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FOREST ECOSYSTEM MANAGEMENT in Indiana

Purdue University
Cooperative Extension Service

Key Terms

Biological diversity — The variety and variability of living organisms and their habitats within a defined area. Biological diversity generally consists of the variety of ecosystems within a region, the number of distinct species which occur in the region, and the genetic variability within those species.

Ecosystem — A systems of plants, animals, and microorganisms, together with their non-living environmental components. Ecosystems are arbitrarily defined areas. For example, the area containing an individual tree, a stand of trees, or an entire watershed containing many stands of trees could all be defined as ecosystems.

Ecological processes — Natural processes that occur within ecosystems, such as the cycling of water or nutrients, or the interactions between predators and prey within the system.

Landscape — A grouping of distinct, but interacting ecosystems. A landscape might consist of several stands in a small drainage, or it could include a region of several hundred thousand acres.

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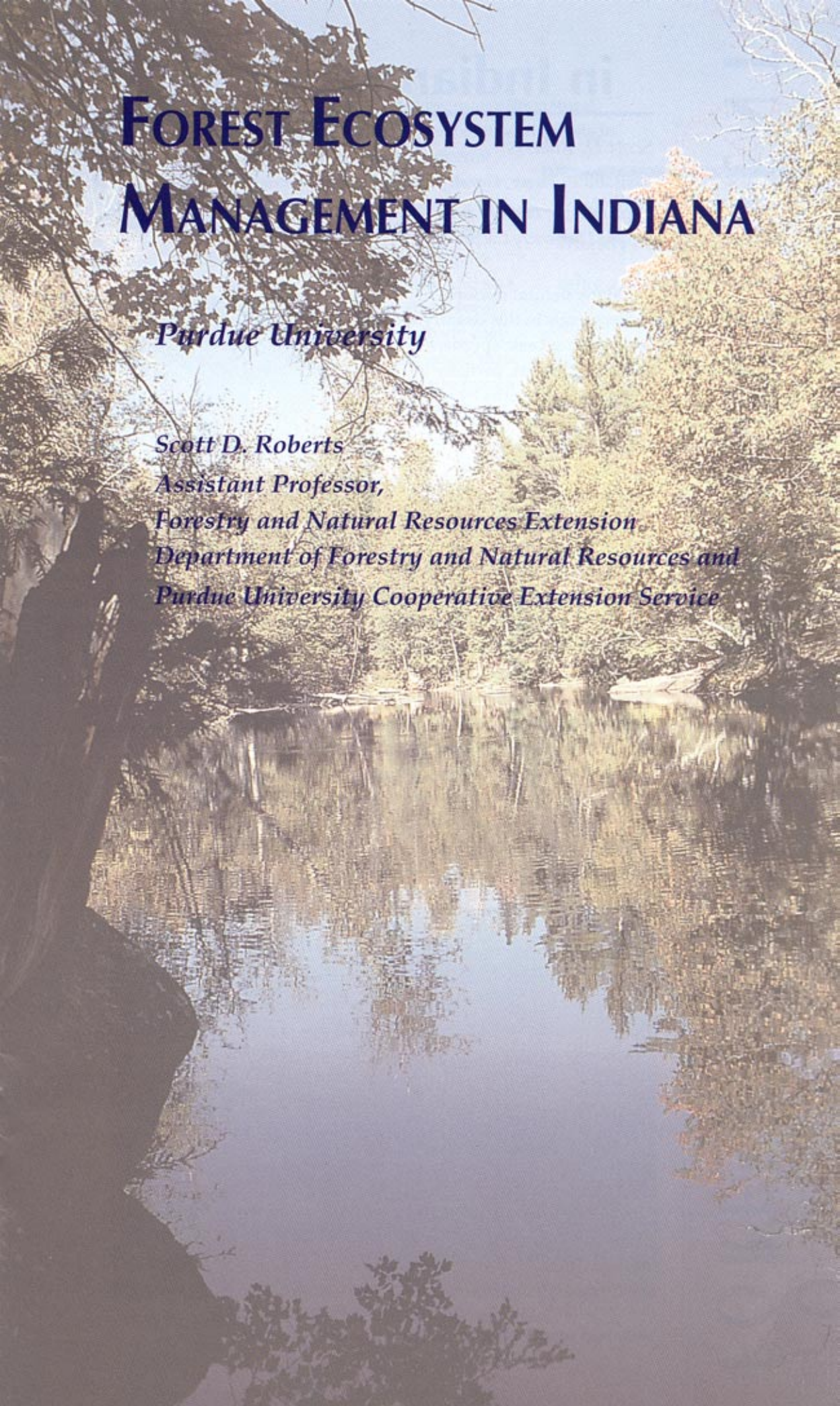

