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Forest Resources of Illinois: What Do We Have and What Are They Doing for Us?

Louis R. Iverson, Illinois Natural History Survey

Forests occupy only a relatively small proportion (12%) of the land area of Illinois (Figure 1), yet they provide tremendous benefits to the citizens of the state. We need only walk through the woods to be aware of some of these benefits: aesthetic beauty, habitat for specialized plants and for birds and other wildlife, recreational opportunities, and high-quality hardwood. The more subtle but equally important benefits that forest ecosystems provide, however, are not so readily perceived. Forested acres, for example, dramatically inhibit soil erosion, thereby reducing the sediment load that eventually finds its way into our water courses; no forest benefit is more important when we consider that 3.3 pounds of soil are lost for each pound of grain produced in Illinois (Iverson et al. 1989). Global warming, due largely to the excessive buildup of carbon dioxide in the atmosphere, is also counteracted to some degree by our forests because plants convert tremendous quantities of carbon dioxide into plant tissue and oxygen each day. Then too, our forests contribute greatly to the maintenance of biological diversity, a benefit of crucial importance in Illinois where the landscape is dominated by a row-crop monoculture.

The purpose of this paper is to review the historic trends that shaped the Illinois forest, to document its present status, and to summarize the benefits it currently provides. The material is largely condensed from a more detailed and complete document, *Forest Resources of Illinois: An Atlas and Analysis of Spatial and Temporal Trends* (Iverson et al. 1989). Readers are encouraged to consult that book and the map (Iverson and Joselyn 1990) that accompanies it for a great deal more information regarding the forests of Illinois, including data specific to the counties in which they may be particularly interested. Both the book and map are available as Special Publication 11 from the Illinois Natural History Survey.

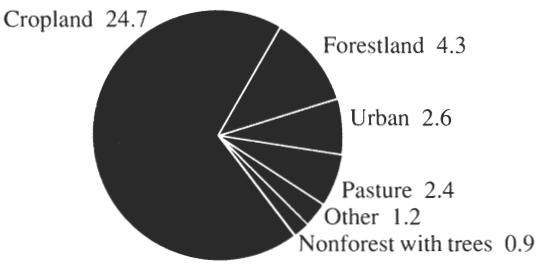

Figure 1. Major land use in Illinois in millions of acres, 1985. Total acres in Illinois = 36,061,000. Source: Hahn 1987.

Much of the story of the Illinois forests can be understood by comparing the earliest systematic vegetation data available for the state, data recovered from the original land surveys made during the first half of the nineteenth century, with recent land-use information taken via remote sensing from airplanes and satellites.

FORESTS OF 1820

Illinois was surveyed by the United States General Land Office between 1807 and 1844. Starting from southern Illinois and working northward, surveyors divided the land into townships and sections, prepared plat maps, and made notes on the vegetation they encountered. These records provide a fairly complete picture of the landscape prior to the massive disturbance caused by European settlement. Anderson (1970) published a map showing the statewide distribution of forest and prairie as deduced from these data (Figure 2). Large expanses of forest existed, primarily in the south and west. Approximately 38.2% of the state (13.8 million acres) was forested at the time of the European settlement, 61.2% was prairie, and 0.6% was water. Fifteen counties were at least 80% forested, and only 21 counties had less than 20% forest cover.

FOREST TRENDS 1820–1980

Illinois forests have undergone drastic changes in the decades since European settlement. Only 31% of the forest area present in 1820 exists today (Figure 3). The lowest percentage of forest occurred about 1920 when only 22% of the land forested in 1820 remained in forest (Telford 1926; U.S. Forest Service 1949; Essex and Gansner 1965; Hahn 1987). Although forest area has increased in recent decades, most of today's forest is secondary forest, and only about 11,600 acres exist in a relatively undisturbed condition (Illinois Natural Areas Inventory as reported in Iverson et al. 1989). Illinois ranks 49th, next to Iowa, in percent of the state converted from its "potential" vegetation type (Küchler 1964); only 11 percent of the state remains in its "potential" vegetation type and essentially all of that is forest (Klopatek et al. 1979).

The pattern of deforestation of the primary (i.e., "virgin") forests of Illinois can be deduced to some degree by relying on estimates of forestland in 1820 and 1924 and on other written accounts (especially Telford 1926). From initial settlement in the early 1800s to 1860, agriculture was the only important industry associated with wooded lands. Until 1830, forests were the sole source of potential agricultural land; however, when settlers realized that the prairies made good cropland and after the invention of the moldboard plow, the prairies were converted to cropland at an astonishing rate of approximately 3.3% per year (Table 1). Over 300,000 people settled the prairies during the decade of the 1830s, and this burgeoning population created an enormous demand for housing material, fuel, and fence posts. Railways were not yet in place to import lumber, and most of the timber in the prairie counties rapidly disappeared.

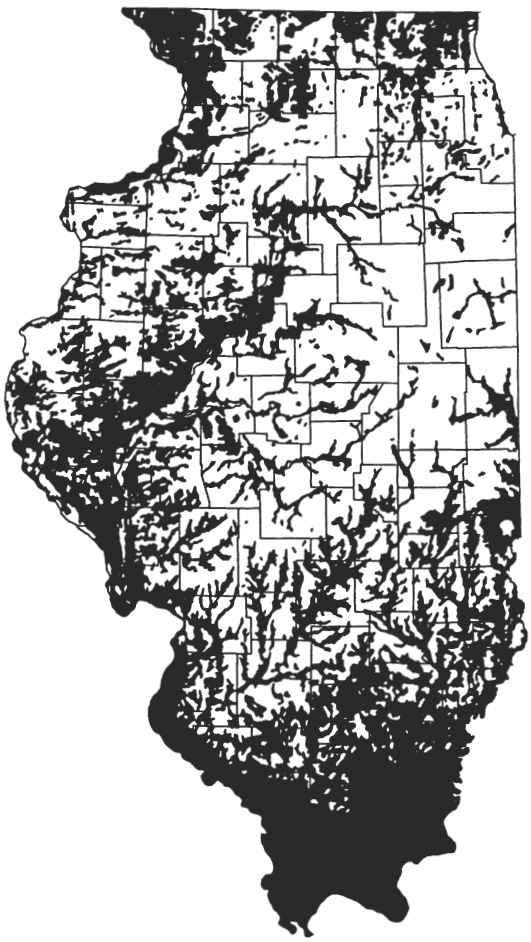

Figure 2. Forests in Illinois about 1820. Source: Anderson 1970.

