Forest Resource Trends in Illinois

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INTRODUCTION

Even though forests occupy only 12% of the land area of Illinois, they play a valuable role in the health of the state's environment and that of its citizens. Many of these benefits have been reviewed in *Forest Resources of Illinois: An Atlas and Analysis of Spatial and Temporal Trends* (Iverson *et al.* 1989), and summarized in the *Forests of Illinois* (Iverson *et al.* 1991). Readers are encouraged to obtain copies of these documents from the Illinois Natural History Survey. The purpose of this paper is to focus on current trends in Illinois forests and to report information obtained following these earlier publications, specifically, changes in forest cover from 1820 to 1985, current (1990) trends and patterns of forest land for a portion of south-central Illinois, and trends in forest composition and diversity, timber growth and harvest, value for wildlife habitat, and value for carbon sequestration.

Trends in Forest Area from 1820 to 1985

Illinois forests have undergone drastic changes since European settlement. In 1820 there were 13.8 million acres (5.6 m ha) of forest in the state (Fig. 1a, see also the large wall map by Iverson and Joselyn 1990, available at no charge from the author). Only 31% (4.26 million acres or 1.72 m ha) of the forest area present in 1820 remained in 1985 (Fig. 1b shows forest distribution as of 1980); essentially all (except for about 11,600 acres or 4700 ha) of the present forests are secondary or cutover timberland. Illinois also ranks 49th (Iowa is 50th) in the percentage of land remaining in the vegetation types (Kuchler 1964) on the land when the European settlers arrived (11 percent). The pattern and rate of deforestation in the latter part of the last century, estimated at 1.13% per year (Iverson 1991), rivals and even surpasses that of any tropical deforestation occurring today.

However, forest area has recently been increasing in Illinois. The lowest estimate of forest area in the state was made by Telford (1926), who estimated forest area to be only 3.02 million acres (1.22 m ha) compared to estimates of 4.0 million acres (1.62 m ha) in 1948 (USDA Forest Service 1949), 3.87 million acres (1.57 m ha) in 1962 (Essex and Gansner 1965), and 4.26 million acres (1.72 m ha) in 1985 (Hahn 1987). Forest area increased by 10% from 1962 through 1985 due primarily to reduced cattle production in the state during that period with subsequent conversion of hayland and pastures to secondary forest. Recent farm programs such as the Conservation Reserve Program have provided incentive to convert additional marginal acres to forest land.

When the state is evaluated according to five ecologically based regions (Fig. 2), changes in forest area since 1820 show similar patterns: major declines in forest area are dramatic between 1820 and 1924, with slow increases in area since 1924 (Fig. 3). The only region to lose forest area between 1962 and 1985 was the South-Central Region, a group of 31 counties south of the Shelbyville moraine and north of the Shawnee Hills. Figure 4 is a county map showing trends of forest area between 1962 and 1985. Counties that lost more than 5,000 acres (2,000 ha) of forest land between 1962 and 1985 were Bond, Clark, Clinton, Fayette, Franklin, Gallatin, Hamilton, Jasper, Lawrence, Marion, Montgomery, Perry, Richland, Shelby, St. Clair, Wabash, and Wayne. Counties from other regions that lost more than 5,000 acres were

[1]The majority of this work was conducted while the author was employed by the Illinois Natural History Survey, Champaign, IL.

Alexander and Massac from the Southern Unglaciated Region, Greene from the Western Region, and Lake from the Northern Region. However, an additional 38 counties gained more than 5,000 acres of forest land during this interim, mostly from the northern two-thirds of the state (9 of 12 counties in the Northern Region, 11 of 31 in the Grand Prairie Region, 14 of 21 in the Western Region, 1 of 31 in the South-Central Region, and 3 of 7 in the Southern Unglaciated Region. Clearly, the northern counties generally have increased in forest area (especially those along the major river systems) while the southern portion of the state (except for the Shawnee National Forest counties) suffered significant forest losses during the same period.

Forest Pattern and Trends in South-Central Region

To better understand the temporal and spatial patterns of forest patches in the South- Central Region, a detailed analysis of one 1990 Landsat TM scene, that covered 13 counties was performed. This region was selected for intensive study since it was the only one with forest loss during 1962-85. The satellite data were at a resolution of 98 x 98 ft (30 m x 30 m), so that forest patches as small as approximately 0.25 acre (0.1 ha) could be identified. The distribution of the forest is highly fragmented and primarily distributed adjacent to streams. Given the constraints of a completely different methodology, direct comparisons of trends between the Forest Service's 1985 estimate (a sampling procedure) and the 1990 assessment (satellite image classification) are not reliable. Still, it is useful to estimate forest area and the amount of fragmentation in this portion of the state.

According to the satellite data, the forest area for the 13 counties was substantially lower in the 1990 estimate compared to the 1985 or 1962 estimates of the Forest Service (Fig. 5). However, it is likely that many of the changes can be attributed to variation in the methodology -- the classification of the satellite data did not include some areas interpreted by the Forest Service as forest in 1985. Still, the region of satellite analysis was the one portion of the state that showed a decline in forest area between 1962 and 1985 (Figs. 3-4), and this trend might have continued since 1985.

The satellite data also show the extraordinarily fragmented nature of the forests. Fragmentation of forest habitat generally has negative implications for wildlife, especially for neotropical migrant birds that need large blocks of uninterrupted forest for successful nesting. As large tracts of forest are broken into small isolated woodlots, more forest edge is created and there are more opportunities for edge-adapted species, most commonly the cowbird, to invade the area and prevent adequate nesting for many forest songbirds. Most of the forest parcels in this region are less than 1 acre (0.4 ha) in size (Fig. 6). In these forest patches, as small as about 65 by 65 ft (20 by 20 m), trees dominate the area, even in backyards, so that the 98 by 98 ft (30 by 30-m) pixel would classify as forest in the satellite imagery. Parcels larger than 40 acres (16 ha) are much less frequent (range: 95 parcels in St. Clair County to 269 parcels in Fayette County). When one considers the larger forest-patch sizes (e.g., 600 acres or 243 ha) approaching that needed to support forest interior birds, the range is 3 in Montgomery County to 17 in Fayette County for a total of 131 patches in the entire 13-county area (Fig. 6).