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Many natural resource professionals in this country are reevaluating basic approaches to managing forests, partially in response to concerns by segments of the public that traditional management techniques do not adequately address ecological and amenity values. A new approach, referred to as "ecosystem management," is being developed which offers landowners in Indiana a different choice in how to manage their lands. This publication explains the major elements of ecosystem management, discusses what it will take to implement such an approach in Indiana, and suggests what landowners might do if interested in implementing ecosystem management on their own forestlands. Because some of the terminology used in this publication may be new to some people, a glossary is provided.

Mixed hardwood forests of Indiana contain naturally high levels of biological diversity and structural complexity.

What is Ecosystem Management?

Ecosystem management represents a different philosophy for forestland management. It places greater importance on the ecological values of the forest. The primary objectives of ecosystem management are:

- Sustainability of the long-term health and productivity of forests
- Maintenance or enhancement of biological diversity
- Production of the goods and services that society wants from its forests

Traditionally, the main focus of forest management has been on what resources could be removed from the land: timber, forage, harvestable game, water, etc. An ecosystem management approach places greater emphasis on what is retained on the land in terms of the structure and functioning of natural ecological processes.

Ecosystem management promotes the natural structural and functional characteristics of forests in order to maintain or enhance overall biological diversity, defined as the variety of living things that exist within a given area. The mixed hardwood forests of Indiana are naturally quite diverse in terms of tree species and size classes; thus, maintaining stand-level structural complexity is relatively easy to do. Landscapes are areas larger than the typical stand, ranging in size from a few hundred to several thousand acres. At the landscape level, diversity may be increased by using a variety of harvesting approaches and rotation ages, including providing for the development of mature and old growth forest stages.

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Ecological processes operate over both large and small land areas; therefore, the ecosystem management approach attempts to maintain suitable structural characteristics at both the stand and landscape level. Managers must consider larger land areas and longer time frames than they traditionally have considered important. Managing across landscapes of several hundred to several thousand acres requires some degree of cooperation from many individual landowners. Planning over several decades is easier when there is stability in land ownership objectives, which may be difficult to achieve in Indiana given the relatively high turnover rates of property.

Indiana's forests provide many benefits, including wood products, . . .

Changing to an ecosystem management approach requires natural resource professionals to deal with greater levels of uncertainty. Quite simply, managers do not have complete knowledge on how to manage for biological diversity, ecosystem processes, and sustainability.

. . . wildlife habitat, . . .

"Adaptive management," therefore, is an important part of ecosystem management. Adaptive management entails building in the flexibility to adjust management plans as ecological conditions change and as our knowledge expands. Individual landowner's management objectives also change over time, requiring additional flexibility. To be flexible and responsive to changing conditions, natural resource professionals must know whether ecological objectives are being met. This requires careful monitoring of ecologic conditions of the landscape.

Ecosystem management represents a new approach to land management; however, it does not imply a completely new technology. The same basic tools are available for managing the land; although, when and where specific tools are used may change somewhat. A few new tools will need to be developed, such as organizational approaches to planning on multi-owner landscapes and techniques for long-term monitoring. In general, though, existing technologies will be used to achieve new sets of objectives.

. . . supplies of clean water, . . .

Where is Ecosystem Management Applied?