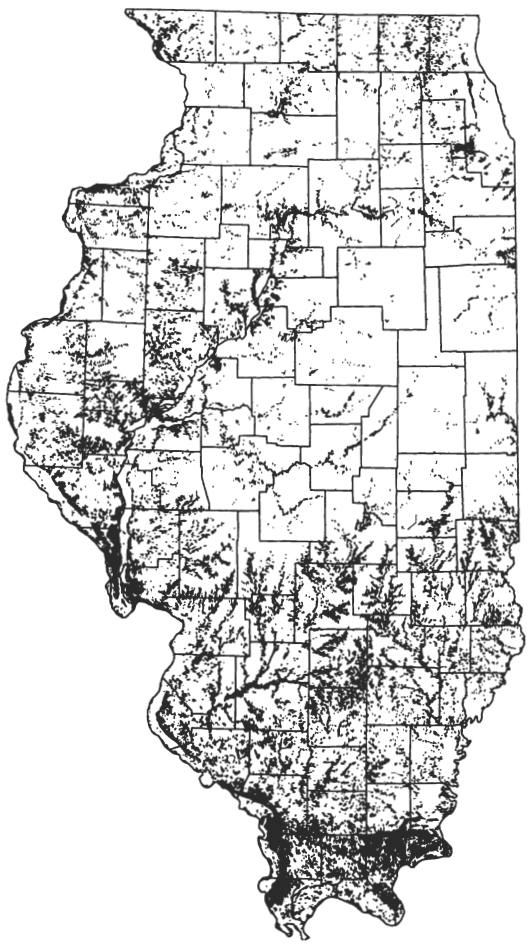

Figure 3. Forests in Illinois about 1980. Source: U.S. Geological Survey land-use data, 1973–1981.

By 1860, a timber industry had begun to flourish in Illinois. Ninety-two of the 102 counties had industries based on wood products by 1870, and forestland had dwindled to 6.02 million acres (Telford 1926). During the 1880s, annual lumber production exceeded 350 million board feet, 2.2 times the present production, and continued to increase until 1900, when it began to decrease as the resource itself declined. By 1923, only 22,000 acres of the original 13.8 million acres of primary forest remained.

A useful comparison can be made between deforestation in Illinois in the nineteenth century and the deforestation presently under way in the tropics. The primary forests of Illinois went from 13.8 million acres in about 1820 to 6 million acres in about 1870, to 22,000 acres in about 1920 (Figure 4), an overall deforestation rate of 1% per year (1.13% of the original primary forest lost during the first half of the century, 0.87% during the second half). Deforestation rates, however, were not a constant during the period and probably followed a curve such as that shown in Figure 5, with maximum deforestation in the late 1800s. Rates of deforestation have also been compiled for Rondônia in Brazil (Malingreau and Tucker 1988), for Costa Rica (Sader and Joyce 1988), and for Malaysia (Iverson et al. 1990) and are shown in Table 1. The fastest rate, 2.47% annually, was found from 1972 to 1982 in peninsular Malaysia, even though more forestland was being removed in Rondônia. This rate was probably equaled in Illinois in the late 1800s (Figure 5). A similar curve is currently found in the other countries, with Malaysia at the apex of the curve, Rôndonia on the upward slope with increasing rates, and Costa Rica on the downward slope with a declining resource and a dropping rate. History does indeed repeat itself, and we Americans should acknowledge our own history of deforestation as we now attempt to curb the destruction of tropical forests.

FOREST TRENDS 1962–1985

Forest area increased by 10% from 1962 through 1985, from 3.87 to 4.26 million acres. This increase is partially explained by the reduced number of cattle raised in Illinois and the conversion of pastures and hayland to secondary forest. Total net volume of growing stock has also increased 40% since 1962 (Table 2). Pine plantations have shown the highest percentage of increase in volume (up to 375%), but the largest absolute increase in volume was shown by oaks (an increase of 0.64 million cubic feet).

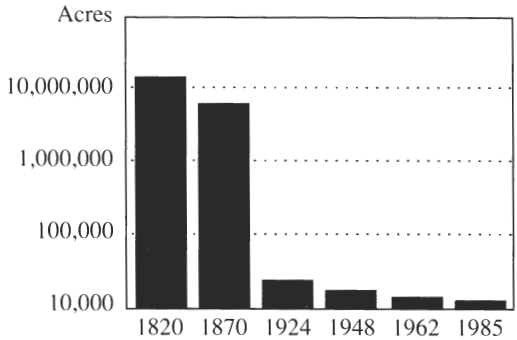

Figure 4. Extent of Illinois primary forests, 1820–1985. Interpreted from Telford 1926; U.S. Forest Service 1949; and Anderson 1970.

Table 1. Recent rates of land clearing in three tropical countries compared with rates of land clearing in Illinois from 1820 to 1923.

Location	Land use	Year	Sq km of land	Percent cleared per year
Rondônia, Brazil	Forest	1978	239,800	
		1987	208,000	1.47
Malaysia	Forest	1972	48,970	
		1982	36,870	2.47
Costa Rica	Forest	1940	34,210	
		1983	8,710	1.73
Illinois	Forest	1820	55,870	
		1870	24,290	1.13
		1923	90	0.87
Illinois	Prairie	1830	87,550	
		1860	10	3.33

Compositional changes during 1962–1985 were especially profound, with vast percentage increases in commercial acreage of white, red, and jack pines, oak–gum–cypress, and especially maple–beech forest types (Figure 6). Maples increased 41-fold in the past 25 years—from 0.025 million acres to 1.046 million acres! Concomitantly, oak–hickory decreased by 337,000 acres (14%), and over half of the state's elm–ash–soft maple disappeared. The loss of oak–hickory is largely from maple "take-over" as shade-tolerant maples replace oak–hickory stands following mortality or harvest. A documented case of the maple take-over of a forest in east-central Illinois is presented later in these proceedings (Ebinger and McClain, page 375) and elsewhere (Ebinger 1986). The reduction of elm–ash–soft maple is due to mortality from Dutch elm disease and the conversion to cropland of bottomland forests that once supported this forest type. These data make clear that although forest acreage and volume have increased since 1962, the quality and value of the timber resource has diminished, at least by today's standards. Maple-dominated forests also support a somewhat different array of wildlife than that supported by oak-dominated forests, and such "hard mast" (acorns and hickory nuts) feeders as squirrels and woodpeckers are less abundant in maple-dominated forests.