When evaluated on a per-unit-area basis (density of forest patches per township-size area of 36 mi^2 or 93.2 km^2), one can better understand the "population dynamics" of the forest patches. A range of 211 to 770 forest patches less than 1 acre can be found in St. Clair and Jefferson Counties, respectively (Fig. 7). The data also show the paucity of large forest patches in the region. Of all patches larger than 40 acres, only 5.2 patches of this size can be found on average in each township of St. Clair County, ranging up to 14.1 patches per township in Jefferson County. Jefferson originally (ca. 1820) had 73% forest cover, at least 20% higher than any other county in the study area (Iverson *et al.* 1989); so it would be expected to have the highest density of forest patches remaining. For the entire 13-county area, an average of 10.1 forest patches per township can be expected--about one patch for each 4 mi^2 (10 km^2). A cautious comparison of these data can be made to data from a study by Iverson *et al.* (1989). Using U.S. Geological Survey land-use data for 1974-79, Iverson *et al.* (1989) calculated a density of forest patches larger than 40 acres of 7.1 to 9.7 per township in this region. If the comparison is reliable, these data represent a slight increase in patch density over the past 11 to 16 years. This trend could

be achieved in at least two ways: (1) additional patches of at least 40 acres have been added to the pool due to regrowth or aggregation of smaller patches, or (2) some large patches have been split into two or more medium-size (but still larger than 40 acres) patches due to continued fragmentation. On the basis of these data and a reevaluation of the data in Iverson *et al.* (1989), the latter is most likely the case.

By overlaying the forest classification from satellite data with the streams from the area (1:100,000 digital line graph files), we can estimate the proportions of the Illinois forests within certain distances of the streams. For this area, no less than 78% of the forests is within 984 ft (300 m) of the streams (Fig. 8); a full 22% of the forests is within 98 ft (30 m) of the streams. An evaluation of the distribution of forests circa 1820 (Fig. 1) shows that the proximity of streams and forest in this region has historically been the case; the streams were efficient fire barriers which reduced the frequency of fire near them. As evidence continues to mount on the value of riparian forests in maintaining stream health (the reverse is also true), it can be seen that the majority of forests in Illinois are well situated on the landscape.

Changes in Forest Composition

The composition of Illinois forests has changed dramatically over the past three decades. Today, about one-half of the commercial forest acreage (2.03 million acres or 0.82 m ha) is oak-hickory, one-fourth is maple-beech (1.05 million acres or 0.42 m ha, almost exclusively sugar maple), and one-sixth is elm-ash-soft maple (0.72 million acres or 0.29 m ha) (Fig. 9). The remaining forest types (white-red-jack pine, loblolly-shortleaf pine, oak-pine, and oak-gum-cypress) account for an additional 217,000 acres (87,850 ha) of commercial forest land. However, in 1962, there was much more acreage of oak-hickory and elm-ash-cottonwood and little area dominated by the maple-beech type; the maples (especially sugar maple) have increased by a factor of 41 since that time, whereas the oaks have been reduced by 14% and the elms have been cut in half (Fig. 9). The loss of oak-hickory forest is largely explained by the maple "takeover," that is mature oak-hickory forests are unable to regenerate because tree seedlings are intolerant of excessive shade, whereas maple seedlings thrive in the shady environment and are positioned for rapid growth and dominance once the overstory is removed or dies (Ebinger 1986). This takeover by maple is common throughout the northeastern quarter of the country, with red maple dominant in many of the more states (Powell *et al.* 1993). The reduction of elm-ash-soft maple is largely due to the effects of Dutch elm disease and the conversion to agriculture of bottomland forests that once supported these trees (especially in the South-Central Region). These trends also are evident by the age-class distribution of the major forest types (Fig. 10). The oak-hickory type dominates in the older age classes, while the maple-beech type dominates in the younger age classes; as time passes, maples will continue to increase in dominance. The changing composition of the forests will continue to have wide-ranging implications with respect to plant and animal habitat as well as timber resources.

Botanical Diversity

The Illinois Plant Information Network (ILPIN) was queried regarding the county distribution of forest-associated taxa within the state (Iverson and Ketzner 1988). The wide range in latitude from north to south accounts for a considerable range in climate and geomorphic conditions, and, subsequently, a remarkable diversity of habitats. For example, 261 species of trees (native and introduced) have been recorded in Illinois. Southern counties have the greatest variety: Jackson has 145 species, Pope 129, and Union 128; several northeastern counties also have high diversity due to varied landscapes and escaped cultivars from the Chicago Region (Fig. 11). Also, there are 284 taxa of shrubs (some of which can be called trees) and 47 taxa of lianas reported for the state. Overall, 508 taxa of woody plants have been recorded; 370 are native and 138 are introduced.

Besides the woody flora, Illinois forests are exceptionally rich in nonwoody taxa. Including woody species, there are 1,581 forest-associated plant taxa in the state, 1,414 (89%) of which are native. Jackson County, a botanically rich southern county that includes Southern Illinois University, from which numerous botanical forays have been conducted, has 954 forest-associated native taxa on record, while Warren County in the northwest (not near a botanical center) has had only 262 taxa

recorded (Fig. 12). Again one can see the higher botanical diversity levels in the southern counties, with species richness in Appalachian flora, and in the northern counties, with richness in northern temperate flora. Relatively lower diversities of forest-associated species are found naturally in the counties formerly dominated by prairie.

The forests of Illinois harbor nearly half of the state's threatened and endangered species even though forests occupy only 12% of the land area. The importance of maintaining high-quality forests as refuges for these taxa cannot be overemphasized, especially in the face of extreme pressures from human activity.

The major problem related to biodiversity in Illinois no longer is from land-use change and habitat conversion, a major concern until 20 to 30 years ago. Rather, it is now the invasion of exotic species, many of which compete aggressively with the native species, eventually replacing them. The proportion of the Illinois flora that is exotic has reached 28%, according to the ILPIN data base. Published vascular plant floras of the state dating back to 1846 show a continued rise in the percentage of exotics (Henry and Scott 1980). To date, about 130 exotic species from Illinois forests have been recorded, according to ILPIN. More than 50 exotic species have been recorded in each of several counties, especially in the northeastern and southwestern part of the state. The numbers of taxa per county probably are even higher because routine collection of exotics is not a high priority of most field botanists. Some of the major pests include *Alliaria petiolata* (garlic mustard), *Lonicera maackii* (amur honeysuckle), *Lonicera tatarica* (tartarian honeysuckle), *Rhamnus cathartica* (common buckthorn), *Rosa multiflora* (multiflora rose), *Lonicera japonica* (Japanese honeysuckle), and *Pueraria lobata* (kudzu-vine). The problem of exotics is increasing in severity and scope in the forests of Illinois.

Timber volume and growth

The total volume of growing stock in 1985 was 4.8 billion feet^3 (135 million m^3), 40 percent greater than the 3.4 billion feet^3 (96.3 million m^3) reported for 1962 (Hahn 1987). Estimates of net volume for 1985 showed the prominence of oak and hickory in commercial forests, with considerable amounts of ash, black walnut, cottonwood, elm, maple, and sycamore. The 1985 volumes averaged 1,200 feet^3/acre (83.9 m^3/ha) of commercial forest land in Illinois.