Many elements of ecosystem management are applicable to the management of any land area, including urban settings, agricultural lands, and semi-natural or natural wildlands. Ecosystem management, from a natural resource management standpoint, has evolved for use in the management of natural and semi-natural landscapes. In Indiana, these are primarily forested lands or areas of forest mixed with other land uses. These lands provide the greatest opportunities for management to enhance biological diversity, while still producing the many commodities and amenities demanded of forests by society.

Private forest landowners in Indiana will continue to manage their lands to meet personal objectives. Ecosystem management provides a way of meeting those objectives while at the same time addressing ecological concerns.

Ecosystem management is applicable to lands of all ownership. This includes public lands managed for a multiplicity of values, industrial forestlands managed primarily for commodity production, and nonindustrial private forestland managed for a wide variety of landowner objectives. The ultimate nature of the forest ecosystems that are created through ecosystem management will differ, depending on forest type, condition of existing landscapes, local land ownership patterns, and societal expectations. Private forest landowners in Indiana will continue to manage their lands to meet personal objectives. Ecosystem management provides a way of meeting those objectives while at the same time addressing ecological concerns.

. . . and recreational opportunities.

What Are the Challenges to Ecosystem Management in Indiana?

Ecosystem management is a new concept and as such is evolving rapidly as natural resource professionals deal with the many challenges associated with a change in management philosophy. In Indiana, several factors must be addressed before ecosystem management can effectively be implemented.

Land Ownership

Nationally, about 57 percent of all forestland is in nonindustrial private (NIPF) ownership, with 15 percent in private industrial and 28 percent in public ownership of some kind. In Indiana, the percent of forestland in nonindustrial private ownership is over 87 percent, with only about 12.5 percent in public ownership and less than one percent in industrial ownership. This ownership pattern is characteristic of the entire upper midwestern region. In the six states comprising the majority of the central hardwood region of the United States, NIPF ownership averages nearly 89 percent of all forestland.

Little of Indiana's original old growth forest remains today. Old growth forests contain unique ecological values not found in younger forests.

Ecosystem management requires coordinated management across large landscape units. This becomes more difficult when dealing with multiple landowners, each with their own set of management objectives. In Indiana, there are around 90,000 NIPF owners, with an average size of forest holdings of less than 50 acres. This means that on a management unit of 10,000 acres, there could be 200 or more individual owners, each with unique sets of objectives. In most cases in Indiana, landowners practicing proper forest management, which keeps the land in a forested condition, will meet most objectives of ecosystem management; however, effective techniques

for landscape level coordination across multiple ownerships still must be developed. It is essential that such methods allow individual owners to retain control over their individual management objectives.

Ecosystem management also requires planning over several decades. The predominance of NIPF owners in Indiana results in less continuity of ownership which makes long-term planning more difficult. In 1986, one-third of all private forest properties had been owned for less than 10 years; two-thirds had been owned for less than 20 years. Frequently, when forestland changes ownership, the objectives for the property changes. Objectives can also change over time due to individual landowner financial considerations as well as changes in local, regional, or national economic conditions. Whatever the reasons, changes in landowner objectives may require adjustments to coordinated management plans.

Private Property Rights

A major concern of private property owners is the right to set their own management objectives and manage their land to meet those objectives. Ecosystem management does not imply the need for new regulations on private landowner activities. It does recognize the need for cooperation between adjacent landowners which will provide for coordinated management over areas large enough to be ecologically significant. Most policy makers do not favor additional regulation. They would rather rely on voluntary cooperation and compliance with recommended practices, or provide incentives to encourage landowners to practice good stewardship management.

Ecosystem management does not imply the need for new regulations on private landowner activities.

The primary approach to be used in Indiana to encourage adoption of ecosystem management principles will be to provide educational information and technical assistance to private landowners. Information provided by the Indiana Department of Natural Resources and the Cooperative Extension Service will help landowners decide whether ecosystem management is appropriate for meeting their individual management objectives. If a landowner decides that it is, then technical assistance will be made available to help develop a management plan for their property. In addition, several programs exist in Indiana

which may provide financial incentives to landowners for implementing an ecosystem management approach (e.g., Stewardship Incentive Program, Classified Forest Act). No new regulations requiring ecosystem management on private lands are being considered in the state of Indiana.

