LESSON 12. THREATS TO ILLINOIS FORESTS

Early European settlers removed or modified essentially all of Illinois' forests and savannas. The large majority were destroyed; the fragmented remains being highly modified by fire suppression, grazing, and the introduction of exotic and weedy species. Acid rain, chemical pollutants, changes in drainage and water tables, and species extinction also caused other more subtle changes. During the past 200 years much of the original forests of Illinois has been cut, and the vast majority of the land has been used for crop production. Most of the remaining forests are second growth communities that usually differ significantly from the presettlement forests, not only in tree size but also in species composition.

Subtle differences that occur over long time periods were slowly beginning to take place in the forests during early settlement time. These slow, and barely perceptible changes were going to have profound influences on our remaining forests and savannas. Selective logging causes composition changes in the forest. Also, a few exotic species were starting to appear. These species, which were introduced by European man, or were "camp followers", that follow European man throughout the world, were starting to appear in disturbances created by man. The most troublesome change in the prairie peninsula of Illinois, however, was fire suppression. The vegetation of the western prairie/forest border had evolved with fire set by lightning and the Native Americans. Once European man settled in these forests dominated by fire-insensitive, shade-intolerant trees, he tried to control fire.

Habitat Loss

In Illinois it is estimated that in 1820, the time when many European settlers were beginning to enter the state, 6 million hectares (14.8 million acres) were wooded. A little over one century later, only 1.22 million hectares (3.02 million acres) of forest remained. In contrast, by 1980 the amount of forested land had increased to 1.72 million hectares (4.26 million acres) in Illinois, mostly due to a reduction in cattle production, and the decrease in farming marginal land, with the subsequent conversion of these areas to secondary forests. Similar changes took place in other midwestern states. Overall, the general trend in Illinois' forests has been a relatively rapid and major decline since European settlement to about 1924, with a slow but steady increase since that time (Table 12.1).

Few remaining forests and savannas still retain much of the character of presettlement times. Essentially all of the present day forests of Illinois are considered to be second- or third-growth forests. Only small remnants of this presettlement forest, about 4,700 hectares (11,600 acres), or less than 1 percent of the original forest, still are found in the state. These remnants, though usually not very large, do give some indication of the splendor of these presettlement communities. Many of these remnants are being protected as nature preserves. Many of these preserves are owned by the state of Illinois, and are being managed, as nearly as possible, to give some indication of the past structure and composition of the presettlement community. The Illinois Nature Preserves Commission approves dedication, oversees the management, and safeguards the preserves from external threats. Field staff of the Illinois Department of Natural Resources also accomplish some of the management on the preserves.

Table 12.1. Total area (in hectares) of forested lands at the time of settlement and at the present time in the states of the Midwestern United States.

State	Land area	Presettlement forests	Present forests
Illinois	14,399,000	6,000,000	1,726,000
Indiana	9,291,000	8,100,000	1,796,000
Iowa	14,472,000	2,400,000	830,000
Minnesota	20,621,000	13,800,000	6,766,000
Missouri	17,845,000	11,800,000	5,669,000
Ohio	10,607,000	10,100,000	3,182,000
Wisconsin	14,068,000	13,300,000	6,278,000
TOTALS	101,303,000	65,500,000	26,247,000

Presently more than 300 nature preserves are dedicated in Illinois. Though dedicated for many reasons, including endangered and threatened species and unusual geological features, the large majority are being protected since they contain intact or remnant communities that best display the original plant communities of the state including the flora and fauna that were present in these communities. A few examples include the mature lowland forests of Beall Woods Nature Preserve in southeastern Illinois; Hooper Branch Nature Preserve, a sand savanna in northeastern Illinois; the high quality swamps and floodplain forests of Heron Pond-Little Black Slough Nature Preserve in extreme southern Illinois; and the extensive tamarack bog and marsh communities of Volo Bog Nature Preserve in extreme northeastern Illinois. A list of the many nature preserves of the state along with a general description of each preserve, the location, and how to access each preserve is available from the Illinois Department of Natural Resources.