The trends in volume since 1948 for several major species groups are shown in Figure 13. For all groups except elm, there has been a dramatic increase in volume since 1962. The elms have declined since 1948 due to bottomland conversion to agriculture and Dutch elm disease. White and red oaks and black walnut had decreased in volume from 1948 to 1962, but showed increases from 1962 to 1985. The hickories, maples, and ashes have increased in volume since 1948.

Estimated net annual growth in 1985 (Hahn 1987), totaled 96 million feet^3 (2.72 million m^3) in growing stock (437 million board feet of sawtimber growth). More than 42% of net annual sawtimber growth was accounted for by oaks, with another 10% by soft maple, 6.3% by ashes, 3.7% by black cherry, 3.3% by hard maple, and 3.2% by black walnut. Only elm and black ash had negative growth rates between 1962 and 1985, attributable to Dutch elm disease and the clearing of bottomlands during this period.

In contrast to the 1985 data, the 1962 inventory showed annual growth of 125 million cubic ft^3 (3.5 million m^3) in growing stock, an increase of 30 percent. The lower annual growth and higher volumes in 1985 compared to 1962 indicate that growth has outstripped removals in the past several decades but that growth rates may be declining due to maturing forests. When evaluated by county, trends in volume during 1962-85 show large percentage increases for all northern and central counties (except Whiteside), but generally lower or even negative volume changes for south-central counties (Fig. 14). This trend can be linked primarily to area changes for the region discussed earlier (see Fig. 3).

Timber harvest

Illinois ranks fifth in the nation in demand for wood but 32nd in the production of wood; as a result, the state imports much of this wood from other states. Therefore, it is surprising to discover that 14 % of the wood harvested in Illinois is processed in

neighboring states and then imported back into Illinois (Blyth *et al.* 1987). Currently, the annual growth of timber (96 million cubic ft^3 or 2.72 million m^3) exceeds timber removals (68.6 million cubic ft^3 or 1.94 million m^3), so a higher proportion of Illinois' demand for wood could be met within the boundaries of the state if it had processing facilities. With judicious management of an increased harvest, negative effects on the environment could be minimized and multiple benefits achieved. Local markets for Illinois hardwoods could be an incentive for reforestation with native trees and as provide needed local employment, especially if value-added industry located in the resource-rich regions.

An enormous quantity of firewood is harvested from Illinois forests -- nearly 2 million cords a year (Blyth et al 1985). In fact, about 43% of all trees removed in a given year in the state are used for firewood! However, the demand for firewood does not present a major threat to the state's forests, because 75% of the firewood cut is from dead trees, mostly from forests in the heavily populated northeastern counties (Fig. 15). Trees cut for sawlogs are primarily from the southern half of the state (Fig. 16); the major counties cutting sawlogs in 1983 were Franklin, Fulton, Jackson, and White (more than 6 million board feet per county).

Sequestration of Carbon

Because of the massive changes in total forest volume in Illinois over the past several decades, the amount of carbon being sequestered into forest biomass in the state also has changed considerably during that time. From 1948-62 there was a slight loss (0.15 million metric ton) of total forest volume due to conversion of forestland to other uses (Fig. 17). This loss was offset by an increase in the volume contained within extant forests (0.06 million metric ton) and the harvesting of wood products which put 0.29 million metric ton of carbon into long-term storage. The result was that forestlands were a net sink of 0.20 million metric ton of carbon per year during 1948-62. After 1962 there was a gain in forest land and particularly a gain in forest volume per unit of forest land, with a resulting sequestration of about 1.37 million metric tons (1.51 million tons) of carbon per year (Fig. 17). Carbon sequestration into long-term storage of wood products also increased between the two time periods, though not as significantly as the change in land use or volume. This net sink from Illinois forest lands helps balance the carbon cycle in the state, but still represents only about 2.7% of the total emissions of carbon that the people of Illinois contribute to the atmosphere each year --51.55 million metric tons (56.82 million tons) in 1988.

Trends in Wildlife Habitat

The forests of Illinois provide the major habitat for numerous wildlife species. Losses in the quality and quantity of that habitat severely affect wildlife populations (Illinois Wildlife Habitat Commission 1985). One method of summarizing the value of wildlife habitat in Illinois is based on land use. One method for calculating an index of wildlife habitat is presented in Graber and Graber (1976); revised calculations based on current data are given in Iverson *et al.* (1989). The index devised by Graber and Graber is based on the proportion of a particular habitat type within a given area, the availability of that habitat type within the state or region, the trends associated with that habitat over the previous decade, and the "cost" of a given habitat measured in years required to replace the ecosystem. A summary of habitat factors for Illinois as of 1985 is presented in Table 1. By this calculation, more than 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 (Fig. 9). Values for oak-hickory 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 (Fig. 10). A minor rating was earned by maple-beech because this forest type has increased so dramatically in recent years (Fig. 9). Scores for habitat factor generally were much more favorable for wildlife habitat in the southern half of the state, which is more heavily forested. In fact, total habitat-factor scores for the South Region were twice those of the Central Region, with the North Region in between (Iverson *et al.* 1989).

By comparing habitat-factor scores of Iverson *et al.* (1989) for 1985 to those of Graber and Graber (1976) for 1973, one can evaluate temporal trends in habitat, and the role of forest land in those changes. This evaluation was possible for the North, Central,

and South regions. Caution is advised in this comparison, however, because these regions are not an exact match geographically. It was not possible to directly compare habitat scores between dates because of slight variations in the methodology. However, by calculating the percentage of the habitat factor occupied by each land type for the two dates, relative contributions to habitat by each land type can be calculated over time (Fig. 18), as can total contributions of forest land to habitat. For example, in the north, the cumulative percentage from forest was 53.4 in 1973 and 65.3 in 1985 -- an increase of 22% in relative habitat factors from forests in that region (Fig. 18a). This increase is due mostly to large increases in relative habitat factors for the elm-ash-cottonwood and pine types and a decrease in marsh habitat. In the Central Region, relative habitat increased from 71.6 to 76.1% (Fig. 18b), while in the south, relative habitat decreased from 88 to 84% (Fig. 18c). In all regions there were increases in relative habitat factors for elm-ash-cottonwood because that type decreased in area by nearly 50% between 1973 and 1985 (Fig. 9). All regions showed a decrease in relative habitat value for the oak-hickory and maple-beech types, though for different reasons. The oak-hickory type decreased because large increases in availability were apparent in the older (> 60 yr) age classes even though the younger age classes had decreasing acreages. The maple-beech type decreased in relative habitat value because of the extremely large increases in area for all age classes. This resulted in low changing availability scores which, in turn, lowered the habitat-factor scores.