Organizational Structures

Effective implementation of ecosystem management will require organizational structures for providing leadership in pulling landowners together and developing coordinated, long-range management plans. Nationally, the U.S.D.A. Forest Service has assumed the leadership role in ecosystem management. In Indiana, the Forest Service represents only a small portion of the forestland in the state. While they will certainly have a role to play in providing leadership, additional sources of leadership must come from elsewhere. Other federal land management agencies may assume minor leadership roles. These include the U.S. Fish and Wildlife Service, and branches of the military managing lands within the state. The Soil Conservation Service already provides planning assistance to private landowners, and could assume a greater role in the future. Again, however, all of these are likely to be limited due to the general lack of federal forestland in the state.

The Indiana Department of Natural Resources (IDNR) manages about as much land in the state as the U.S. Forest Service. Also, state lands are more evenly distributed around the state, which could make it easier for IDNR to assume a leadership role in the implementation of ecosystem management. Resource limitations, variability in state land management objectives, and a limited overall land base may slightly reduce the state's leadership role; however, because the IDNR is the primary source of contact between private landowners and resource professionals, its involvement will be critical to the success on ecosystem management in Indiana.

The forest products industry is an important segment of Indiana's economy, and therefore, has a strong interest in the management of the state's forest lands. In some states, industry is a major leader in ecosystem management. In Indiana, however, forest industry owns less that one percent of the forest lands. The lack of a significant land base probably precludes them from assuming a major leadership role in the state.

The most likely source of leadership for ecosystem management in Indiana is from the NIPF landowners themselves. Landowner organizations already exist, although a relatively low percentage of landowners are currently members of such groups. The American Tree Farm System is a national program with participation in Indiana, but it too is supported by a limited number of landowners.

The most likely source of leadership for ecosystem management in Indiana is from the NIPF landowners themselves.

No single organization or agency will provide exclusive leadership for ecosystem management throughout the state. It will likely come from many different sources, varying with location in the state. Several organizations already exist in Indiana (private, state, and federal) which will be needed to provide leadership. A major challenge will be to get these groups to step forward and accept this leadership role.

Assuming that organizational leadership will be available to promote ecosystem management in Indiana, another challenge will be getting landowners to participate in cooperative planning. Many landowners may be reluctant to participate if they feel they are relinquishing some decision-making power over their own property. Other landowners are simply not inclined toward long-term management planning. Foresters have long been challenged by how to get NIPF owners to adopt scientific management. In Indiana, it is estimated that less than 20 percent of private forestland owners have consulted with a professional land manager or developed a management plan for their forest properties. Getting landowners to participate in cooperative planning will be a major hurdle to overcome before ecosystem management is effectively implemented in the state.

State of the Existing Landscape

Another challenge facing ecosystem management in Indiana is the condition of the existing land base. Currently, Indiana contains slightly over 4.4 million acres of forestland, roughly 19 percent of the state's total land area. Few areas in the state contain forested landscapes of significant size which have not been fragmented, or broken up, by urban or agricultural development. Fewer still contain large forested areas dominated by a single owner, these generally being areas of public lands. Virtually all of the land in the state has been significantly disturbed at some time in the past.

Few large, unfragmented forest landscapes remain in Indiana today.

Computer map of an Indiana landscape. Dark green shades are public lands, lighter shades are private lands.

Typical fragmented condition of forest landscapes in the state.

Forest distribution in Indiana differs greatly, depending on the region of the state. This will strongly influence how ecosystem management is practiced in any specific location. The northern two-thirds of the state are primarily agricultural land containing relatively little forestland. Most of the forest is mixed into the agricultural landscape in small woodlots or along stream corridors. Few opportunities exist to manage for ecologic processes over large forested landscapes. Opportunities do exist, however, to manage for ecological values of aquatic ecosystems, enhanced biodiversity, soil and water resources, and wildlife habitat.

