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ENTICE – Environment and Nature Training Institute for Conservation Education

Illinois Prairies 101

Part II

Fire

Historic Occurrence of Wildfires in Illinois

Fire had a major influence on the development and distribution of vegetation in Illinois. Some pioneer writers observed a relationship between the distribution of forest and prairie, stating that forest was more abundant on the east side of streams and bodies of water in the prairie regions where they were protected from fires driven by the prevailing westerly winds. Only the most fire-resistant trees, such as bur oak or white oak, remained exposed to the flames on the west side of streams. Using the Government Land Survey records, plant geographer Henry A. Gleason published an article in 1913 that explained the distribution of forest and prairie in the prairie regions.

His conclusion for the existence of prairie within Illinois, an area whose climate could readily support forest, was the occurrence of wildland fire. His conclusions were substantiated by other researchers who determined that grasslands throughout the world exist under a wide variety of soil types and climates. However, the two features common to all of them are a season of the year during which the vegetation becomes dry and extremely flammable and a flat to gently rolling topography.

These two features provide a most ideal setting for the ignition and movement of fire. Dry vegetation, especially grass, ignites easily and fire moves rapidly across a flat to gently rolling terrain, like much of Illinois. Some scientists have insisted that fire and grasslands are inseparable; one simply cannot exist without the other. Indeed, there are observations of fires on grasslands throughout the world due to ignitions by lightning or by indigenous people. Indigenous people often take advantage of ideal weather when the vegetation is dry and start fires for a multitude of reasons, including hunting.

The French explorer La Salle described the effects of widespread fire on the upper Illinois River in the late autumn of 1674: "To the right and the left stretched the boundless prairie, dotted with the leafless groves and bordered by gray wintry forests scorched by the fires kindled in the dry grass by Indian hunters, and strewn with the carcasses and bleached skulls of innumerable buffalo." Because the burning of the prairies was extensive, the explorers had difficulty finding wild game for food.

Father Louis Hennepin, an early Jesuit priest, described a fire hunt in 1679 near the present site of Kankakee: "When they (Miami Indians) see a herd (of bison), they gather in great numbers, and set fire to the grass everywhere around these animals, except some passage that they leave on purpose, and where they take post with their bows and arrows." Following a journey in 1721, Pierre Charveloix wrote, "the kind of hunting most in vogue in the southern and western parts of New France, on both sides of the Mississippi is that of the buffalo. The huntsmen draw up in four lines, forming a large square, and begin by setting the grass on fire, that being dry and very rank at this season." Claude de la Potherie also described the use of fire hunting in the upper Mississippi valley region in the early 1700s. "When the

natives wish to take many of these animals (bison), they shut them in with a ring of their fires, from which the animals can not escape." According to these early French accounts, the Illinois Indians would kill as many as 120 bison in a day. Sides of meat were cut off, smoked over slow burning fires and returned to the villages where it was divided among the families. The carcasses and skulls were left on the prairies, a practice that corresponds with the observations of La Salle in the 1670s.

Nicholas Perrot, an Indian agent in Wisconsin, describes a high level of organization in the fire hunts. The tribe chose a "fire chief" at a council meeting. He organized three separate crews from the tribe, and at midnight on the designated day, directed the crews onto the prairie to surround the bison. As dawn approached, the circle was completed and once the morning sun had dried the dew from the grass, it was set on fire and the hunt began. Severe penalties were imposed upon anyone who scared the bison away, including destruction of personal belongings, weapons and living quarters.

The use of Indian summer for hunting was verified by numerous pioneers, including the Scotsman James Caird. "So long back as we have any knowledge of the country, it has been the custom of the Indians to set fire to the prairie grass in autumn, after frost set in, the fire spreading with wonderful rapidity, covering vast districts of the country, and filling the atmosphere for weeks with smoke." This smoky atmosphere prevents the sun from being seen "until 10:00 in the forenoon, and the sky at night is a fiery red."

