf
[18] http://www.orsanco.org/index.php/river-factsconditions

Basin Consortium for Research and Education (ORBCRE) are mostly pollution-oriented and include effluent from municipal waste water treatment plants, combined sewage and stormwater overflows, coal mine drainage and resulting sedimentation, urban stormwater, agricultural and forest runoff, toxic pollutants, problems from oil and gas recovery brines, reservoir eutrophication, ground water pollution, and drinking water contamination. The region has a number of hazardous waste disposal sites (Karl et al. 1996).[19]

Agricultural activities in the Ohio River Basin region are a major contributor to nitrogen and phosphorous loadings in the Mississippi watershed (Figure 2).[20] These pollutants, coupled with other water quality issues such as sedimentation are believed to be the primary drivers for a large hypoxic "dead zone" in the Gulf of Mexico.

Figure 2. Sources of Nitrogen and Phosphorus Loadings in the Mississippi River



The combined effects of industrial pollutants, urbanization, agriculture, mining and other land uses are increasingly threatening clean water supplies. Forested landscapes play a key role in providing a broad range of ecosystem services, including clean water. Paradoxically, the high degree of amenity values associated with forests makes them highly desirable as housing development sites, which often results in significant diminishment of their ability to produce clean water. The USDA Forest Service, Northeastern Area State and Private Forestry has utilized geographic information systems to map areas (including OH, PA, and WV within the

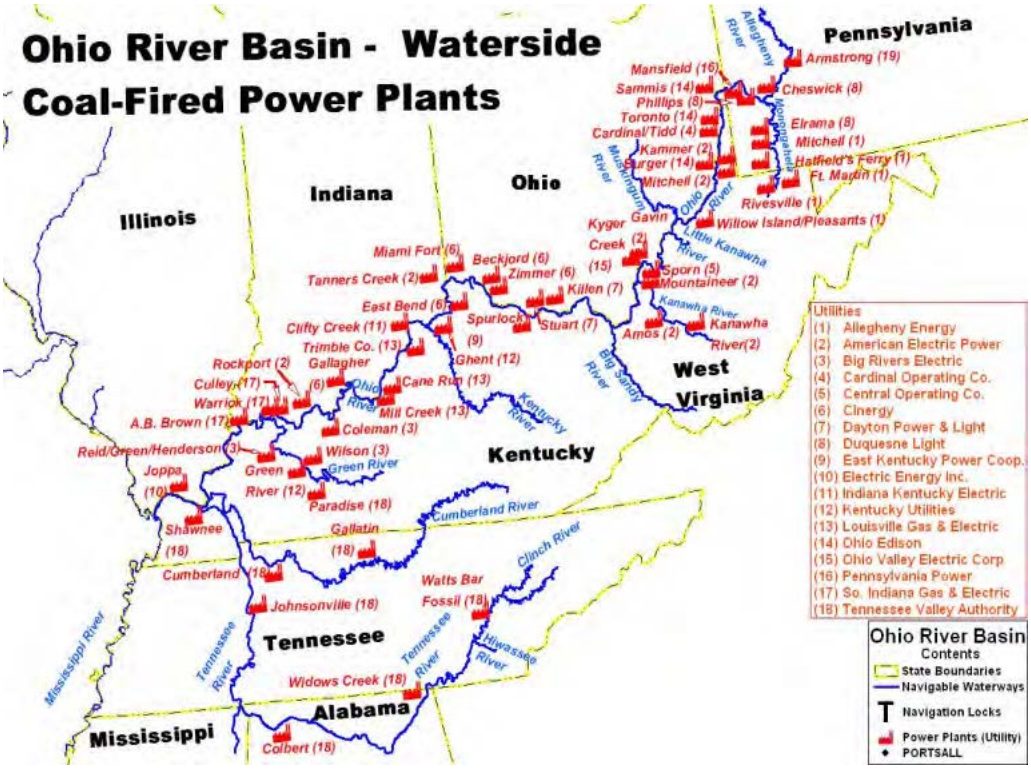
[19] http://www.colorado.edu/research/cires/banff/pubpapers/140/
[20] http://water.usgs.gov/nasqan/docs/missfact/missfactsheet.html

Ohio River Basin[21]) and to identify those watersheds that are have a high ability to produce clean water and are threatened by development, located on private lands and which many people rely on for their drinking water. A number of areas in West Virginia and particularly southeastern Ohio have been identified as highly significant sources of clean water.[22]

<u>The Ohio River Basin & Energy Production</u>

Energy generators in the Ohio River Basin produce 6% of the nation's energy. While a small proportion of that is hydropower, the majority is fueled from the regions coal resources. Figure 3 depicts the number of coal fired power plants in the Ohio River Basin. The Ohio River plays an important role in the transportation of coal resources to these power generators. State economies in the region, including WV, PA, and OH have traditionally been dependent both on jobs related to coal production and the inexpensive energy produced.