Another way to evaluate the trends in relative habitat factor scores for forest types between 1973 and 1985 is to plot the percentage changes during the period (Fig. 19). Here we see increases in relative habitat factors in all three regions for elm-ash-cottonwood, an increase in pine for the North Region, and an increase in oak-hickory in the South Region. Scores for pine increased in the north because its availability increased, especially in the older (> 40 yr) age class. Similarly, oak-hickory increased in the south primarily because of a negative changing availability in the younger age classes. All other forest types showed decreases between 1973 and 1985. Especially apparent is the decrease in all regions of the score for maple-beech. Pine decreased in the south because of increasing availability in that region. Overall, the data show the extremely high value, and an increasing value of forest habitat relative to other habitat, for wildlife habitat across the state.

CONCLUSIONS

A review of some of the trends apparent in Illinois forests over the past several decades lead to several conclusions:

1. The state's forests are now increasing in area when evaluated statewide, probably due to several incentive and educational programs as well as to an overall reduction in pastureland during this period. The exception may be in the South Central region where fragmentation apparently is continuing.

2. Most of the forests historically and currently are associated with the state's stream network. In the south-central portion of Illinois, 78% of the forest land is within 300 m of the streams.

3. Although forest area is increasing overall, the composition of the forests is changing dramatically, as it is in many states in the northern and northeastern United States. Maple species are replacing much of the oak-hickory in forests and dominating new forest land succeeding from abandoned pastures. The oak-hickory forests are not being regenerated and will continue to decrease in area and importance.

4. The botanical diversity of the state is being carried, in large part, by its forests. More than half of the native flora and more than half of the threatened or endangered flora are found in Illinois forests. Invasion by exotic species, one of the most serious problems facing these forests, continues to increase both in severity and scope.

5. Timber volume increased by 40% between 1962 and 1985. Volumes of most forest types have increased substantially except for elm-ash-cottonwood, which has decreased because of Dutch elm disease and conversion of bottomland forests. However, net annual growth over all forests in the state was 30% higher in 1962 than in 1985, showing the aging nature (with concomitant slowing of growth rates) of our secondary forests.

6. Because of the dramatic increases in volumes, Illinois forests served as a large carbon sink during 1962-85. The estimated annual sequestration of carbon into the state's forests is 1.37 million metric tons, enough to counteract about 2.7% of the total emissions of carbon into the atmosphere by the people of Illinois.

7. According to one index, more than 75% of the wildlife habitat in the state is within its forests. Further, in the northern two-thirds of Illinois, the relative contributions of forest land to wildlife habitat has been increasing over the past two decades.

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Table 1. Habitat factors for Illinois, 1985, calculated according to Graber and Graber (1976).

Land type	Habitat factor	% of wildlife habitat
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

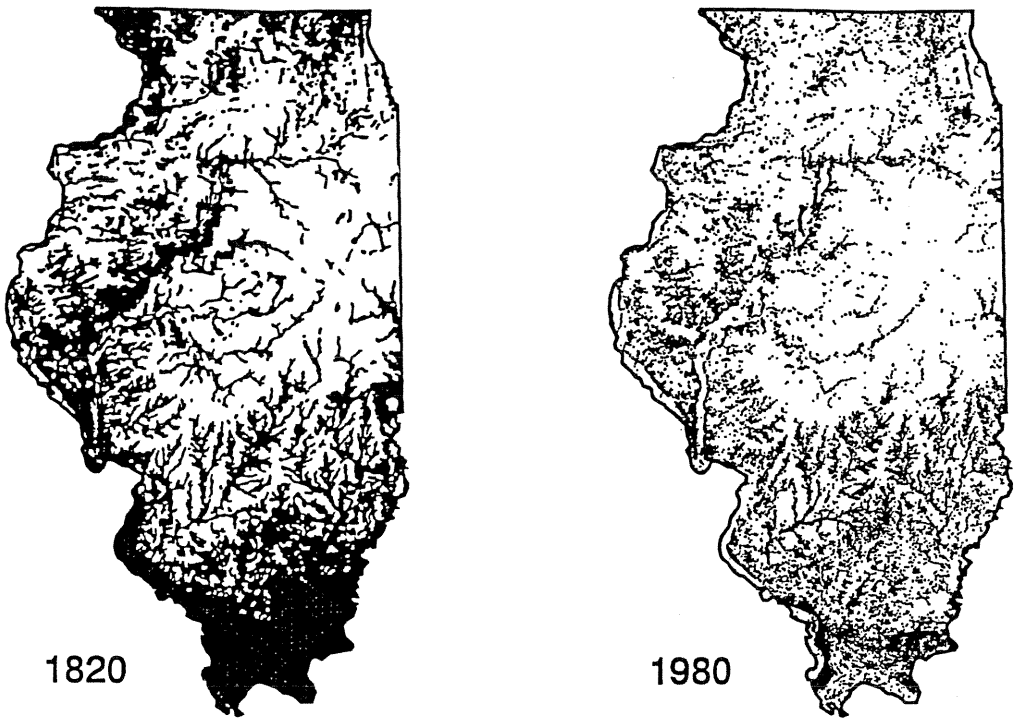

Figure 1. Forest coverage in Illinois in (a) 1820 and (b) 1980. Sources: Anderson 1970 and U.S. Geological Survey land-use data, 1973-1981.

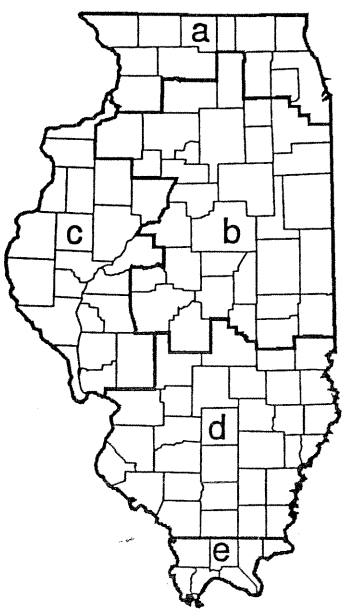

Figure 2. Illinois regions: (a) Northern, (b) Grand Prairie, (c) Western, (d) South Central, and (e) Southern Unglaciated.