ILLINOIS FORESTS TODAY

A closer look at the current status of the Illinois forests reveals some interesting and on occasion surprising information.

Area

Estimates of current forestland compiled from the 1985 U.S. Forest Service inventory indicate that about 12% (4.27 million acres) of the land area of Illinois is forested (Hahn 1987). The extent of this forestland can be seen in Figure 3 (as well as in several forms on the 1:500,000 scale map of Iverson and Joselyn 1990). The importance of the southern and western counties is clear. At one extreme is Ford County with only 3,000 acres of forestland; at the other is Pope County with 149,200 acres, Jackson with 134,500, and Pike with 122,500. Included in this 4.27 million acres are 4,029,900 acres of commercial (capable of and potentially available to produce commercially valuable trees) forestland and 235,600 acres of reserved or protected timberland.

Wooded strips less than 120 feet wide and land on which at least one tree (5 inches in diameter at breast height) occurs per acre make up a category that has been designated "nonforestland with trees." Included in this category are wooded strips (178,500 acres), wooded pastures (162,400), urban and other built-up land (139,500), windbreaks (133,100), improved pastureland with trees (103,600), urban forest (102,800), and several miscellaneous classes. Taken together, 900,800 acres of nonforestland with trees are found in Illinois.

Composition

The composition of many Illinois forests has changed over the past several decades. Today, about one-half of the commercial forest acreage

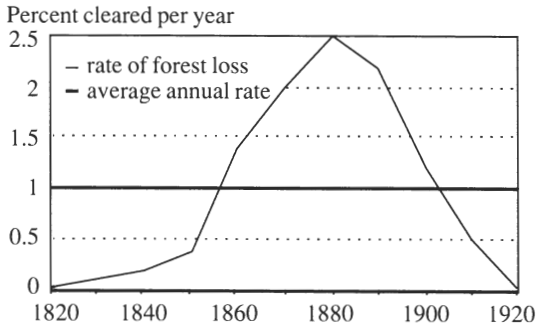

Figure 5. Rate of forest clearing in Illinois, 1840–1920. Interpreted from Telford 1926; U.S. Forest Service 1949; and Anderson 1970.

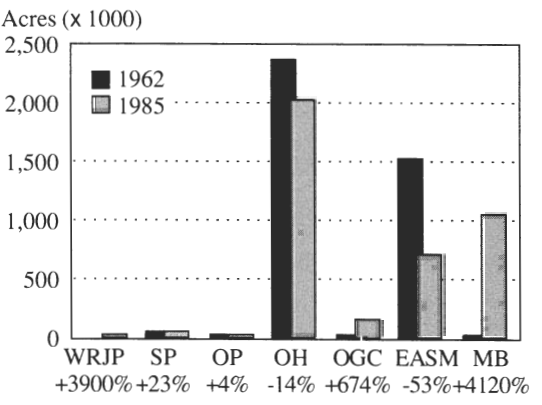

Figure 6. Composition of Illinois commercial forests, 1962–1985. Percent change is given below each pair of bars. Abbreviations are decoded as follows: WRJP = white–red–jack pine, SP = shortleaf pine, OP = oak–pine, OH = oak–hickory, OGC = oak–gum–cypress, EASM = elm–ash–soft maple, MB = maple–beech. Source: Hahn 1987.

Table 2. Net volume of growing stock on commercial forestland in Illinois by species group for 1962 and 1985, percent change between those dates, and net annual growth estimated from 1985 data.

Species group	1962 (thousand cubic feet)	1985 (thousand cubic feet)	Percent change	Net annual growth (thousand cubic feet)
Softwoods				
Loblolly–shortleaf pine	15,200	64,700	+327	1,891
White pine[1]	—	16,800	—	393
Red pine[1]	—	12,000	—	310
Eastern red cedar	2,400	11,400	+375	445
Bald cypress	6,800	8,900	+31	13
Jack pine[1]	—	700	—	36
Other softwoods	700	3,000	+329	110
Total	25,100	117,500	+368	3,224
Hardwoods				
Red oak	701,800	1,062,400	+51	18,352
White oak	739,700	1,017,600	+38	15,075
Hickory	343,900	522,500	+52	7,443
Soft maple	259,200	341,600	+32	14,144
Elm	367,700	267,400	-27	-5,106
Green–white–black ash	218,200	261,000	+20	6,932
Hard maple	99,800	163,100	+63	3,717
Cottonwood	114,100	157,800	+38	1,976
Sycamore	123,300	134,600	+9	2,412
Black walnut	77,500	119,100	+54	2,279
Hackberry[2]	—	93,500	—	5,683
Black cherry[2]	—	87,700	—	3,663
Basswood	25,800	54,100	+110	1,215
Yellow poplar	26,400	51,800	+96	1,609
Willow[2]	—	50,300	—	1,427
Sweetgum	58,600	45,100	-23	1,163
River birch[2]	—	36,800	—	1,257
Tupelo	13,900	28,000	+101	209
Beech	14,500	12,100	-17	242
Butternut[2]	—	5,700	—	105
Aspen	9,100	1,900	-79	28
Other hardwoods	223,100	203,500	-9	8,966
Total	3,416,600	4,717,600	+38	92,791
Total all species	3,441,700	4,835,100	+40	96,015

[1] Tabulated only in 1985 survey, included with other softwoods in 1962.
[2] Tabulated only in 1985 survey, included with other hardwoods in 1962.
Source: Hahn 1987; reprinted from Iverson et al. 1989.

(2.03 million acres) is oak–hickory, one-fourth is maple–beech (1.05 million acres, almost exclusively sugar maple), and one-sixth is elm–ash–soft maple (0.72 million acres) (Figure 6). Together, the remaining forest types (white–red–jack pine, loblolly–shortleaf pine, oak–pine, and oak–gum–cypress) account for an additional 216,800 acres of commercial forestland.