Dr. Lyman Foot, a physician in Wisconsin, described Indian summer in October of 1837. "We had three weeks of Indian summer, all with that peculiar redness of the nighttime sky. The prevailing winds were west and north of west with a dry atmosphere. The country was on fire for forty miles around us." Dr. Foot referred to this time as the season for the annual fall hunts of the Indians. "If you ask an Indian when he is going to his hunting ground, he will tell you when our great spirit sends our fall summer, meaning that time in October and November that we call Indian summer." According to Henry Schoolcraft, an Indian agent, writer, and traveler in the Midwest, the Indians initially had no horses to aid them in their hunts, a deficiency that they compensated for by the use of fire.

There is good reason why the hunts were conducted in the fall. There is a season in Illinois, known as Indian summer that follows the first killing frosts in October or early November. At this time a mass of Pacific air dominates the weather pattern, producing days with clear skies, mild temperatures, low humidity and mild westerly winds. This season usually occurs every year and is known in the meteorological literature as a singularity. Indians made reference to the fall summer as the time for fire hunting, and European settlers repeatedly stated that these terrible fires began in the fall following the first killing frosts. At this time, the atmosphere was full of smoke for weeks due to the burning prairies and forests.

In most descriptions of fire hunting, bison or buffalo is the quarry, but ring fires were also used to hunt deer and elk. Colonel James Smith was a captive of the Indians in Ohio from 1755 to 1759. They adopted him and allowed him to keep a diary in which he described a deer hunt in October of 1757 on the great prairies that existed between the Sandusky and Scioto Rivers in Ohio. "When we came to this place we met with some Ottawa hunters, and agreed with them to take what was called a ring hunt in partnership. We waited until we expected rain was nearly falling, and then we kindled a large circle in the prairie. At this time, before the bucks began to run, a great number of deer lay concealed in the grass in the day, and moved about in the night. As the fire burned in towards them, they would run from the advancing flames and the Indians would shoot them down at every opportunity. The rain did not come on that night to put out the outside of the circle of fire, and as the wind arose it extended through

the whole prairie which was about fifty miles in length, and in some places near twenty in breadth. This put an end to our ring hunting this season, and was in other respects an injury to us in the hunting business."

The Indians continued to use fire after pioneers moved into the state. One Winnebago County pioneer remarked that "the Potawatomie Indians were doing a great deal of fire hunting this fall, and we came very close to being burned out," a term used by pioneers to describe the total loss of crops, cabins and other buildings due to wildfire. On another day, they were out on the open prairie when a fire suddenly appeared, driven by a strong west wind. When the fire hit our wagon, the horses dropped to the ground as though fatally wounded by gunshot. When they were finally able to stand, we saw that the hot flames had seared their bodies, causing large flaps of skin to hang loosely from their sides and legs. Our own hair, eyebrows, and clothing were burned, but we escaped with our lives. It would be a time we would not soon forget."

While Native Americans used fire as a tool to hunt deer and bison, the uncontrolled prairie fire was feared by the pioneers and was considered detrimental and incompatible with their life style. The rapidly increasing number of settlers, buildings, crops and livestock made the occurrence of widespread prairie fires more undesirable with each passing year. Due to these increasing demands for legal protection from prairie fires, the Northwest Territory legislature passed a law in December of 1799, stating that there were "persons in the habit of setting on fire the herbage in the woods, prairies and other grounds, thereby producing a conflagration prejudicial to the soil, destructive to the timber and the improvements of the territory." The Indiana Territory approved virtually the same act in 1807. This act also defined the season during which prairies could be legally burned as "between the first of December and the 10th day of March," and may have contributed to the increased emphasis placed on spring burning by the European pioneers. In 1807, a petition was prepared by a group of citizens from Gallatin County complaining about the lack of legal protection from prairie fires and the damage they were causing to buildings and livestock.