Figure 3.



<u>Forest Conservation Challenges</u>

As noted earlier, increasing urbanization is a significant threat to forested ecosystems. Other issues likely to affect forests within the Ohio River Basin include:

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[21] Ohio - http://www.na.fs.fed.us/watershed/factsheets/fwap/FWAP_state_sheet_OH.pdf
Pennsylvania - http://www.na.fs.fed.us/watershed/factsheets/fwap/FWAP_state_sheet_PA.pdf
West Virginia - http://www.na.fs.fed.us/watershed/factsheets/fwap/FWAP_state_sheet_WV.pdf

[22] Forests, Water, and People. http://www.na.fs.fed.us/watershed/fwp_preview.shtm

- **Climate change**. While the science available to document climate change effects on a regional or sub-regional basis are still limited, the expectation is that changes in weather patterns already observed will intensify in future years. While not all changes will necessarily negatively affect forest health, it is expected that there will be changes in species composition, tree vigor, etc. as trees attempt to adapt. As changes occur, climatic conditions may often favor the further dispersion of invasive plants and pests.
- **Forests - adaption and mitigation responses**. Humans and trees have highly interdependent relationships. In response to changes in forest health, society is likely to implement a number of adaptive and mitigative responses which will likely have an impact on forest resources.
- **Energy development**. Now perceived to be nearly as important as food in Maslow's hierarchy, even optimistic projections indicate that America's demand for energy will continue to increase in future years. If America becomes a "carbon constrained society" as many expect, the search for energy resources with a lower carbon intensity will accelerate. While carbon capture and sequestration technologies may eventually enable electrical energy to be produced from coal with zero carbon emissions, the availability of that technology is still speculative. Woody biomass and natural gas contained in Marcellus shale deposits in the region have significantly lower carbon footprints than coal, but their extraction and use have implications for forest health and water quality which must be understood.

  Currently, many electrical generating facilities in the Ohio River Basin (and elsewhere) are responding to state mandated requirements to increase their use of renewable energy by very actively considering the use of woody biomass either as a sole source of energy or co-fired with coal. This concept is now being actively promoted by the U.S. Environmental Protection Agency as a climate mitigation strategy. The potential demand created should only a fraction of electrical generators switch to wood would have very significant impacts on forest resources in the region, especially when added to emerging demand for woody biomass to be used in pellets, transportation fuels, etc.

- **Loss of forest products industries**. Interactions between international competition, changes in the structure and composition of forest products industries, a weak U.S. economy, and the "housing crisis" have converged resulting in a significant downturn in forest products related businesses in the Ohio River Basin region. For example, it is anticipated that more than one third of existing capacity in primary hardwood industries may be lost in the current economic downturn.

- **Conservation education**. The need for public understanding of the importance of forests, and the trade-offs involved when forest cover is degraded or removed is critical. In expanding conservation education programs across the region, the ultimate outcome is greater integration of the benefits of forest cover, forestry, and natural resource conservation into public education and public policy decisions.

Efforts Underway

Definitions of sustainability recognize the high levels of integration between economic, ecological, and societal factors. Forests, and the many ecosystem services they provide will become increasingly acknowledged as vital, and perhaps even strategic resources as issues already acknowledged as important (water availability, energy, economic survival) take on increasing importance.

Efforts recently underway that could have implications for forest resources in the Ohio River Basin include:

1. **The U.S. Army Corps of Engineers is doing an Ohio River Basin Study**. [23] The Ohio River Basin Comprehensive Reconnaissance Study is a collaborative effort between four Corps Districts that share the Ohio River Basin – Huntington, Nashville, Louisville and Pittsburgh, the 15 basin states and a multitude of stakeholders, project sponsors and the public. This ongoing comprehensive reconnaissance-level basin plan will feature a preliminary reinvestment plan for the existing reservoirs and local protection projects as well as identify opportunities for additional municipal and industrial water supply, hydropower facilities and restoration of damaged ecosystems. The reconnaissance study will provide a pathway for resolving not only the problems faced by Corps projects but also other federal, regional, state and local water resource problems and needs while identifying opportunities for expanded and enhanced water management through future collaborative watershed planning and decision-making. They have identified a number of water related issues which will be addressed in the study.[24]