The location of these various forest types has been mapped (Iverson et al. 1989; Iverson and Joselyn 1990). Oak–hickory is found throughout the state with maximum levels in the western and southern counties. Maple–beech, a forest type also found throughout Illinois, has the highest average number of acres per county in western Illinois but is proportionally most prominent in the central Grand Prairie counties. Elm–ash–soft maple is found in bottomland forests, and these forests are more frequently located in the southern counties. Oak–pine, oak–gum–cypress, and shortleaf pine types are confined to the southern counties, but the white pine type is most common in the western part of the state.

According to the Illinois Plant Information Network (Iverson and Ketzner 1988), 508 woody taxa have been recorded in Illinois, a

high diversity of woody plant species considering the extensive agricultural acreage. Trees account for 261 taxa, shrubs 284, and lianas 47 (some taxa include more than one type). These woody plants account for a diversity of cover types and occupy a variety of habitats. On average, 70 tree taxa and 54 shrub taxa have been recorded from each county (Iverson et al. 1989). Southern counties have the largest number of tree taxa (Jackson has 145 taxa, Pope 129, and Union 128), and northeastern counties have the most shrub taxa (Cook has 153 and Lake 136).

Volume, Annual Growth, and Number

Net volume estimates for 1985 showed the prominence of oak and hickory in commercial forests, with considerable amounts of ash, black walnut, cottonwood, elm, maple, and sycamore as well (Figure 7). The data shown in Figure 7 may have greater immediacy if we consider that 1 million board feet provide enough lumber to build an estimated 73 wood houses. The total net volume of Illinois timber in 1985—17.5 billion board feet—would theoretically build 1.3 million wood houses!

Total net volume estimates of growing stock were 4.8 billion cubic feet, an average of 47.4 million cubic feet per county or 1,200 cubic feet per acre of commercial forestland in the state. Hard hardwoods (predominately oak, hickory, and ash) accounted for 68% of total volume; soft hardwoods (e.g., elm and soft maple) accounted for 30% and softwoods (e.g., pine) made up 2%.

According to annual growth estimates for 1985 (Hahn 1987), growing stock showed 96 million cubic feet of growth, or 437 million board feet of sawtimber growth. Over 42% of net annual sawtimber growth was accounted for by oaks, with another 10% from soft maple, 6.3% from ashes, 3.7% from black cherry, 3.3% from hard maple, and 3.2% from black walnut. Only elm and black ash showed negative growth rates between 1962 and 1985, and these are attributed to Dutch elm disease and the clearing of bottomlands.

The estimated number of trees in Illinois commercial forests revealed a somewhat surprising statistic: the elms, with 344 million trees, were the most common group. Most of these, however, are small slippery (or red) elms with little commercial value (Figure 8). Overall, white oaks (99 million), red oaks (136 million), hickories (185 million), hard maples (117 million), and soft maples (91 million) were very abundant.

Age

Illinois forests are reasonably well distributed among age classes, with 61-year to 80-year classes most prevalent; however, certain trends appear when the ages of major forest types are considered (Figure 9). Oak–hickory forests show a very uneven age distribution, with the majority older than 60 years. A predominance of maple–beech is found in younger age classes (<30 years) relative to oak–hickory and elm–ash–soft maple. This pattern again illustrates, as it did in the data on acreage trends (Figure 6), two important aspects of Illinois forests today: maples are rapidly increasing in younger age classes and forest types dominated by oaks and elms are declining and have relatively fewer trees in younger age classes. Among the other forest types, white

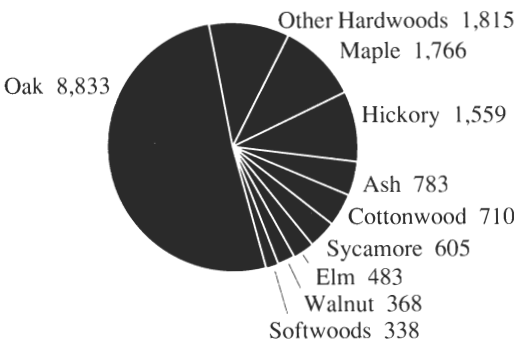

Figure 7. Total volume of Illinois commercial forestland in 1985 in million board feet. Total net volume of sawtimber was 17.5 billion board feet. Source: Hahn 1987.

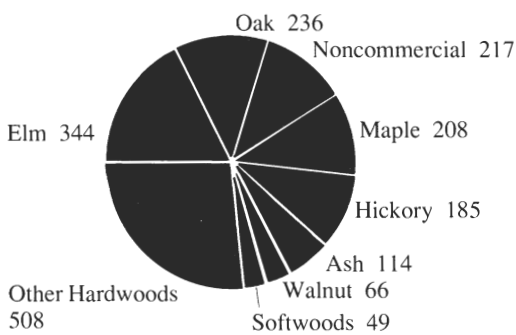

Figure 8. Number of live trees in 1985 in Illinois commercial forestland in millions of trees. Total number of trees was 1.93 billion. Source: Hahn 1987.

and shortleaf–loblolly pine peak in the 21- to 30-year class with very little stand acreage under 10 years of age. Pine plantations are no longer being planted to the extent they were from 1930 to 1960, primarily because of changes in the management of the Shawnee National Forest (U.S. Forest Service 1986).

Site

Forest stands can also be classified according to an index that measures the quality of a site based on the height its trees attain after 50 years of growth. The soils of Illinois are superior for forest growth compared to the relatively shallow or infertile soils of neighboring states like Missouri or Kentucky. According to this index, fully 84% of the trees in the commercial forestlands of Illinois are capable of supporting growth of 61 to more than 100 feet during a 50-year interval.

Mortality

In 1985, the forests of Illinois experienced an annual mortality of over 200 million board feet of sawtimber (67 million cubic feet of growing stock) (Hahn 1987). In contrast, 161 million board feet of timber were cut in 1983 (Blyth et al. 1987); at that time, therefore, more timber was dying than was being cut. These mortality data represent an annual death rate of 1.36% of the total inventory and 69% of the annual growth of growing stock. These rates are quite high in comparison to the mortality rate (0.9%) in Illinois in 1962 and to rates in neighboring states—central Wisconsin, for example, had an average mortality rate of only 0.8% of its total inventory in 1983 (Raile and Leatherberry 1988). The Illinois secondary forests are aging, with concomitant increasing mortality. Disease accounted for 38% of the mortality, but weather, suppression, and unknown causes were also important (Hahn 1987). Elms suffered the greatest mortality and accounted for 26% of total mortality; 56% of the elm mortality was due to disease.