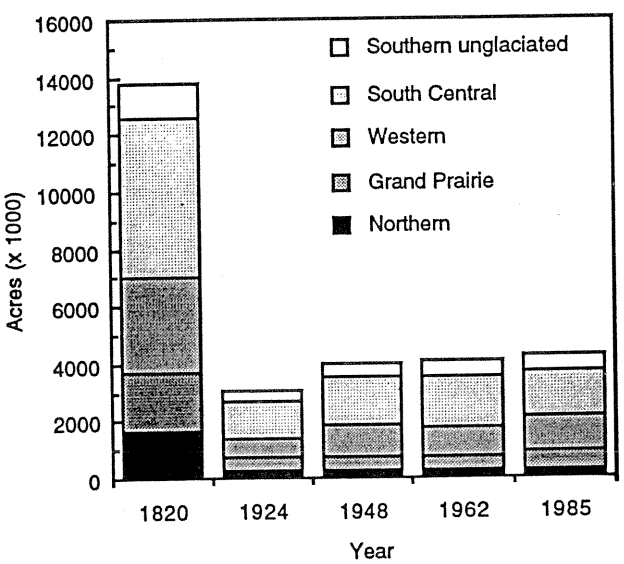

Figure 3. Trends in forest area in Illinois by region, 1820-1985.

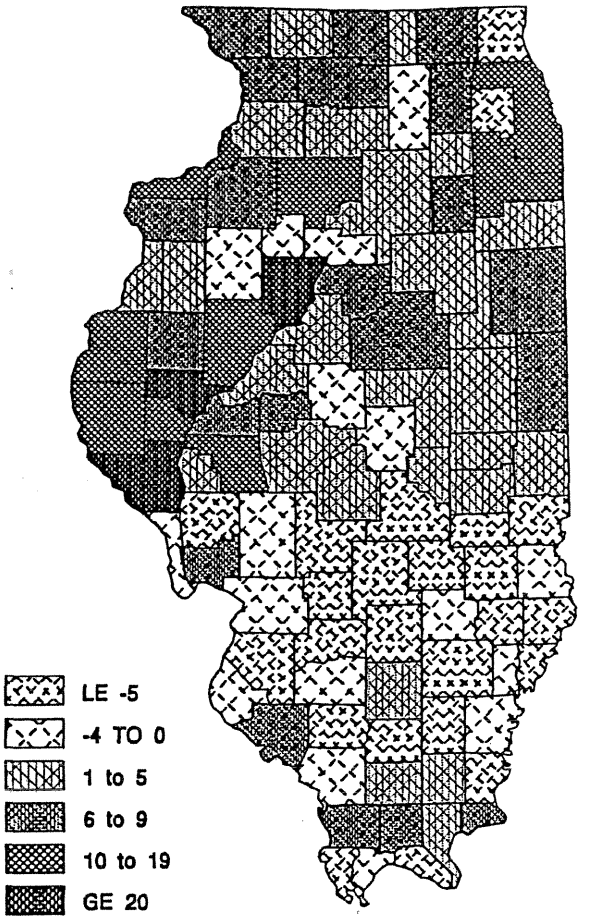

Figure 4. Distribution of forest-area trends (acres x 1000) in Illinois by county, 1962-1985.

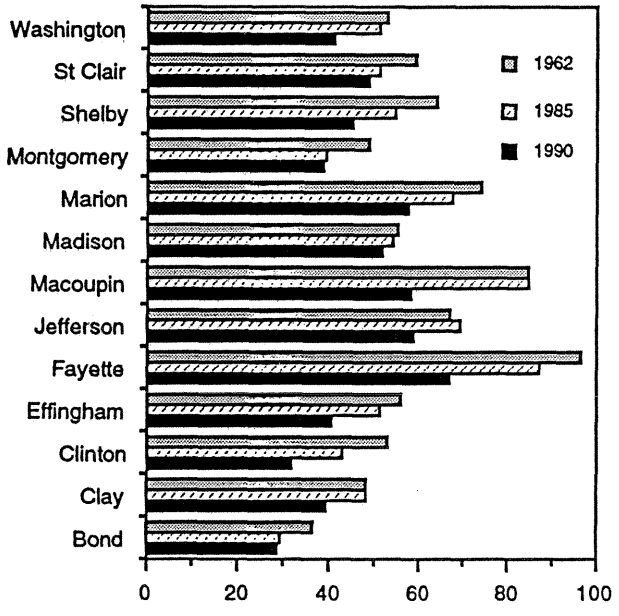

Figure 5. Forest-area trends (1962-1990) for 13 counties in south-central Illinois.

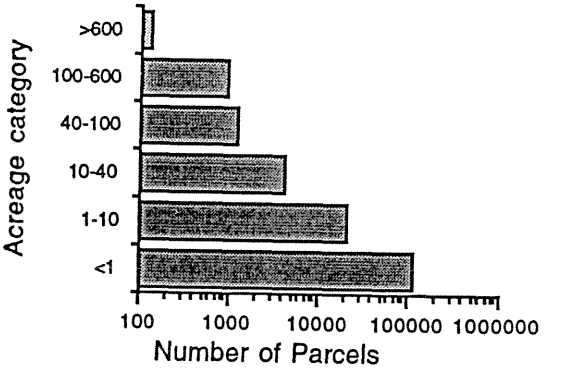

Figure 6. Number of forested parcels, by acreage class, for each of 13 counties in south-central Illinois, as detected by satellite in 1990.