Most opportunities for ecosystem management in the northern portion of the state center around streams. Riparian areas—the zone of vegetation on either side of the stream, along with the stream itself—are extremely important in agricultural landscapes, as are wetlands and filterstrips. These zones of vegetation act as filters to materials entering streams, thus helping protect water resources. Trees can act as windbreaks helping conserve soil resources in adjacent fields. These communities are a major source of biological diversity in agricultural landscapes, providing habitat for aquatic organisms, birds, mammals, and numerous smaller organisms. Finally, many of these areas act as important corridors for movement of wildlife between upland wooded areas.

Most of the upland forest in northern portion of the state is found in small woodlots, shelterbelts, and windbreaks. These patches are generally too small to support all the ecological processes characteristic of larger forest areas, such as providing habitat for native predators or other far ranging mammals, allowing movement of plant and animal species across landscapes, or allowing continuation of historic large scale disturbances. These smaller areas do, however, serve several important ecological functions, and can play an important role in an ecosystem management approach. Similar to riparian areas, these wooded areas reduce the loss of soil and water from adjacent fields by buffering the effects of the wind. They also serve as islands of habitat for numerous plant and animal species, including some insect-eating species which can be beneficial to agricultural crops.

Most opportunities for ecosystem management in the northern portion of the state center around streams.

Much of the upland forest in the northern portion of the state is contained in small woodlots, or in windbreaks and shelterbelts.

Many wooded areas, when combined with riparian areas, also serve as important corridors allowing movement of some species of wildlife across the landscape that might not otherwise be able to move freely.

The majority of Indiana's forestland is located in the southern third of the state, and this is where the greatest immediate opportunities for forest ecosystem management are found. In the southern portion of the state, as in the northern portion, management of riparian areas, wetlands, and other forested bottomland communities will be important components of ecosystem management. In addition, the forests of south-central Indiana offer opportunities to manage entire landscapes dominated by upland forest types. Ecosystem management will not restore completely natural ecosystems; for instance, native predators will not be reintroduced in the state. However, large predominantly forested landscapes do provide for ecological elements not found in more fragmented portions of the state, such as room for animals that require large areas, and habitat for species that only exist in interior forest conditions.

The southern portion of the state also contains more publicly owned forests, both state and federal, than does the northern part. This provides relatively large areas of land managed by a single owner. While private landowners will continue to be integral to the success of ecosystem management, these large blocks of public land may serve as core areas for landscape planning. In addition, public land management agencies may help provide the organizational leadership required for planning across multi-owner landscapes.

What Factors Favor Ecosystem Management in Indiana?

The challenges facing ecosystem management in Indiana are many. Most are related directly or indirectly to the fact that the majority of forestland in the state is owned by private, nonindustrial landowners. Fortunately, there are also several factors in Indiana which favor the adoption of an ecosystem management approach by many landowners.

NIPF Landowner Objectives

Many studies of private forestland owners have shown that the primary objective of most is not to maximize revenue from their property. In fact, most studies have shown that NIPF landowner objectives are often very similar to the objectives of ecosystem management. These include maintaining a healthy and visually pleasing appearance, providing good wildlife habitat, and being sensitive to other land values such as water quality and site productivity. Many NIPF owners are also becoming increasingly concerned about the impact of their management activities on biodiversity and sensitive species habitat.

While timber production is typically not the primary objective of most private landowners, it very often is one of the objectives. The ecosystem management approach provides for the harvest of timber while at the same time protecting other values that equally concern many landowners. Ecosystem management, in most cases, can incorporate the type of management that many landowners already practice. This often includes frequent harvests which only remove a few trees per acre, or harvests which create small (.25 - 2 acres) openings in the forest canopy. Or it might entail projects specifically designed to create or enhance non-timber forest values. Ecosystem management is even compatible with larger clearcuts if they fit into the overall landscape objectives for the area. At the stand level, therefore, ecosystem management will not result in significantly different approaches than those which are currently widely practiced in Indiana.