Ownership

Over 90% (3.64 million acres) of the commercial forests in Illinois are privately owned, mostly by farmers (45.3%) and other individuals (38.1%) (Figure 10). The remaining 10% is publicly owned, primarily by the federal government (7.2%) in the form of the Shawnee National Forest. The Cooperative Extension Service of the U.S. Department of Agriculture estimated that Illinois had 169,073 private

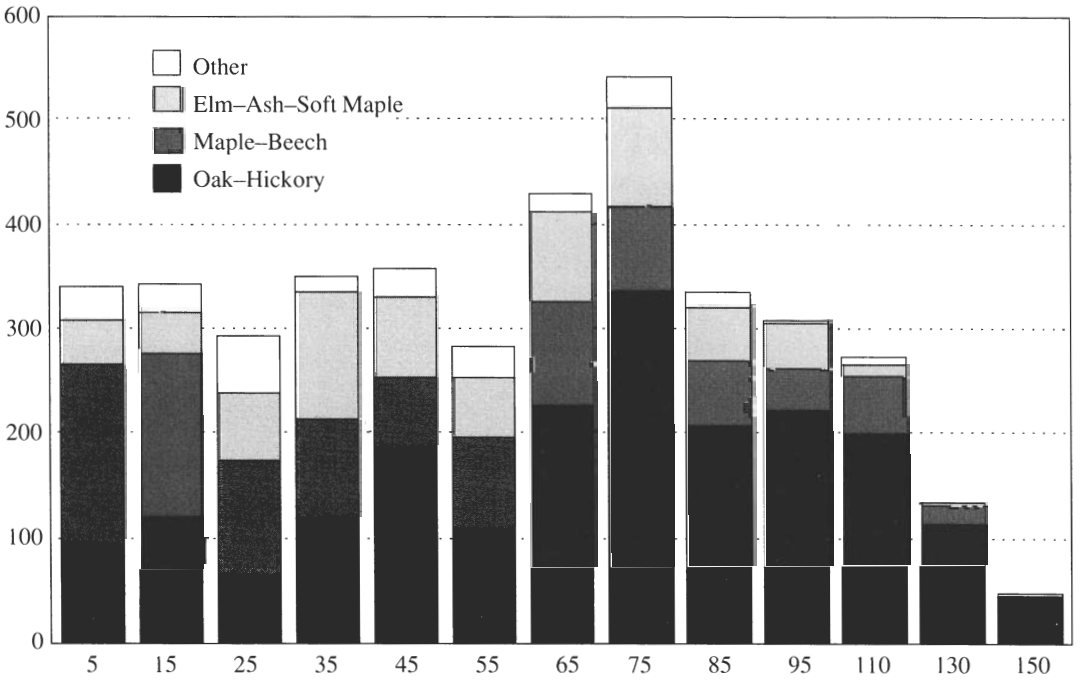

Figure 9. Acreage by age classes (in years) of the three major forest types in Illinois in 1985. Source: Hahn 1987.

forestland owners, each of whom owned an average of 21.5 acres of forest. The primary reasons for forest ownership given by the holders of small parcels were wildlife habitat and aesthetic value (Young et al. 1984); income was of greater importance for those who owned large forest parcels (McCurdy and Mercker 1986).

BENEFITS OF ILLINOIS FORESTS

Although Illinoisans would undoubtedly respond in different ways if queried on the benefits of the forests of our state, probably none of them would be in error. The forests of Illinois truly offer multiple benefits and perhaps one of the most encouraging aspects of management is that plans can be designed to accommodate and enhance these varied benefits.

Natural Communities

In the late 1970s, a search for natural communities relatively undisturbed by human activity was undertaken throughout the state (White 1978). Of the 1,089 natural areas selected for inclusion in the Natural Areas Inventory, 392 (36%) contained forestland; however, only 149 natural areas, a mere 11,593 acres of forestland, were classified as Grade A (relatively undisturbed) or Grade B (some disturbance). Of that total, about a third was classified as Grade A. Since that inventory, a few additional high-quality sites have been added, for a total of 157 areas from 62 counties. Lake and St. Clair counties contain the largest number of forested natural areas (12 and 11, respectively); Peoria has 7, Washington and Mason 6 each, and Massac 5. Adams County has the most extensive acreage of high-quality forestland, 1,950 acres, followed by St. Clair (963 acres), Lake (635 acres), Johnson (622 acres), McLean (450 acres), Saline (447 acres), Cook (444 acres), and Pike (431 acres).

Many high-quality forests in Illinois are undergoing degradation because of the invasion of exotic plants. Over much of the state, forests are threatened by garlic mustard (*Alliaria petiolata*), Amur honeysuckle (*Lonicera maackii*), tatarian honeysuckle (*L. tatarica*), Japanese honeysuckle (*L. japonicus*), multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), and other introduced species. These exotics reduce the diversity of forest communities by eliminating native understory species. Management strategies must be adopted within the few remaining high-quality forests if they are to be protected from aggressive species. Control measures include recruiting volunteers for hand weeding, the cautious application of pesticides, and the implementation of biological controls. Perhaps most important is an educational program to teach the public how to identify and control these dangerous invaders.