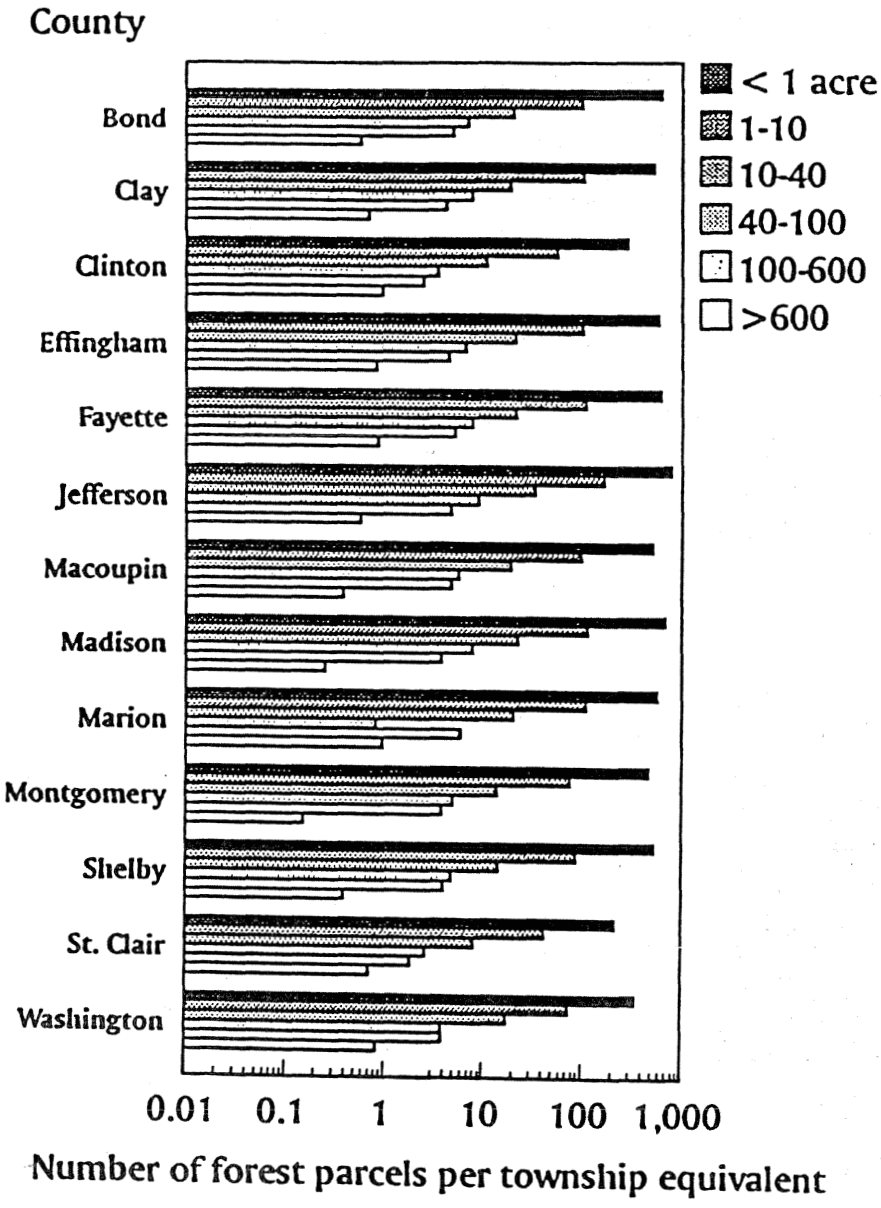

Figure 7. Number of forested parcels, by acreage class, per township equivalent (36 miles^2 or 93.2 km^2) for each of 13 counties in south-central Illinois, as detected by satellite in 1990.

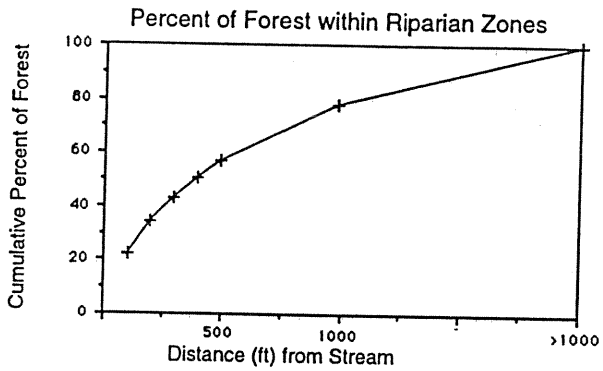

Figure 8. Distribution of forests at various distances from streams in the 13 counties in south-central Illinois.

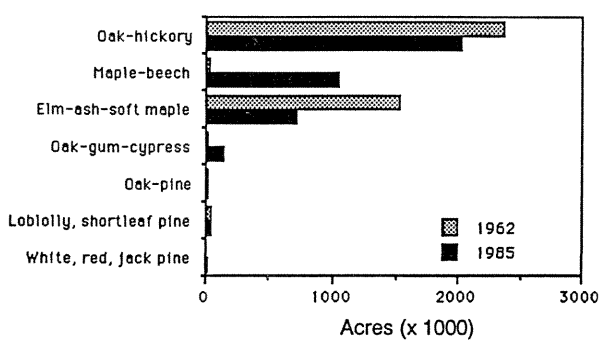

Figure 9. Composition of Illinois commercial forests, 1962 and 1985.

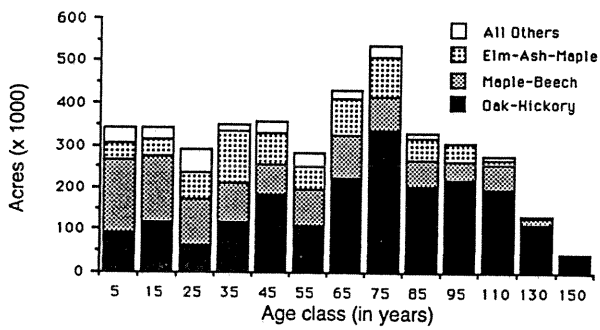

Figure 10. Acreage by age class of the major forest types in Illinois, 1985.

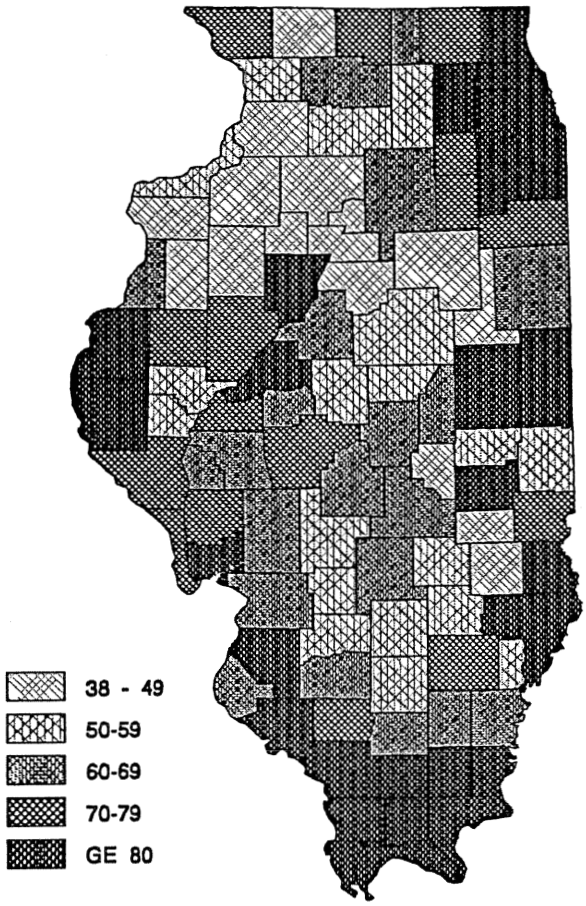

Figure 11. Number of tree taxa in Illinois by county (includes native and introduced species).