Fragmentation and Small Patch Size

In addition to the loss of the original forest and savannas to agriculture and timber harvest, most of the forests that remain were highly fragmented. Many small patches replaced the broad expanses of timber that existed during presettlement times and covered many thousands of hectares. Large, continuous blocks of timber are rare throughout most of the Midwest, commonly occurring only in areas of very rough topography, along waterways, and depressions in swampy areas where agriculture is not presently possible. In general, this fragmentation has resulted in a large expanse of habitat being transformed into a number of smaller patches of smaller total area, that are isolated from each other by a matrix of habitats unlike the original. Agricultural fields, pastures, urban areas, along with roads, reservoirs, and transmission line corridors have all contributed to this fragmentation. Also, continued development of forest lands are causing a continued decrease in patch size, further complicating the problem.

Except for the southern quarter of Illinois, few tracts of timber exceed a few square miles, the large expanses of presettlement times occurring only in parts of the Shawnee Hills of southern Illinois. Even here the forests are highly modified, the timber of varying quality and composition. Abandoned agricultural fields in various successional stages, areas cut during past timber harvests, and pine plantations interrupting the large expanse of native forests. Also, associated with these large forest patches are roads, housing developments and towns, farms, and pipeline and transmission-line corridors. Recent studies, using United States Geological Survey land-use data give some indication of the extent of fragmentation of Illinois' forests. Of the 1.72 million hectares of forest in Illinois in 1980, about 250,000 hectares were in small patches of less than 16 hectares (40 acres). Of the remainder, 4,479 patches were 16 to 40 hectares (40-99 acres), 2,476 patches were 41-80 hectares (100-200 acres), 2,099 patches were 81-243 hectares (201-600 acres), 525 patches were 244-445 hectares (601-1,100 acres), and 542 were patches greater than 445

hectares. The parcels more than 16 hectares in size averaged 145 hectares each and nearly 44 percent of the parcels were 80 hectares or less.

Fragmented communities have a reduced ability to maintain biological diversity since many species, particularly birds and large mammals, require large tracts of forest to survive. Invariably there is a close correlation between the size and diversity of the habitat and the number of species and individuals of these species present. In general, in a smaller area there will be less habitat diversity that will result in reduced species diversity and fewer individuals of each species. In contrast, in larger areas species diversity will be higher as will the number of individuals of each species. Small fragment size appears to show a direct correlation with the quality of woodland animals, particularly birds.

The amount of forest edge increases when fragmentation occurs. This allows many exotic and weedy species into the forest interior. Wildlife populations may decline if the species present are sensitive to increased isolation and smaller habitat size or are sensitive to the proximity of "edge." Studies indicate that forest interior avifauna are particularly sensitive to the decreased size of the forest fragment. Generalist birds usually dominate small forest patches, but with an increase in forest patch size the diversity of birds requiring specialized habitats increases. Area sensitive bird species require large forest patches. These forest-interior bird species are particularly sensitive because the proximity to edge affects reproductive success. The chance of nest brood parasitism and predation increases with proximity to edge. In regions where forest canopy cover is high and the forest tracts are large, brood parasitism is relatively uncommon. Also, in these large forest tracts there are few agricultural fields to augment predator populations. Such forested areas are extremely uncommon in the high fragment landscape of Illinois.

Small patch size creates more opportunities for edge-adapted species. Not only is brood parasitism more common here, but also many alien plant species are adapted to edge disturbances. These species can get a "foot-hold" in these disturbed edges where more light is available and the drying condition of light and wind create a habitat unsuitable for some forest interior plant species. Once in the general area these species, with their high reproductive potential, can take advantage of canopy opens and other disturbances (grazing, trails, etc.) to invade the forest interior. Exotic species densities many not be high in the forest edge. A density of 0.07 stems/m^2 was found for the introduced shrub *Elaeagnus umbellata* (autumn olive) 5 meters inside the edge of Beall Woods Nature Preserve, Wabash County, Illinois. Lower numbers occurred in the interior of the woods, except for canopy opens associated with tree-falls. In a tree plantation 5 meters to the outside of the preserve the density of autumn olive ranged from 3.9 to 12.5 stems/m^2.

Though the number of exotic species invading the forest floor generally drops dramatically just a few meters inside the forest edge it is not uncommon for these aliens to occur in low numbers up to 20 meters into the forest. Studies have found that the frequency of most alien plant species drops abruptly near the forest edge, a few species, however, are at least as frequent in the interior of the forests as at the edge. Forest fragmentation encourages exotic species invasion since it increases both alien abundance and their average proximity to the interior of the forest fragment. Also, the environmental changes at the forest edge (increased light and decreased moisture and humidity) provide a point of entry for the alien species.