Botanical Diversity

Illinois forests provide habitat for an exceptional diversity of plant species and are the natural home for most trees and other woody species. The 508 taxa of trees, shrubs, and lianas found in Illinois represent 15.9% of the state's reported flora, and 346 (69%) of them are associated with forest habitats (ILPIN data; Iverson and Ketzner 1988) (Figure 11). Most of the remaining taxa are cultural (escaped from cultivation). Of the 508 taxa, 370 (73%) are native to Illinois; the remaining are introduced. A relatively high proportion of the state's woody taxa are listed as rare in Illinois (40%); 15% occur commonly, 33% occur occasionally (common in localized patches), and 12% are

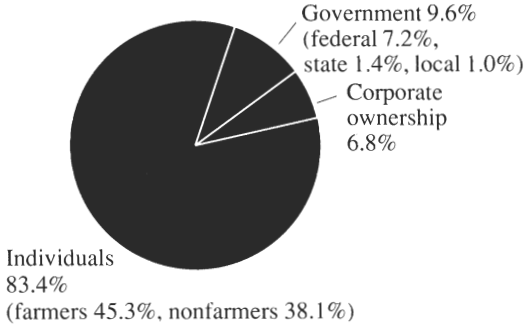

Figure 10. Ownership of Illinois commercial forests, 1985. Source: Hahn 1987.

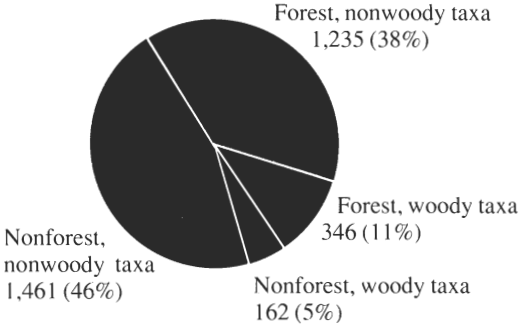

Figure 11. Number of plant taxa by habitat and habit (woody and nonwoody). Total taxa in Illinois = 3,204. Source: Iverson and Ketzner 1988.

uncommon (localized distribution or sparse throughout).

Illinois forests also provide habitat for an amazing number of nonwoody taxa. Including the woody taxa, fully 1,414 native taxa (61% of the native Illinois flora) are associated with forest habitats (Figure 11). Thus Illinois forests, which occupy only 12% of the area of the state, provide habitat for over half of its native flora. If we are to protect this irreplaceable biological diversity, we must maintain and restore forest communities. Beyond the importance of forestland as habitat for total plant diversity, rare plant species are frequently found in forest habitat, for example, 166 taxa (47%) of the 356 plants listed as threatened or endangered in Illinois are forest inhabitants. The importance of high-quality forests as refuges for these taxa cannot be overemphasized, especially in the face of extreme pressures from urban and agricultural growth.

Wildlife Habitat

Illinois forests provide the major habitat for numerous wildlife species, and losses in the quality and quantity of that habitat severely affect wildlife populations (Illinois Wildlife Habitat Commission 1985). Game species—gray squirrel, eastern wild turkey, quail, and white-tailed deer—depend on woodlands as do many more nongame animals—thrushes, warblers, woodpeckers, nuthatches, kinglets, and whippoorwills—to mention only a few bird species. But some relationships between wildlife and forests are more subtle. Most of us recognize the dependence of wood ducks on natural cavities in the trees of bottomland forests, but bottomland forests also provide food and habitat for fish, mitigate the effects of floods, restrain the movement of harmful chemicals into lakes and streams, and provide shade, thereby lowering water temperatures during stressful summer months.

One method of summarizing the value of Illinois wildlife habitat is based on land use. Complete details are presented in Graber and Graber (1976), and revised calculations based on current data are given in Iverson et al. (1989). The habitat evaluation index devised by Graber and Graber is based on the relative amount of a particular habitat type within a given area, the availability of that habitat type within the state or region, the changing availability of that habitat (Is it increasing or decreasing over time?), and the "cost" of a given habitat measured in years required to replace the ecosystem. A summary of habitat factors for Illinois as a whole is presented in Table 3. By this calculation, over three-quarters of the wildlife habitat (88 of 115.7 habitat factor points) is derived from forests. Elm–ash–cottonwood rates highest because this forest type has been disappearing so quickly over the past two decades (Figure 6). Oak–hickory values would be higher except that numbers in older age classes are increasing as secondary forests mature, even though numbers in younger age classes are decreasing (Figure 9). A very minor rating was earned by maple–beech because this forest type has increased so dramatically in recent years (Figure 6).

This method can be used to evaluate wildlife habitat on parcels of various size (see examples in Iverson et al. 1989). In the final calculation, the habitat factor for a given site or region is divided by a regional or statewide habitat factor (115.7 for the state). An index of 1.0, therefore, means that the value of the habitat under consideration is about average for the state or region as a whole. Thus, a habitat evaluation index of 1.5, the value calculated for the 16 southern counties, indicates a much higher wildlife value than the value of the state overall. Similarly, the value of 0.66 for the 60 northern counties indicates a relatively poor

Table 3. Habitat factors for Illinois, 1985, calculated according to Graber and Graber (1976).

Land type	Habitat factor	Percent of habitat factor
Forest		
Pine	5.70	4.9
Oak–hickory	30.07	26.0
Oak–gum–cypress	11.97	10.3
Elm–ash–cottonwood	40.19	34.7
Maple–beech	0.14	0.1
Subtotal		76.0
Nonforest		
Cropland	0.29	0.3
Pasture/hayland	10.01	8.7
Prairie	1.46	1.3
Marsh	15.28	13.2
Water	0.38	0.3
Urban, residential	0.03	0.0
Fallow	0.19	0.2
Subtotal		24.0
Total	115.73	100.0

habitat for wildlife, and the value of 1.09 for the 26 south-central counties indicates wildlife habitat somewhat above that of the state as a whole.

Fragmentation of forest habitat has negative implications for wildlife, especially for neotropical migrant birds that need large blocks of uninterrupted forest for successful nesting (Harris 1984; Blake and Karr 1987; Robinson 1988). As large tracts of forest are broken into small, isolated woodlots, more forest edge is created and more opportunities exist for edge-adapted species, most importantly the cowbird, to invade the area and parasitize the nests of many forest songbirds.

The extent of fragmentation in Illinois forests was made clear in a recent examination of forest parcels by size. Relying on the Illinois Geographic Information System and data from the U.S. Geological Survey, researchers determined that 10,121 forested parcels exist in the state and that the average size per parcel is 358 acres (Iverson et al. 1989). About 44% of the parcels are less than 100 acres in size and about 10% are larger than 600 acres (Figure 12). Perhaps the density of forest parcels can be pictured more clearly if we envision an area the size of a township—36 square miles. On average, 6.1 parcels exist per township-sized area, with 69% of them roughly 40 (limit of resolution of the data) to 200 acres in size. This perspective makes clear that Illinois forests are extremely fragmented and that a concentrated effort must be made to protect larger forest patches and to aggregate smaller ones.