2. **Electric Power Research Institute**. In order to respond to mandates in the Clean Air Act, electrical generators will have to adopt technologies which will increase the release of nitrates and other pollutants into the Ohio River. Already a problem for the Ohio, EPRI seeks to abate pollutant levels and costs for electrical generators and other point sources of pollutants (ex. municipal wastewater treatment plants) by developing a water quality trading market for the entire Ohio River Basin. Forest landowners could potentially be suppliers of abatement credits, although there has been no significant mention of this possibility to date.[25]

3. **USDA efforts in the Mississippi Watershed**. In late September 2009 Secretary Vilsack announced that the Obama administration would support $300 million in expenditures focused on cleaning up the waters of the Mississippi and addressing water quality and hypoxia issues in the Gulf of Mexico. Whether or not the sole focus of USDA efforts will be on abating agricultural pollutants is unknown at this writing.

[23] http://www.orboutreach.com/pdfs/ORBC_Study_announce_news_release.pdf
[24] http://www.orboutreach.com/index.php/ohio-river-basin-issues-and-concerns/
[25] http://my.epri.com/portal/server.pt?open=512&objID=401&&PageID=226975&mode=2

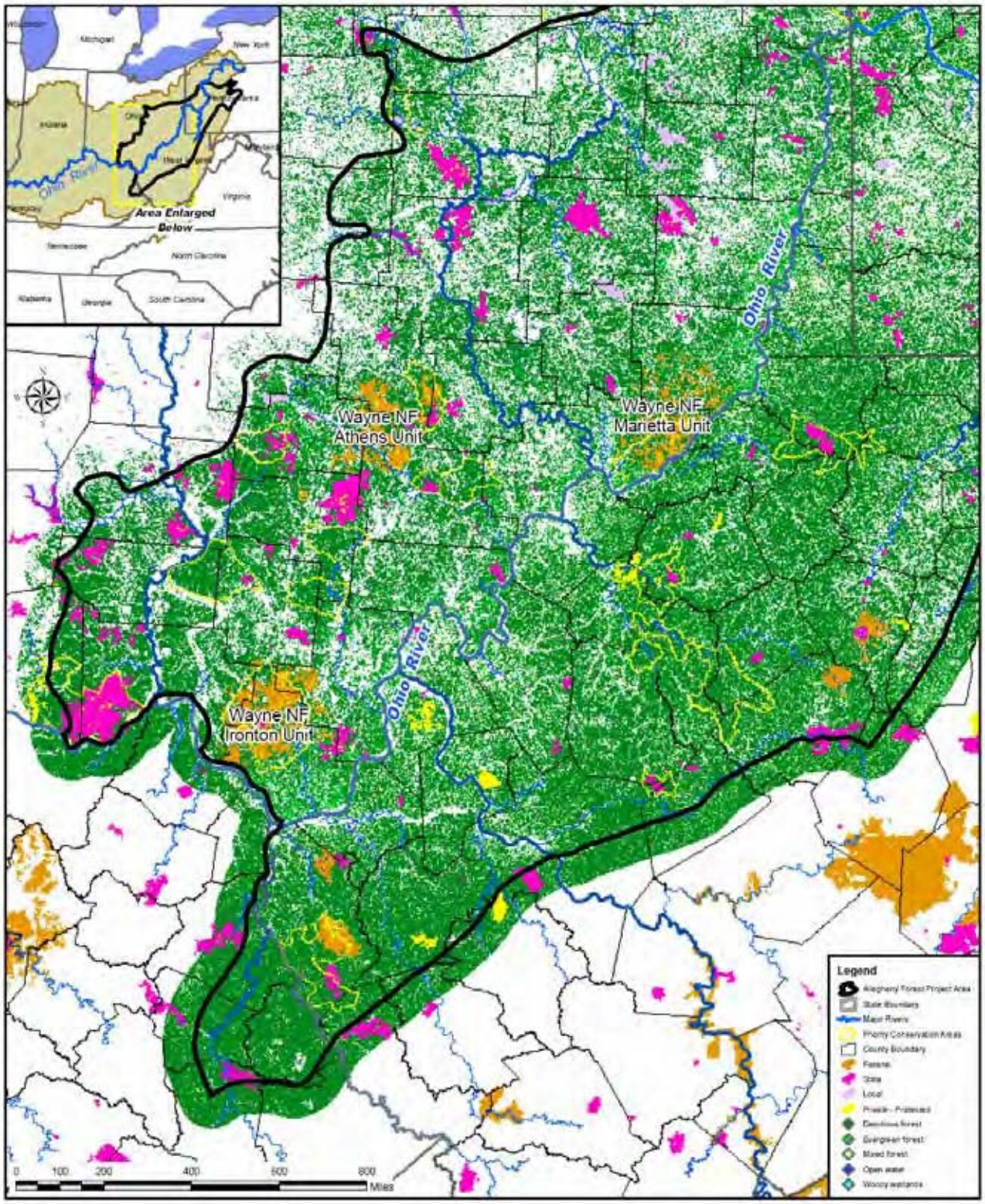
Upper Ohio River Appalachian Forests, Multi-State Priority Area