Small patch size generally means that fewer individuals of a species are likely to inhabit any particular patch. Population size is the best predictor of extinction. Therefore, in small isolated forest patches any catastrophe creates the potential for small populations to become locally extinct. Also, small isolated forest patches commonly inhibit movement of many species that occur in these patches since "biological deserts" of agricultural

fields surround the patches. This spatial isolation may result in genetic isolation, causing excessive inbreeding, which can lead to inbreeding depression and the erosion of genetic viability. For many species such as larger animals that easily move from one patch to another and plants with seeds and fruits that are easily dispersed, inbreeding depression is usually not a problem. Sedentary species with propagules that are not easily dispersed or species with low numbers of individuals, inbreeding depression is a potential problem.

An excellent example of inbreeding depression involves the greater prairie-chicken (*Tympanuchus cupido*) found in the prairie and savannas of north central North America. This species was once abundant throughout the northern two-thirds of Illinois. The cultivation of the extensive Illinois prairie and savannas probably benefited the greater prairie-chicken, and populations reached an estimated peak of approximately 10 million birds by 1860. These early agricultural practices probably increased habitat for the greater prairie-chicken as it created a patchwork of diverse habitats ranging from row-crop agriculture to pasture and many small islands of mature and disturbed prairie adjacent to the cultivated areas. In the early 1900, however, more intensive agricultural practices, the elimination of black soil prairie, and the decrease in pastureland eliminated nearly the entire habitat of the greater prairie-chicken. By 1933 the Illinois population was estimated to be only 25,000 birds, and declined to 2,000 birds by 1962.

Presently remnant populations of approximately 200 birds occur in two flocks on public land in Jasper and Marion counties. Lack of genetic diversity due to the small population size contributed to this recent population decline, and it was feared that the species would soon become extirpated from Illinois. Translocation of individuals from populations in Kansas, Minnesota, and Nebraska appears to have restored genetic diversity into the population. Present estimates suggest that the greater prairie-chicken numbers are slowly on the increase in Illinois.

Fire Suppression

Though the reasons for fire suppression are varied, the most important was that wild fire and high population densities of an agrarian society are not compatible. Prairie fires became rare with the influx of settlers into Illinois during the middle to late 1800s. The presence of buildings, crops, livestock, and the growing number of settlers made widespread wildfires undesirable. One of the primary goals of the settlers was to eliminate prairie fires, and that meant the elimination of the tall grasses that became tinder dry in the fall of the year. In many areas, it became illegal to set prairie fires except on an individuals own property.

The reduction in fire frequency in the oak-hickory forests of the Midwest has completely changed the structure and composition of many forests, open woodlands, and savannas. Soon after settlement by European man periodic fires all but ceased in the prairie peninsula. Savanna and open woodlands became closed-canopy forests, while the closed-canopy forests of presettlement times became more mesic. Overall this resulted in an increase in shade-tolerant, fire-sensitive tree species, and a decrease in oak regeneration. As a result, the composition of many fragmented woodlots changed to forests dominated by mesic, shade-tolerant, fire-sensitive species such as *Acer saccharum* (sugar maple), *Ulmus americana* (American elm), *Ulmus rubra* (red or slippery elm), *Quercus rubra* (red oak), *Tilia americana* (basswood), *Juglans nigra* (black walnut), *Aesculus glabra* (Ohio buckeye), *Fraxinus americana* (white ash) and *Fraxinus lanceolata* (green ash) at the expense of the mostly more xeric oaks and hickories. The closing of the forest canopy also caused a dramatic change in the species composition and structure of the woody understory and the ground layer species, and a corresponding loss in the wildlife depending on these species.

In particular, sugar maple has been increased in importance in most Illinois forests, particularly within the past 50 to 75 years. If this trend continues, many of the oak-hickory forests, their understories, and the wildlife that depend upon them will be in serious trouble. Even the best quality oak-hickory communities on mesic sites are apparently undergoing an irreversible change as sugar maple and other mesic, shade-tolerant species replace many of the original forest components. Very little research has been done concerning methods to reverse this trend, and the problem now concerns many ecologists and managers of natural areas.

Many of the better quality forests that presently exist in the prairie peninsula have been surveyed during the past 50 years. In some of them sugar maple and other mesic species are not important canopy components. At Walnut Point State Park in Douglas County, sugar maple is rarely encountered, oaks and hickory species are by far the most common species found. In the forests and savanna of the Kankakee Sand Area Section and the Illinois River Sand Area Section oaks are dominant and mesic species rare.