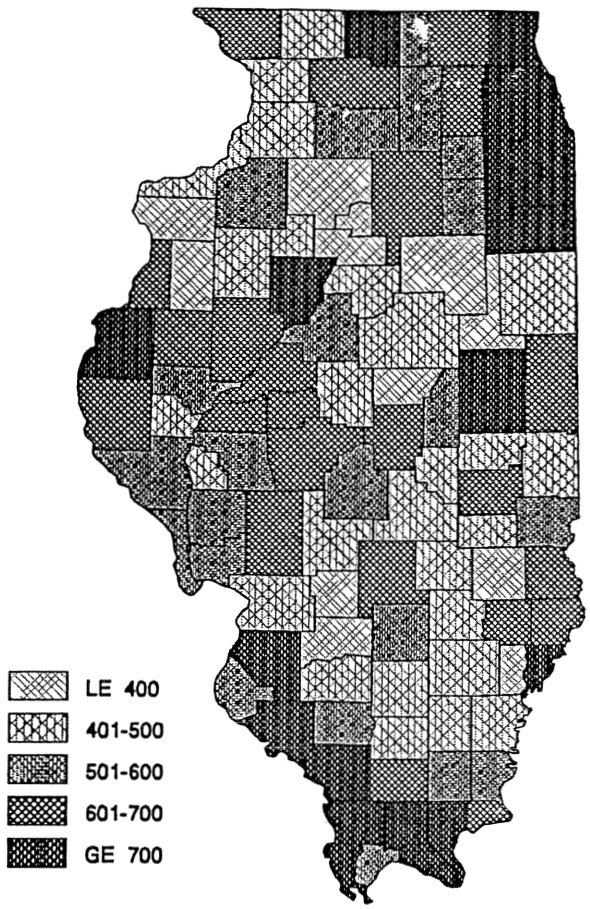

Figure 12. Number of forest-associated native taxa in Illinois, by county.

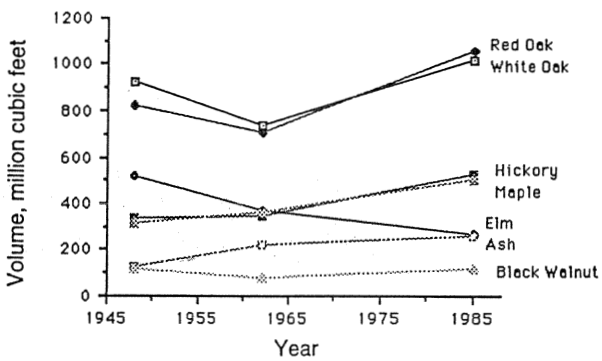

Figure 13. Trends in forest volume in Illinois by type, 1948-1985.

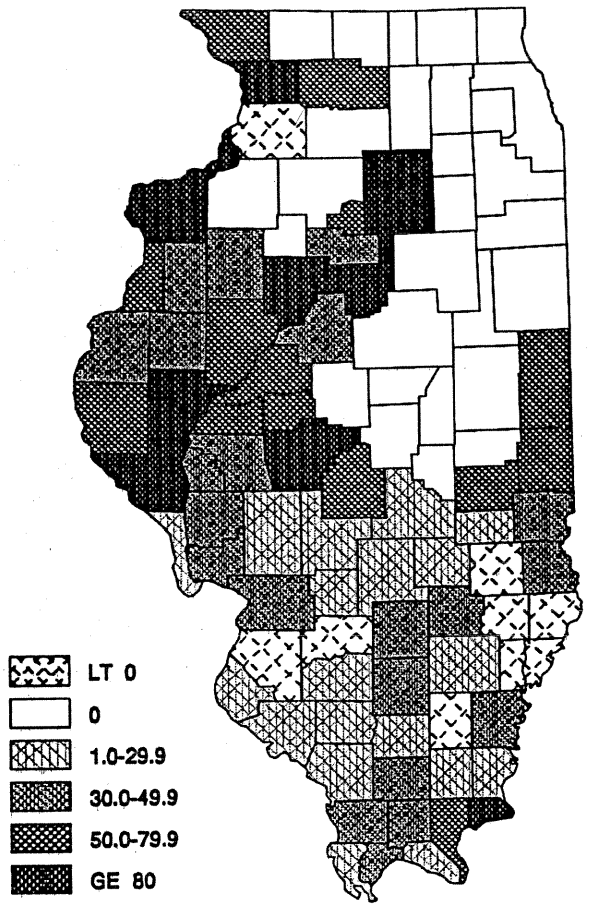

Figure 14. Trends in forest volume in Illinois by county, 1962-1985 (millions of cubic feet of sawtimber). [Note: for 28 counties with no coded change, no specific data were available for 1962 volumes; over all these prairie counties, however, there was a 269% increase in volume between 1962 and 1985.]

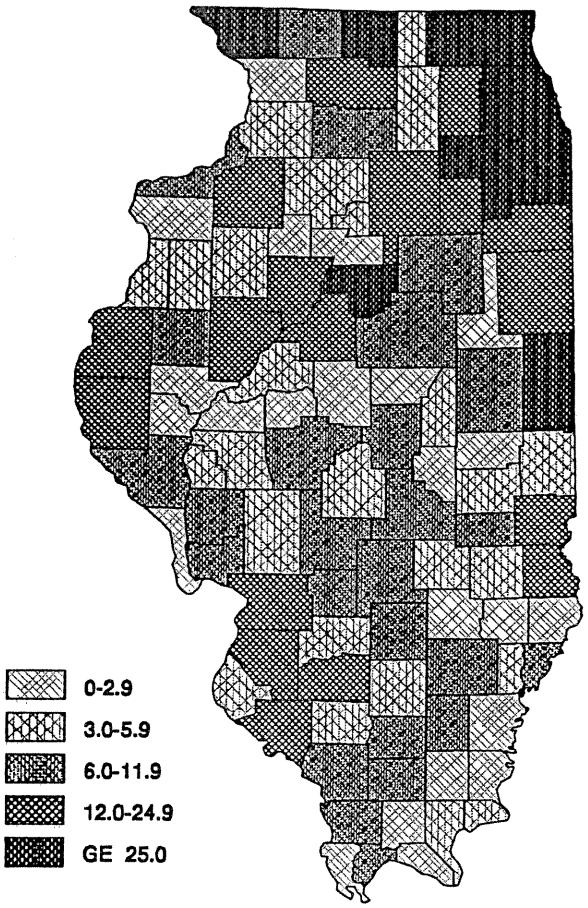

Figure 15. Fuelwood production in Illinois by county (standard cords x 1000), 1983.