However, these acts were rarely enforced and few convictions were ever made. There are, notable exceptions, including Louis Giroux, who was indicted and jailed in 1794 for setting fire to the commons at Prairie du Pont (now Dupon), resulting in the loss of fence rails in Cahokia and Prairie du Pont. John Johnson set fire to a prairie on his father's property in Kane County on November 15, 1845. The fire passed onto the land of a neighbor, burning up his crops (500 bushels of wheat, 500 bushels of oats, and 15 tons of hay), and 6,500 rails for fences, having a presumed value of \$1,480. Peter Johnson was indicted and the case eventually made its way to the Illinois Supreme Court, which affirmed the ruling of the circuit court and awarded the judgment to the plaintiff. The 385-acre farm owned by Peter Johnson was seized by the sheriff and sold at public auction, apparently to raise money to pay the judgment. In Shelby County, Illinois, both John McCarthy and Birch Vermilion were placed in jail in 1845 and 1851 on \$100 bond for the crimes of "firing the prairies." As the news spread regarding these court cases, the potential of prairie fires was further reduced.

Weather conditions at the time of fires were described as dry with west, southwest or south winds. However, fires sometimes came from the east. The fires also burned over considerable acreages, like the fire originating in Stark County, Illinois, in November of 1856. This fire that had a front eight miles wide traveled to where Rockford now stands, a distance of at least sixty miles. Using these figures, this fire is estimated to have burned 310,000 acres of prairie and woodlands. The Ford County fire, also in the fall of 1856, burned through Ford County into Iroquois County until it reached the Iroquois River.

Evidence indicates that prairie fires occurred annually. There are records of prairie fires in Illinois beginning in 1816 and continuing nearly every year until 1839. John Deere invented the self-scouring steel plow in 1837, enabling the prairie sod to be broken more efficiently. Prairie fires after the 1830's occurred in Coles, Ford, Livingston, Mercer and Woodford counties, most of which are within the extensive Grand Prairie region of east central Illinois.

During drought years such as 1819, the fires burned over vast amounts of land, doing considerable damage to trees and woodlands. When the fire reached the trees, some of them became pillars of fire and were quickly consumed. Others that were hollow became gigantic torches, spewing flames and embers into the air until they also fell to the ground with a heavy thud to be consumed by the flames. During October of this same year, John Wood described his trip from Shawneetown on the Ohio River to Albion as the most miserable three days that he had spent because the woods were on fire and thick smoke hung in the air. In Indiana near Princeton, William Faux described the extensive fires in the woods, and trees crashing to the ground, a sound that he described as like the discharge of a canon. The distant horizon in Illinois was aglow at night, and the westerly winds brought smoke and ashes across the Wabash into Indiana.

One of the tools used to prevent large, dangerous fires, spring burning, appears to be an introduction of European man to reduce the danger of prairie fires. Not one record or reference to spring burning was found in the early settlement and exploration of the Illinois Territory, but frequent references to spring fires were located in the literature during the period 1816 to 1861. Spring fires were used to prepare fire breaks to remove grass prior to plowing, to facilitate the planting of cool season grasses or to kill prairie-chickens because they were eating too much grain. In Kentucky, following the removal of the Native Americans, F. A. Michaux reported that the inhabitants set fire to the grass of the barrens during March or April. Many of the pioneers of Illinois came from Kentucky, and they may have continued this practice of spring burning on the prairies of Illinois.

Indians taught the pioneers to use a "backing fire" which burnt slowly with small flames in the direction of the prevailing wind. They used this tactic when a prairie head fire, being driven by a strong wind, was approaching. This procedure was employed by many a pioneer within the prairie country to protect their possessions, and these burned out strips of land came to be known as the "fire lands." In contrast to the Indians, prairie fires were a liability to pioneers and a source of much apprehension. Stopping fires meant the elimination of tall prairie grasses, and that meant the destruction of the prairie. They began a program of plowing, overgrazing, spring burning and overseeding of bluegrass and other cool season grasses onto the prairie to reduce the danger of fire. Laws were passed to prevent the burning of prairies in several Midwestern states, including Illinois. By the time of the Civil War, the large prairie fires were an event of the past. The absence of fire in both grassland and forest communities in Illinois since pioneer times has resulted in changes that are threatening both prairies and forests throughout much of Illinois.