In most of the woodlots studied, however, mesic species, particularly sugar maple, are relatively important forest components. The mesic species are also well represented in the seedling and sapling categories and in the smaller diameter classes. The "prairie grove forests" in Champaign County have been surveyed at various times in the past. In Trelease Woods sugar maple dominates the seedling and sapling categories as well as most of the diameter classes. Similar results were obtained for Brownfield Woods. Also, in central Illinois, the woody vegetation of Funk's Forest Natural Area in McLean County has been surveyed. This forest is presently an example of a mesophytic forest that is transitional between the upland oak-hickory cover type and the "prairie grove forests." Sugar maple, the dominant species in these woods, is followed closely by *Quercus alba* (white oak) and elms. Sugar maple and white oak, however, represent two distinct age classes. White oak, which predominates in the larger diameter classes, is a "pioneer" species. Sugar maple, in contrast, dominates the smaller diameter classes and has probably been increasing in importance in these woods for the past century.

One recently documented example of the increased importance of sugar maple is at Baber Woods Nature Preserve in Edgar County, east central Illinois. This 16-hectare woodlot is located on the flat to gently-rolling ground just to the north of the Shelbyville Moraine, the terminal moraine of Wisconsin glaciation. When first surveyed in 1965, white oak was the dominant overstory species. Sugar maple ranked second and dominated the seedling, sapling, and smaller diameter classes. In a 1983 survey of the woods this trend continued. Sugar maple was first in importance and the number of individuals greater than 10 cm dbh nearly doubled. The number of white oaks, in contrast, decreased while sugar maple continued to dominate the seedling and sapling categories.

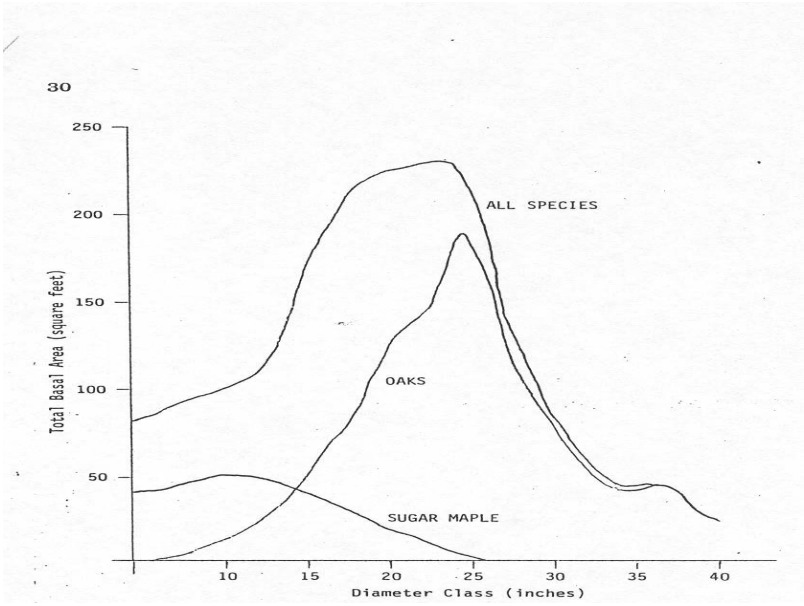

Figure 12.1. Basal area by diameter classes for sugar maple, all oaks combined, and all species combined at Baber Woods Nature Preserve, Edgar County, Illinois.

Sugar maple and oaks represented two distinct age classes in Baber Woods (Figure 12.1). The oaks dominated the larger diameter classes, which suggests that these species had been an important forest component for an extended period of time. Sugar maple, in contrast, was the common species of the smaller diameter classes and had probably been increasing in importance during the past century. The large number of sugar maple seedlings and saplings suggests a continuation of this trend.