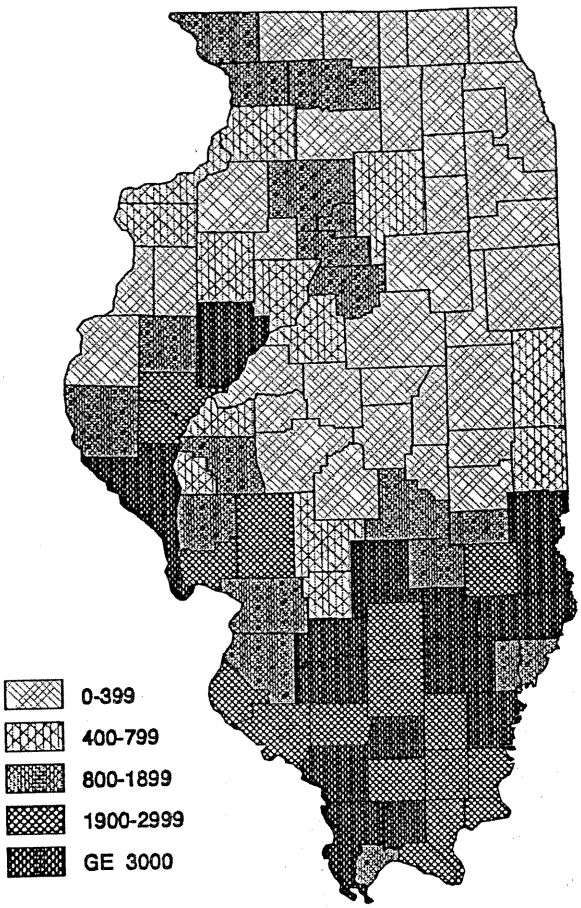

Figure 16. Sawlog production in Illinois by county, 1985 (thousands of cubic feet).

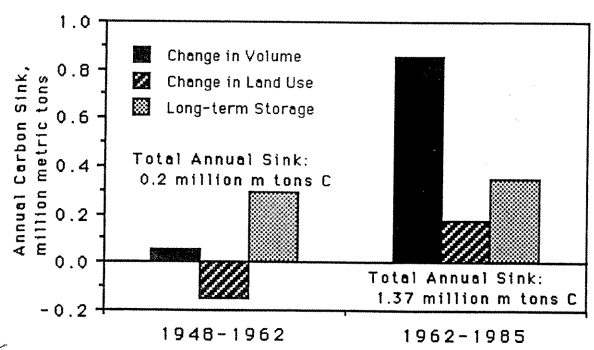

Figure 17. Carbon sinks and sources for Illinois forest lands, 1948-1985. Volume represents changes in carbon due to changes in volume per unit area of forest. Land indicates carbon changes because of land use changes, and storage represents long-term storage of carbon from harvesting of timber products.

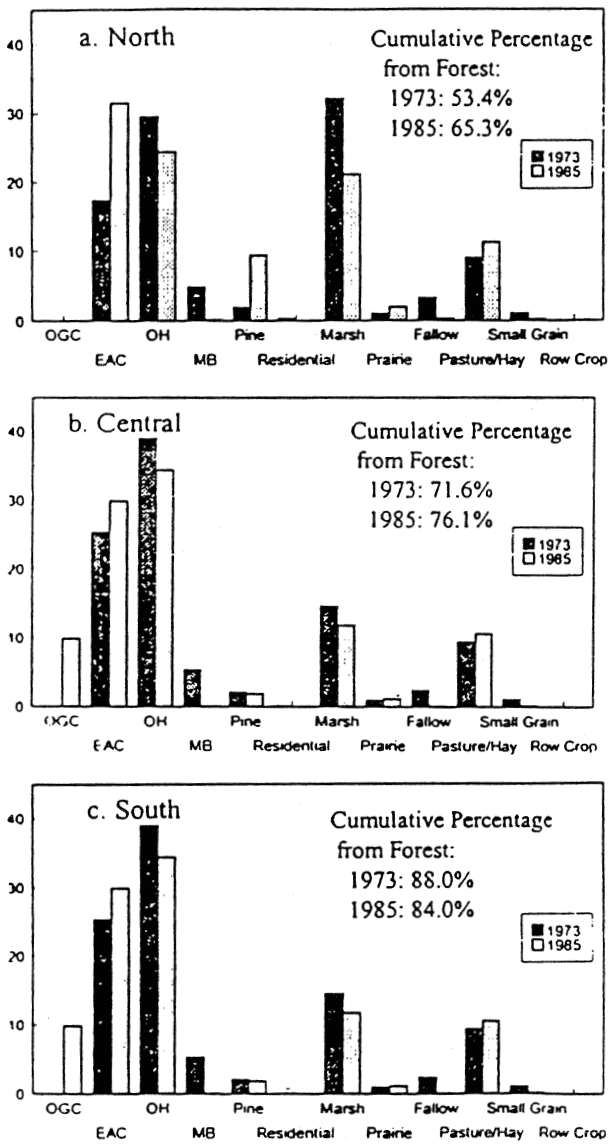

Figure 18a, b, c. Relative habitat factors for three regions of Illinois, 1973-85, according to the index of Graber and Graber (1976). OGC = oak-gum-cypress, EAC = elm-ash-cottonwood, OH = oak-hickory, MB = maple-beech.

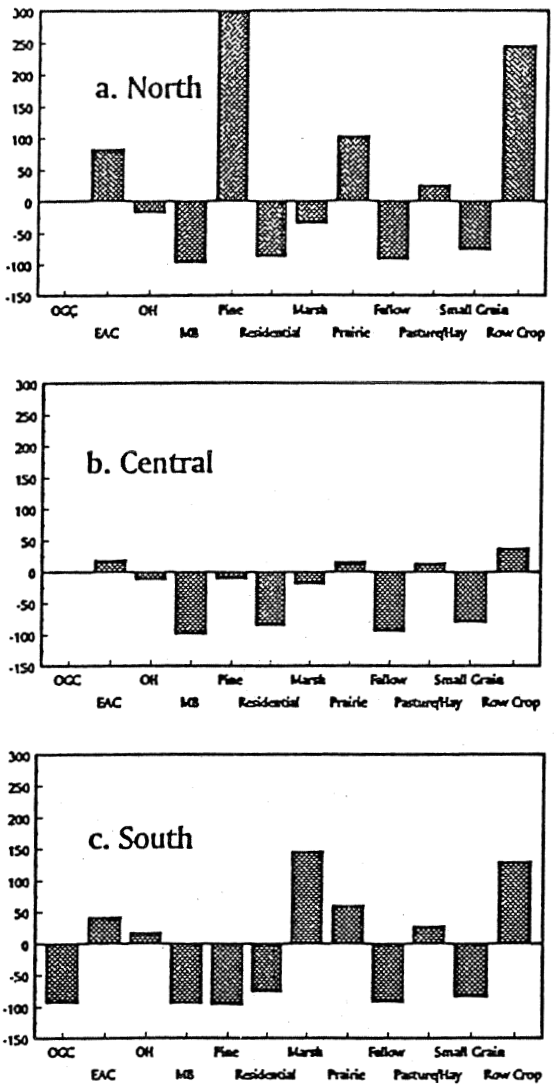

Figure 19a, b, c. Percent change of relative habitat factors in Illinois between 1973 and 1985. OGC = oak-gum-cypress, EAC = elm-ash-cottonwood, OH = oak-hickory, MB = maple-beech.