Available Educational Information and Technical Assistance

There are several sources of information about ecosystem management available to private landowners in Indiana. The Cooperative Extension Service and the Department of Forestry and Natural Resources at

Purdue University are currently developing several Extension publications explaining various aspects of ecosystem management, as well as opportunities for ecosystem management which exist in the state. The Indiana Department of Natural Resources also has information on forest stewardship management which incorporates many of the ideas of ecosystem management.

The ecosystem management approach provides for the harvest of timber while at the same time protecting other values that equally concern many landowners.

In addition to educational materials, there are several sources of technical assistance available to private landowners. Free services are provided by the IDNR-Division of Forestry, IDNR-Division of Fish and Wildlife, USDA Agricultural Stabilization and Conservation Service, USDA Soil Conservation Service, and the Cooperative Extension Service among others. Available services include determining eligibility for incentive programs, enrolling lands into programs, developing management plans, providing advice on design and implementing land management practices, and in some cases performing certain practices. Additional technical assistance is available from private organizations, such as Indiana Quail Unlimited or Pheasants Forever, or for a fee, from private consulting foresters. For additional information, see publication FNR-87, *Forestry and Wildlife Management Assistance Available to Indiana Landowners: Providers, Organizations and Programs*, available through the Purdue University Cooperative Extension Service.

Incentive Programs

Incentive programs, sponsored by government agencies or private organizations, are designed to encourage landowners to put their lands under some form of management to achieve a stated set of objectives. In many cases, the program objective is simply to get the land under long-term management and to keep it in a desirable condition. Beyond that, landowners have a great deal of freedom to incorporate personal management objectives. Various incentives include cost sharing for specific management practices, direct payment to landowners, and reduced tax assessments on properties enrolled in the programs. Currently, no programs exist

specifically to encourage ecosystem management; however, several existing programs are flexible enough to allow landowners to incorporate elements of an ecosystem management approach on their land (see FNR-87). Very likely there will be additional programs developed, and/or amendments to existing programs, to promote ecosystem management as it becomes a more visible national priority.

Increasing Resource Values

Another factor favoring ecosystem management in Indiana is the generally high value of the hardwood resource. Market forces often provide the means by which forest management objectives are met. Increased values for forest products make it easier to implement forest plans. Currently, the price landowners are getting for timber is high. This is true not just for oak or walnut sawtimber and veneer, but also for other tree species and other products. Reduced timber harvests nationwide will likely keep demand for wood, and therefore prices, high.

High demand for wood also favors the development and use of new technologies, lowers wood utilization standards, and thus increases the merchantability of a greater variety of forest products. These favorable market forces provide conditions conducive to implementation of long-term forest plans. An additional economic incentive involves a developing international trend, in which market preferences may be given to wood products produced using sustainable forestry practices. This, too, could favor the adoption of an ecosystem management approach by many private landowners.

Indiana is known for its high-value hardwood resources. Higher prices and increasing demand provide new uses for traditionally low-value materials.

What are the Implications for Private Landowners?

The implications of ecosystem management to individual private landowners, particularly over the next few years, is likely to be quite small. One reason for this is that ecosystem management is still in the early stages of development. Various facets of the approach are still being explored and defined. It will take the natural resource professions a few years to develop new technologies for the planning, implementing, and monitoring requirements of ecosystem management.

Also, participation in ecosystem management on the part of the landowner is voluntary. While environmental regulations exist, they typically deal only with minimum standards for maintaining environmental quality. None require landowners to follow a specific approach in managing their forestland. Voluntary programs designed specifically to encourage the implementation of ecosystem management have yet to be developed. While existing programs may be useful to an extent, it is likely that additional programs will be developed.

Looking at a longer time frame, ecosystem management may have a slightly greater impact on the private landowner. As society's interest in environmental issues increases, there will be pressure on all landowners to protect ecosystem values. At the same time, more educational information will become available, meaning individual landowners are more likely to find information on how ecosystem management can be tailored to fit specific objectives. Incentive programs and organizational structures will be developed making it easier for landowners to become involved in ecosystem management. Participation in ecosystem management will remain voluntary, but rewards for participation will become greater.

. . . participation in ecosystem management on the part of the landowner is voluntary.