A breakdown of species density, large diameter classes, and average diameter by quadrates used in the 1965, 1983, and 1998 surveys suggest when sugar maple began to increase in importance in Baber Woods. In nearly every quadrate, sugar maple increased in size and importance from 1965 to 1998 (Table 12.2). In nearly all quadrates the stems/ha, stems exceeding 40 cm dbh, average diameter, and importance value of sugar maple increased from 1965 to 1998. Also, there was a general decrease in the number and size of sugar maple in the woods from the northwest corner to the southeast corner of the woods. This is very obvious from the 1965 survey. By the 1998 survey, however, sugar maple had increased to the point that it dominated the entire preserve (Table 12.2). This pattern suggests that at the time of presettlement sugar maple occurred in the ravines just to the north and west of the preserve, being protected from fire by the rough topography. With the cessation of fire, this fire-sensitive species invaded the upland that is now called Baber Woods Nature Preserve.

Table 12.2. Distribution of sugar maple in Baber Woods Nature Preserve, Edgar County, Illinois, for the surveys of 1965, 1983, and 1998. The following information is given for each quadrate (1 hectare): the number of sugar maple stems present (±10 cm dbh), the number of sugar maple stems 40 cm dbh and above, the average diameter of sugar maple stems (cm), and the importance value (I.V.) for sugar maple. The importance value is determined by adding relative density and relative dominance. The northern edge of the woods is represented by quadrates 1 through 4.

	Quadrate 1			Quadrate 2			Quadrate 3			Quadrate 4		
	196	198	199	196	198	1998	196	198	199	196	198	199
	5	3	8	5	3		5	3	8	5	3	8
Stems/ha	140	153	133	158	152	157	104	124	147	82	102	140
<40 cm dbh	8	14	22	12	17	29	3	4	8	2	9	17
Av.	23.	23.	26.	22.	25.	27.4	193	20.	21.	20.	22.	23.
I. V.	78.	86.	91.	82.	98.	119.	52.	68.	82.	42.	57.	82.
	Quadrate 5			Quadrate 6			Quadrate 7					
	Quadrate 8											
Stems/ha	98	134	165	91	138	168	90	100	150	45	70	119
<40 cm dbh	7	9	15	5	6	8	3	6	12	1	4	11
Av.	20.	20.	22.	19.	19.	20.6	18.	21.	22.	19.	20.	20.
Diameter	6	5	5	1	4		9	6	9	5	4	8
I. V.	51.	71.	99.	45.	66.	83.0	45.	58.	84.	25.	37.	65.
	2	9	1	9	7		8	3	6	1	8	3
	Quadrate 9			Quadrate 10			Quadrate 11					
	Quadrate 12											
Stems/ha	60	95	171	29	101	204	38	74	144	34	58	135
<40 cm dbh	9	14	12	--	1	2	--	2	8	--	1	6
Av.	23.	21.	17.	15.	15.	16.9	19.	20.	19.	18.	20.	19.
Diameter	5	1	7	6	5		8	2	2	5	9	0
I. V.	40.	53.	73.	13.	39.	74.9	25.	45.	72.	20.	34.	58.
	8	2	0	8	2		4	8	6	4	5	0

Another indication of the slow but steady increase of sugar maple in Baber Woods is the distribution of this species and the oak species by diameter classes from the 1965, 1983, 1998 survey data (Table 12.3). Sugar maple increased in all diameter classes between the three surveys, particularly in the 10-19 and 20-29 cm diameter classes. Sugar maple had an overall increase of nearly 30 stems/ha between 1965 and 1983, and an increase of 48 stems/ha between 1983 and 1998. Oak species, in contrast, decreased in number, dramatically so in the lower diameter classes, with increases occurring only in the 60 through 90 cm diameter classes. Overall, species density increased in the woodlot from 258.6 stems/ha in 1965, 277.3 stems/ha in 1983, and 289.4 stems/ha in 1998. Most of this increase was due to sugar maple and other mesic species that are tolerant of shade. Presently the oaks are common in the larger diameter classes because of recruitment from the smaller diameter classes. Oak reproduction is sparse, and as veteran oaks die, few oaks will be available to fill canopy gaps. Sugar maple, in contrast, with its high gap-phase-replacement-potential will take advantage of these canopy opens.

Table 12.3. Density (stems/ha) in broad diameter classes for sugar maple, oak species, and all other species in Baber Woods Nature Preserve, Edgar County, Illinois for the survey of 1965, 1983, and 1998.