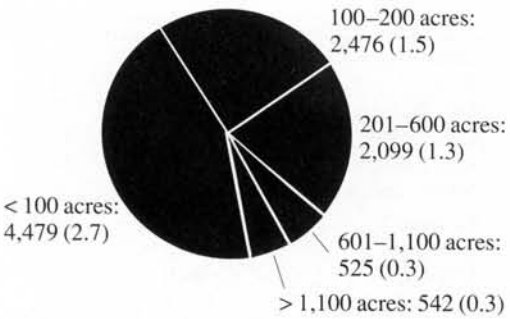

Figure 12. Number of forested parcels in Illinois by size and average number of parcels per township equivalent (36 square miles). Total number of parcels in Illinois of a given size is the number immediately following the size (e.g., <100-acre parcel: 4,479). Average number of parcels of a given size per township equivalent is given in parentheses. Source: Iverson et al. 1989.

Soil and Water Quality Protection

Soil erosion with its accompanying degradation of surface water is indeed a serious threat to the future of an agricultural state: for every pound of corn, soybeans, wheat, or oats grown in Illinois, 3.3 pounds of soil are lost (Iverson et al. 1989). In contrast to cropland, forest vegetation protects against excessive soil loss. Average erosion of cropland proceeds at about four times the annual rate of nongrazed forestland—7 tons per acre compared to 1.6 tons, respectively. The difference in soil loss is even greater on sloping, highly erodible soils. Soils with land capability ratings of IVe to VIIe lose 24.2 to 39.4 more tons per acre each year they are under cultivation than they would lose if they were forested. In 1982, 1.75 million acres of cropland had these capability ratings. Had those acres been converted to nongrazed forestland, 36.5 million of the 157.8 million tons of soil lost annually from cropland would have been saved. Figure 13 shows that the soil savings that would result from converting cropland with higher capability ratings to nongrazed forest would be disproportionately higher than conversions from cropland with lower ratings.

The Conservation Reserve Program is designed to remove marginal cropland from cultivation, and it is helping; however, over 96% of the cropland currently being removed from production in Illinois is going into grass rather than trees. The U.S. Department of Agriculture and the Illinois Council on Forestry Development are working together to alter this percentage in favor of trees.

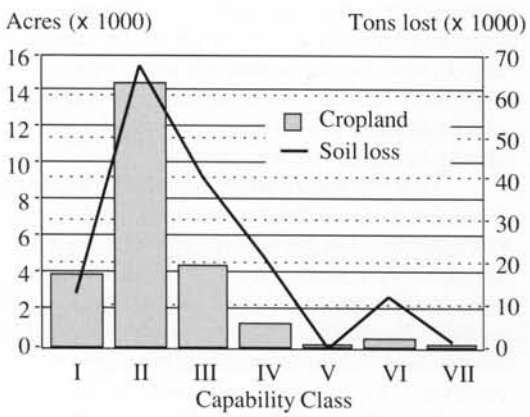

Figure 13. Cropland acreage and annual soil loss by capability class. Class I soils are most productive; Class VII soils are least productive. Source: U.S. Soil Conservation Service data base 1982.

Heavy grazing, and especially feedlot operations, in forestlands largely negates the benefits of soil protection. Average soil loss from forestland that is heavily grazed or under feedlot operations is 13.1 tons per acre per year in contrast to only 1.6 tons per acre per year on nongrazed forest. Thus, 66% of the 12.6 million tons of soil lost annually from forestland is lost from these areas, even though only 19% of Illinois forests are categorized as grazed. Light grazing of forestland generally does not increase soil loss significantly and is certainly to be preferred over cultivation of marginal lands.

According to estimates by the U.S. Forest Service, 133,100 acres of windbreaks existed in Illinois in 1985 (Hahn 1987). Windbreaks retard soil loss due to wind erosion, but they also provide shade for livestock and shelter for wildlife. Their aesthetic qualities are not to be overlooked, but their role in the conservation of energy is growing in importance. Back in 1981, the Soil Conservation Service estimated that 124,000 buildings in rural Illinois needed windbreaks. Had they been planted, energy equivalent to 941 million kilowatt-hours of electricity could have been saved (USDA Soil Conservation Service 1982).

Recreation and Scenic Values

In 1987, surveys by the Illinois Department of Conservation indicated that Illinoisans spent about 240 million days or portions of days pursuing recreation on or near forestlands; in the process they spent approximately $6.3 billion (Illinois Department of Conservation 1989). Activities closely aligned with forest recreation (picnicking, observing nature, cross-country skiing, backpacking, hiking, camping, canoeing, horseback riding, snowmobiling, riding off-road vehicles, trapping, and hunting) accounted for 206 million of those days, an average of 18.7 days per resident (Figure 14).

The majority (93%) of the 4,528 areas developed for recreation in Illinois (almost 900,000 acres) are publicly owned and operated. Total land available for recreation totals roughly 2.7% of the state's land and water area, a per capita outdoor recreation acreage of less than 0.1 acre. Among states, Illinois rates 46th in total public open space per capita. In addition, most of the publicly owned land available for recreation is located in the southern part of the state; the majority of Illinoisans, however, live in the north.

Urban Forests

Most Illinoisans (83%) live in urban centers, and urban forests are often their only exposure to a natural environment. Urban forests provide many benefits beyond those normally associated with rural forests, including temperature modification and energy conservation; the abatement of air, water, and noise pollution; the masking of unpleasing urban views; and physical and psychological benefits to city dwellers. Because the urban forest exists in such a heterogeneous environment, an accurate assessment of its extent and function is difficult. The U.S. Forest Service, however, has estimated that 102,800 acres of urban forest and 139,500 acres of urban areas with trees existed in Illinois in 1985 (Hahn 1987). Cook County alone has over 67,000 acres of forest preserves, and much of this land is available for recreation. A recent remote-sensing study revealed that 21.3% of the land area in the six-county Chicago area had tree cover in 1988 (Cook and Iverson 1991). Yet less than 0.01 acre per capita of publicly owned forestland exists in that six-county area, and Chicago ranks last among the nation's ten largest urban centers in this regard.