Developed by The Nature Conservancy, 10/13/09
(Ohio, West Virginia, Kentucky, Pennsylvania)

The Appalachian forests of the Upper Ohio River provide tremendous commercial, wildlife, and aesthetic benefits, but need more support. With over 90% of the forest land in this region in private hands, a vision and strategy that will better *conserve, connect, and restore all lands* is the best chance for thriving forests, waters, and people, and meeting the threats of development, poor fire management and climate change. The Ohio River and tributaries that are fed by these forested watersheds are used for industrial water supplies and recreation, and as a source of drinking water for more than three million people. While a great economic resource, the Appalachian streams characteristic of this region also support more aquatic diversity than any similar habitat on the planet. As an example, Ohio's forests are the basis of the state's $15 billion wood products industry, providing over 100,000 jobs. These forests are also rich in biodiversity, with more than 30 tree species found in the canopy at some sites, and hundreds of species of herbs, shrubs, and ferns in the lush ground cover.

Unfortunately, incompatible harvesting practices, conversions of private lands to non-forest uses, and increased demand for biomass energy are fragmenting habitat, reducing the forests' capacity to provide timber, and harming water quality and recreational opportunities. The future of these forests in the states of Ohio, West Virginia and Kentucky, will depend on better cooperation between public and private landowners. In Ohio, the state is leading by example by seeking third-party SFI and FSC certification of its forest management. Success will require a diverse set of partnerships dedicated to *conserving, connecting and restoring* the Appalachian Forests of the Upper Ohio River. We will need to add and connect core protected areas while restoring forests through third-party certified timber management, improved fire management, and payments for water and carbon benefits.

Appalachian Forests of the Upper Ohio River



Map created by The Nature Conservancy.

MORWOOD, Multi-State Project (current project)

The Mid-Ohio River Valley Woody Biomass Feedstock Zone project is a collaborative effort of the West Virginia Division of Forestry, the Ohio Division of Forestry, and the Appalachian Hardwood Center at West Virginia University. Together, the project partners are working to develop estimates of woody biomass quantity and availability and organize the woody biomass supply chain to confidently supply large quantities of biomass to new, green bioenergy projects. The project will focus its efforts on areas centered around the Ohio River, as the proximity to the river allows for clustering of energy intensive industry.

This project has four primary components:

1. Hardwood Processing Byproducts Assessment
2. Urban Wood Residues Assessment
3. Logging Residue Assessment
4. Industry Capacity and Willingness to Market

Appendix D

Issues & Actions identified in the 1983 Ohio Forest Resource Plan

Issues are listed by number and followed by recommended action (a.):

1. The need to establish windbreaks for protection of fields, livestock and buildings
    a. Improve publicity and efficiency of existing DOF Windbreak programs.
2. The need to establish stands of trees on sites suited for such land use.
    a. Expand the Division's role in reforesting Ohio.
3. The need to acquire in-holdings to improve management of state forest lands.
    a. Establish an active land acquisition program supported by monies appropriated on a "willing buyer-willing seller" policy. Goal of adding 20,000 acres by the year 2000. To be supplemented by: 1) A land exchange program is a low-cost alternative although it does not acquire on a planned basis, and 2) Parcels received as gifts could supplement the Division's acquisition needs at little cost to the state.
4. The need to consider and provide for non-timber resources on the DOF's state forests.
    a. Evaluate recreation opportunities on state forests, and include them in state forest planning efforts.
5. The need to update management plans of the DOF's state forests.
    a. Develop state forest management plans using new technology, data, and procedures (ten-year plans recommended).
6. The need for better private non-industrial forest land management.
    a. Expand the service forestry program.
7. The need to evaluate the role of public support in private forest land management through cost-sharing and tax policies.
    a. Encourage the reduction of the federal portion of cost-share funds to make more money available for more practices. AND Support efforts that will increase funding of FIP and ACP forestry practices.
8. The need for more efficient utilization and marketing of Ohio's timber resources.
    a. Expand the present (U & M) program as opportunities occur.
9. The need to determine the capability of Ohio's forests to meet and manage the wood energy demands.
    a. The Division should continue to support future fuel wood monitoring efforts and assess the results AND Increase assistance to fuel wood users by providing information on sources and selection of trees for harvesting.
10. Information and education affecting the value and use of Ohio's forest resource.
    a. Strengthen the information and education program.
11. The need to increase the public's awareness and support of Ohio's urban forest resources.
    a. Continue with the present Division of Forestry program but expand or alter to meet changing urban forestry needs.
12. The need to provide protection of wildland resources from damaging effects of fire comparable with the benefits provided by and values associated with the resource.
    a. Extend the present program to include statewide coverage.
13. Forest insect and disease activity should be monitored and suppression activities carried out when necessary.
    a. Expand the forest pest management section AND rely on other agencies for assistance.