Diameter Classes	Sugar Maple			Oak Species			Other Species			Totals		
	1965	1983	1998	1965	1983	1998	1965	1983	1998	1965	1983	1998
10-19cm	42.6	58.9	88.1	7.6	3.7	1.4	50.0	62.1	44.9	100.2	124.7	134.4
20-29cm	17.8	24.7	34.2	10.9	4.9	2.7	17.0	17.7	17.9	45.7	47.3	54.8
30-39cm	7.3	10.6	15.5	14.7	8.3	3.3	19.0	13.2	10.1	41.0	32.1	28.9
40-49cm	2.4	4.6	7.2	17.7	11.6	7.9	15.4	12.6	11.4	35.5	28.8	26.5
50-59cm	0.6	1.0	2.5	16.2	13.0	9.9	5.6	7.9	6.7	22.4	21.9	19.1
60-69cm	0.1	0.3	0.6	7.5	11.1	8.7	0.9	2.1	3.6	8.5	13.5	12.9
70-79cm	--	--	0.2	2.7	4.4	6.6	0.3	0.6	0.8	3.0	5.0	7.6
80-89cm	--	--	0.1	1.1	2.3	2.5	0.1	0.2	0.3	1.2	2.5	2.9
90+ cm	--	--	--	1.1	1.5	2.0	--	--	0.3	1.1	1.5	2.3
Total	70.8	100.1	148.4	79.5	60.8	45.0	108.3	116.4	96.0	258.6	277.3	289.4

In a walk through survey conducted during the early spring of 1990, 26 large, open-grown white oaks were observed in Baber Woods. All had open, round crowns and large lower branches, most within 4 m of the ground. They were probably remnants from a time when this forest was an open, upland savanna. The average diameter of these open-grown white oaks was 101.6 cm dbh, and two that had just died recently were cut in 1990 and aged at 313 years. Both had fire scars at 65 and 77 years, indicating that in the past fires were common in the area. Five other large oaks that had recently died were also cut and aged. These were forest-grown trees with straight trunks, no lower branches or branch scars, and had an average diameter of 68.2 cm. They varied in age from 140 to 158 years, with an average age of 148 years. Also, during this walk through in 1990 increment cores were obtained for 30 of the largest sugar maples found throughout the woods. The sugar maples from the northwestern part of the woods, where the largest individuals were found, averaged 44.7 cm dbh, and had an average age of 107.6 years. Sugar maples from the remainder of the woods were all smaller and younger (Table 12.4).

Table 12.4. Tree growth rings and diameter (dbh) of sugar maple at selected sites throughout Baber Woods Nature Preserve, Edgar County, Illinois.

	Diameter (cm)		Growth rings	
Area	Range	Average	Range	Average
Northwest corner of woods	37.4-59.7	44.7	101-116	107.6
Northeast corner of woods	26.0-35.8	30.4	52-91	70.6
Southeast corner of woods	17.5-35.5	25.7	51-71	61.1

The data suggest that before European settlement of central Illinois, the area known as Baber Woods was an open, white oak savanna of open-grown trees maintained by periodic fires. This community was probably park-like with an understory of prairie grasses, forbs, and shrubs, the understory being kept open by wildfires which killed back the young trees. With the cessation of fire soon after the settlers arrived, young oak trees and oak grubs began to fill the gaps in the canopy between the large open-growth white oaks. These trees grew straight and tall with minimal lateral branching as light became a limiting factor. As shade increased, moisture levels within the partially closed-canopy forest increased, creating a habitat for the more mesic, shade-tolerant and fire-sensitive species such as sugar maple, elms, and ashes.

Exotic Species Introductions
The introduction of exotic and weedy species and their rapid spread into forest communities as a result of fragmentation has had a very significant impact on the fauna and flora of the deciduous forests of the Midwest. It is estimated that the number of exotic species in the Midwestern United States is between 20 and 30 percent of the total flora. For Illinois nearly 31 percent of the vascular plant species in the flora are exotics. The majority of the species are agricultural and roadside weeds that are rarely problems in forest communities. Some species, however, are major pests in forest and savanna communities, and the problem will continue to increase in severity and scope as new species enter the flora. Exotic plant species commonly reduce diversity by decreasing the habitat available and the habitat quality for the native fauna.

Exotic insects and pathogens have also become a major problem in forests and savannas, sometimes attacking entire communities, in other instances decimating a particular tree species. By the middle of the 1900s the introduced Dutch elm disease fungus and the virus disease, phloem necrosis, had eliminated the American elm as a common ornamental throughout most of North America and had greatly reduced its importance in most forest stands. Earlier, the introduced chestnut blight fungus all but eliminated *Castanea dentata* (American chestnut), radically altering a major forest association of the eastern deciduous forest and the fauna and flora depending on that species. Gypsy moths, which were imported from Europe in the late 1800s, are capable of causing enormous devastation over large areas. The larvae of this species feed on the leaves of most of our native forest trees and shrubs, completely defoliating and eventually killing hardwood forests.