Urban forests face three problems. First, maintenance and management are inadequate. A recent survey by the Illinois Council on Forestry Development (1988) estimated that 6.5 million municipal street trees exist in Illinois with an estimated value of $3 billion. These trees are generally not adequately maintained because of inadequate budgets and the lack of trained foresters. In addition, less than half the potential number of street trees are presently in place, and removals outstrip plantings (American Forestry Association 1988). Second, forestlands are jeopardized by

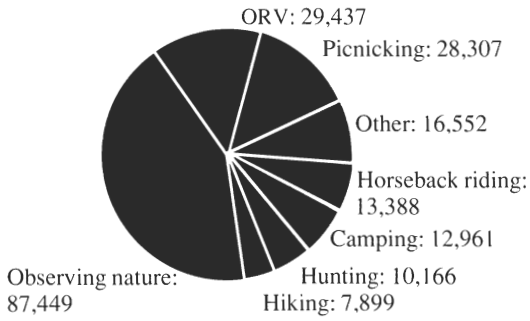

Figure 14. Days (in thousands) spent in recreational pursuits on or near forestlands in Illinois, 1987. Source: Illinois Department of Conservation 1989.

development and population pressures. Tremendous growth is now occurring in the six collar counties around Chicago. Information from the Northeastern Illinois Planning Commission (1987) shows that 867 quarter sections (about 5.6% of the area) were urbanized (population density exceeding 1,000 per square mile) between 1970 and 1980. Much of this growth was at the expense of forestland. A third problem is the absence of a policy for using wood waste. Until recently, much of the debris from tree removals and large amounts of other wood wastes were deposited in landfills, an enormous waste of wood and leaf mulch and the needless use of costly landfill space. Better uses for this material must be developed and marketed.

Timber Products

Illinois ranks fifth in the nation in demand for wood but 32nd in production. As a result, Illinois imports much of the wood it uses from neighboring states. In addition, 14.2% of the wood harvested in Illinois is processed in neighboring states and then often imported back into the state. Currently, the annual growth of timber (96 million cubic feet) exceeds timber removals (68.6 million cubic feet removed for timber products, logging residues, and changing land uses), and a higher proportion of the state's demand for wood could be met within its own boundaries if the processing facilities were at hand. With judicious management, harvesting could be increased, negative effects on the environment minimized, and multiple benefits achieved.

In 1983, 161 million board feet of timber (mbf) were harvested in Illinois (Blyth et al. 1987); 146 mbf were processed in 178 Illinois sawmills. Red oak (29%), pin oak (19%), white oak (16%), and cottonwood (10%) accounted for the majority of sawlogs processed in the state. Of the 4 mbf of veneer and other high-quality logs (mostly white oak, walnut, and red oak) cut in Illinois during 1983, only 0.3% remained in the state. Additionally, all pulpwood (7.2 million cubic feet) produced in the state were processed elsewhere. The veneer and pulpwood statistics are not surprising because virtually no plants for either veneer or pulpwood are found in Illinois.

An enormous quantity of fuelwood is harvested from Illinois woodlands. In 1982, nearly 2 million cords of firewood were cut or gathered, a figure that represents 43% of the total trees utilized that year! The major harvest of fuelwood takes place in the heavily populated northeastern counties. Cook, McHenry, and Will counties, for example, each harvested over 150,000 cords of fuelwood in 1983 (Blyth et al. 1985). The majority of firewood (97%) was cut from private lands, and 75% was gleaned from dead trees.

According to U.S. Department of Commerce figures, forest-related industries in Illinois employ 55,000 people with an average payroll of $965 million. These firms contribute more than $2 billion annually to the state's economy through value added by manufacture; in addition, they invest more than $144 million in capital improvements annually (U.S. Department of Commerce 1982–1985).

According to 1984 data from Dun & Bradstreet, 166,900 employees work for 957 Illinois firms that are primarily involved in the manufacture of wood products. If the paper industry is included, an additional 576 firms and 367,450 persons are involved (Figure 15). The Dun & Bradstreet numbers are much higher than those released by the U.S. Department of Commerce because Dun & Bradstreet include the total number of employees, even those not directly associated with the wood-manufacturing component. Nonetheless, a large number of employees work in forest-related industries, most of which are located in the Chicago region.

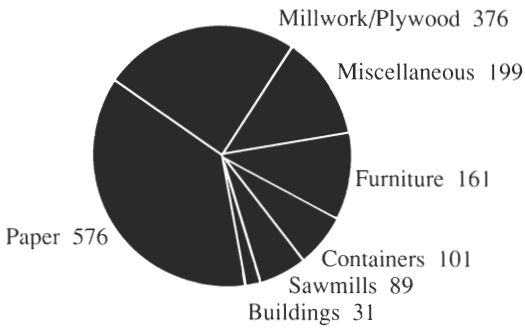

Figure 15. Forest-related industries in Illinois, 1984. These 1,533 sites employed 534,342 workers. Source: Dun & Bradstreet data base 1984.

CONCLUSIONS

A great deal of information has been presented to establish the initial contention of this paper: the Illinois forests provide numerous important benefits to the citizens of the state. Nevertheless, considerable improvement in the quantity and quality of these benefits could be achieved if forestlands were better managed. Over most of the state, little forest management is underway, and the potential of our forests to provide wildlife habitat, preserve biodiversity, and extend wood production has not been tapped. Even in "wilderness" areas, management is often necessary to maintain the status quo (e.g., remove exotic invaders). Ecosystems are not static entities; change is inevitable, but only with management can change benefit the resource as well at its human guardians.

We need to manage the forest resources we currently possess, but we also need to plant more forests if we are to assure continuing benefits from our forests. Recent political developments have and may continue to support tree planting programs; however, caution is in order. Planting trees requires more than seedlings and a spade. Species most appropriate to a given site must be selected, follow-up care must be available, and long-term management must be provided if the success of these programs is to be ensured.

The environmental problems facing Illinois, the nation, and the planet are grave indeed. Yet we are learning the important role that forests can play in mitigating some of these problems. We have, however, only begun to realize the enormity of the task. We have only begun to take the actions needed to create a sustainable world.

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