Stand-level activities will not be greatly affected by ecosystem management in Indiana. Landowners who wish to voluntarily adopt the approach may find they already practice many of the elements of ecosystem management. In general, the tools commonly used by private forestland owners in Indiana are perfectly compatible with ecosystem management. Partial cutting

or creation of small openings promotes structural diversity and enhances plant and animal species diversity in many forests. Extending cutting cycles provides for the development of larger tree sizes required by some wildlife species. Minimizing activities along streams protects important riparian habitat and reduces impacts to soil and water resources. These are all practices commonly utilized by private landowners who value the environmental benefits of their forests.

Landscape-level management strategies is where Indiana landowners wishing to adopt ecosystem management will have difficulties. Organizational approaches to facilitate planning and implementation of coordinated management on multi-owner landscapes have yet to be developed. Once these are in place, the challenge will be to get landowners to participate. This will be successful only if landowners feel their private property rights are not being compromised. Given that major changes in stand-level management are not called for, effective cooperative management at the landscape level is the primary feature of ecosystem management which could potentially have a significant effect on the management of the Indiana's forests.

Given the existing situation in the state, there are relatively few recommendations that can currently be made to private landowners wishing to participate in ecosystem management, and most would not result in significant changes in how the typical landowner is currently managing their land. The major recommendations are:

- **Maintain the land in a forested condition.**

  It is important that lands remain forested. This minimizes fragmentation of the landscape, and provides the natural or semi-natural conditions important for maintaining ecological values.

- **Maintain or restore the natural forest structure and composition.**

  The forests of Indiana have a high degree of natural structural complexity and tree species diversity. This is important for many ecological functions and processes. Landowners interested in ecosystem management should minimize actions intended to simplify the forest structure or limit the natural species diversity. Current management practices of most forest landowners adequately maintain forest structure and composition.

- **Be aware of, and protect, sensitive or unique habitats.**

  Much of the biological diversity of forest ecosystems is contained in unique habitats such as riparian areas, wetlands, seeps, cliffs, or areas with thin, droughty soils. Impacts to these sensitive areas can be minimized by taking special precautions when harvesting, applying herbicides, or constructing roads and trails.

- **Be aware that individual actions have impacts on the entire ecosystem.**

  Actions of individual landowners often have impacts beyond their own property boundaries. Landowners should consider their actions in the context of the entire landscape. Often times, approaches can be found which meet the landowners objectives while minimizing ecosystem level impacts.

The best thing the interested landowner can do is seek the advice of an IDNR District Forester or District Wildlife Biologist when planning the management of their forestland. As new information on ecosystem management becomes available through research and actual applications, foresters and other natural resource professionals will be better able to provide specific management recommendations to landowners.

Summary

The primary emphasis of ecosystem management is maintenance of biological diversity and long-term health and productivity of forest ecosystems. This represents a subtle, but important change in the philosophy guiding the management of forest ecosystems, which has been to achieve and maintain a sustainable yield of specific renewable natural resources. In practice, ecosystem management will not change what historically have been important management considerations: production of desired outputs and protection of forest health and productivity. Ecosystem management does, however, introduce some additional considerations, such as looking at longer time-frames and larger land areas, and putting more emphasis on conservation of diversity.

. . . an approach to management which may be better suited to his or her personal objectives than traditional management approaches.

The state of Indiana faces several challenges if ecosystem management is to be accepted and implemented. The major challenges center around landownership patterns dominated by nonindustrial private forestlands, landowner concerns over private property rights, and landscapes highly fragmented by urban and agricultural development. There are components of the ecosystem management approach that need to be better developed, both conceptually and operationally, before ecosystem management is suitable for most of the state. However, ecosystem management provides the NIPF landowner an approach to management which may be better suited to his or her personal objectives than traditional management approaches.

Additional reading:

Miller, B.K. and J.R. Seifert. 1992. *Forestry and wildlife management assistance available to Indiana landowners: providers, organizations and programs.* Purdue University Cooperative Extension Service, FNR-87. 11 p.

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