Native Pests, the Impact of Deer on Illinois' Forests
White-tailed deer (*Odocoileus virginianus*) is a native species common throughout the deciduous forests of the eastern United States. Illinois was probably near the center of deer abundance in North America prior to European settlement. This prairie/forest transition, where there was extensive forest edge, was ideal habitat for this browsing species. White-tailed deer commonly browsed on woody plants for much of their food. Forest edge, and extensive resprouting of grubs and woody seedlings and saplings after fire provided excellent forage for this species. Under the dense shade of closed forests very little browse was available, but in savannas and at the prairie/forest interface shrubs and woody seedlings and saplings were abundant.

When Europeans settlers arrived in North America it is estimated that there were about 40 million deer on the continent. Settlers, sportsmen, and commercial hunters killed large numbers of these deer in the 1800s. Early estimates indicate that the number of deer in Illinois actually increased in number between the 1820s and the 1850s as the number of Native Americans were reduced. By the mid-1800s, however, deer populations were starting to decline, the effects of year-round market hunting and habitat destruction. Deer were probably extirpated throughout most of Illinois by the end of the 19th century, although they probably persisted in southern Illinois until 1910. This massive decline in the deer heard population caused the complete ban on hunting in Illinois in 1901.

Probably the most successful species reintroduction program in Illinois occurred when the Illinois Department of Natural Resources brought deer back into the state. Since the early 1900s the size of the deer herds in Illinois has increased dramatically, in many areas becoming so abundant that they are a nuisance species. Beside the problem of extensive crop loss is the impact of deer on natural communities and on endangered and threatened plant species. Also, in recent years deer-vehicle collisions average about 20,000 annually in Illinois. Presently in many of our nature preserves and natural areas deer completely destroy the understory of forest communities, greatly decreasing species diversity

(Warner 2004). Within the highly fragmented landscape of Illinois, as well as throughout most of eastern North America, highly nutritious crops usually surround small forest fragments. Deer are sustained by these crops at an artificially high density. As a result, deer mortality is low in the absence of natural predators such as the wolf. Also, the nutrition provided by the crops sustain the deer in an excellent physiological condition that is correlated with long life, high reproductive rates, and the ability to resist parasites and diseases that often kill deer herds under nutritional stress.

The endless supply of food from crops sustains the deer, which can then exert continuous browsing pressure on the native flora without having to depend completely on that vegetation. In Illinois deer spend much of their time in cultivated fields where cover and food are plentiful. In the fall and winter, however, deer concentrate in the forest fragments. This results in intensive browsing pressure on the forest understory. Also, during the spring and summer deer use these fragmented forests for bedding and browsing. High deer densities in these areas have led to serious damage to the herbaceous understory species. In many natural areas wildflower populations have been severely impacted. This browsing of the understory vegetation has been followed by a dramatic increase in invasive species that are unpalatable to deer.

Trends and Threats in the Future

The structural complexity and extent of the deciduous forests has resulted in high species diversity. In presettlement times this diversity was undoubtedly higher, but extinction, range reduction, fragmentation, and the resulting inbreeding depression, as well as the introduction of exotic species and other anthropogenic factors have resulted in many species becoming threatened and endangered. Presently the greatest threats to native species diversity are the destruction of habitat and the competition from non-native species. It is presently estimated that at least 75 species of vascular plants have been extirpated from Illinois in the last 100 years.

For the short term, the situation will undoubtedly get worse. With increased population pressures there will be a continued need of more land for housing, food production, and recreation. More and more pressure will be put on public lands for recreation, and open space will become more valuable. Presently some of our nature preserves are being impacted by just pedestrian use, others have problems with off-road vehicles, destruction and removal of plant and animal species, dumping, etc. Added to these problems are the time, effort and money necessary to maintain preserves and other open space. Nature is not static, and many areas are still in need of protection, others desperately in need of maintenance, others still need to be found. All of our dedicated nature preserves, as well as the other natural areas in the state, are threatened by invasive species, the lack of management, encroaching development, and surrounding land use.