Appendix E

Chronology of the Ohio Forest Tax Law Program

1. The 1912 amendments to the Ohio Constitution (which were substantial) included the conservation language, and took effect 1-1-13.

   The constitutional amendment of 1912 (Section 36, Article II), reads as follows:

   "Laws may be passed to encourage forestry, and to that end areas devoted exclusively to forestry may be exempted, in whole or in part, from taxation. Laws may also be passed to provide for converting into forest reserves such lands or parts of lands as have been or may be forfeited to the state, and to authorize the acquiring of other lands for that purpose; also, to provide for the conservation of the natural resources of the state, including streams, lakes, submerged and swamp lands and the development and regulation of water power and the formation of drainage and conservation districts; and to provide for the regulation of methods of mining, weighing, measuring and marketing coal, oil, gas and all other minerals."

2. In 1925, Amended Senate Bill 186 passed a law to implement this authority. The act was titled, "To provide for the taxation of forest lands, to promote the production of timber, provide for the utilization of idle and low-grade agricultural lands, and to encourage the general practice of forestry among private owners." The law included property taxed at 50% of the actual local values of the land and a recoupment of up to 10 years of forgone taxes except that property that was enrolled for 25 years or more would be exempted from recoupment.

3. By 1937, the law included a severance tax for timber or 5% and the recoupment was for 5 to 10 years but again except that property that was enrolled for 25 years or more would be exempted from recoupment.

4. By 1939, the law was amended and the recoupment and severance tax were eliminated. The law took on the elements of the "rules" that governed the program until the promulgation of rules in 1993.
   "In order that the owner may receive this reduction in his forest taxes he must:
   1. Protect his forest from livestock.
   2. Protect the forest from fires.
   3. Maintain a crop of valuable timber trees on the land.
   4. When trees are destroyed or removed from the woods, young trees must be planted, unless provision is made for natural regeneration.
   5. Post at least two signs which state that the woods has been classified under the tax law, and explain what the owner is doing to receive this consideration. These signs may be obtained from the State Forester at a small cost, or must be similar to them.
   6. File an agreement with the State Forester, stating that it is the owner's intention to practice forestry on the area."

5. In 1993 (effective 2/26/93), the first rules were passed to govern the FTL. Prior to 1993, there were no formal rules in place; only an agreement form was signed by the landowner that outlined the basic rules. The balance of the program was governed by policy.

   The 1993 rules established (fundamental points that may be at issue):

   Definitions
   Eligibility
   Lands certified prior to the implementation of rules were to "remain certified as long as those lands comply with the regulations under which they became eligible for certification."
   10 acres minimum
   building exclusions
   Property line marking
   Application process
   Forest management plan requirement
   Violations/withdrawals
   Notification
   Conversion
   Failure to comply with mgt. Plan
   Conversion of Ownership that included cancellation for any ownership change.

6. In 1994, (effective 11/7/1994) the rules were amended to allow forest land acreage to be added without application.

7. In 2004 (effective 1/9/2004) the rules were modified
   Definitions were added and some modified.
   Lands certified prior to 11/7/1994 were given the pass to remain certified as long as those lands comply with a new rule 1501:3-10-7.
   Landowners were required to attend training.
   Added an appeal process.
   Required the use of a master logger to perform harvests.
   Notice of violation for conversion of land.
   Cancellation of certification if owner authorizes a lessee or other to manage the property inconsistent with the management plan.
   Added the special provisions for property certified prior to November 7, 1994.