Effects of Fire on Plants and Animals

Most prairie plants have underground parts that are protected from fires. In contrast, woody plants have growing parts above ground, making them vulnerable to the intense heat of fires. Soil is also an excellent insulator, thus preventing the heat from the hottest fires from penetrating more than an inch into the soil. Most fires move rapidly, burning all dead plant material that they encounter. Fires sometimes remain at the base of trees in forests due to the accumulations of leaves and branches, causing considerable damage to the growing tissues.

One of the greatest benefits of a prairie fire is the removal of thatch, or dead plant material. This allows sunlight to reach the soil surface, increasing the soil temperature. Increased soil temperatures result in earlier growth of plants of burned prairies. Another benefit of the removal of dead tops is sunlight received by the spring-blooming prairie plants. These plants, such as violets, buttercups and shooting stars, tend to be much shorter compared to the height of the plants of summer and fall. Without the thatch removal, these plants would remain covered by dead grasses and perish from a lack of sunlight.

Much of the research concerning the effects of fire on prairie vegetation has been completed following spring burns. Much of the work has also focused on the above ground biomass. Burning results in a biomass twice to four times greater than unburned prairie sites. The majority of this biomass is comprised of big bluestem grass and Indian grass. Long-term research demonstrates an increase in the densities of big bluestem in prairie remnants.

The general pattern after a spring fire in grasses is an increase in flowering. This is especially true of the prairie grasses that are warm-season or C4 plants, such as big bluestem, Indian grass, little bluestem, switch grass and prairie dropseed. In contrast, cool-season grasses, such as needle grass or June grass, demonstrate a general decrease in flowering following a spring burn.

Much less is known about the response of wildflowers to spring fires. It is known that black-eyed Susan, leadplant, stiff tickseed and drooping yellow coneflower display dramatic increases in flowering after a spring burn. Pale purple coneflowers on hill prairies and prairie blazing stars in mesic prairies have also been observed to flower prolifically following prescribed burns in Illinois. In contrast, flowering in spring blooming plants like shooting stars has been reduced considerably. Some of the effects of the burn are not apparent until the second year following the fire.

Fires have negative impacts upon small mammals like voles and short-tailed shrews that make surface nests out of plant materials. Mortality of voles has been high following spring prescribed burns in Illinois. Fires appear to benefit species like ground squirrels and meadow jumping mice that forage for seeds and other food in areas with little cover. If unburned prairie is left adjacent to burned areas, those small mammals adversely impacted by the fire immigrate back into the burned area, allowing the population to recover within two or three years following the fire. The effects of fire on large mammals are not completely known. Bison were afraid of fire and would run from it.

Spring burns in Illinois have sometimes had a detrimental effect upon reptiles, especially snakes. The day of the prescribed burn is often one of the first warm, sunny days of spring, and many snakes are just coming out of hibernation. A common method of conducting a prescribed burn is to make a circle of fire completely around the proposed burn area. In so doing, any newly emerged snakes present in the grass are caught in a ring of fire with no escape route. Lizards have also been killed on hill prairies for the same reason. The best way to prevent this from happening is to provide an unburned path for reptiles to exit.

Certain life stages of prairie-dependent butterflies, including skippers, are vulnerable to fire because they survive the winter months as larvae in plant debris or clumps of prairie grass. These insects perish when the prairies are burned, causing a decline in their population or the extirpation of the population at that site. In situations where vulnerable insect species are at risk due to prescribed burns, it is best to leave portions of the prairie unburned so the insects in this part will not be affected.

The effects of fire upon the plants and animals that comprise the prairies must be viewed as the effects upon the entire system, not upon individuals of a certain plant or animal species. The management goal of any prairie site should be to maintain all species of the prairie. With most plant and animal groups, there are species that will increase with fire while others will decrease. Fire maintains prairie, and prairie is the habitat of these organisms. The absence of fire may result in woody invasion and the conversion of the site into woodland. This has happened to many small prairie remnants throughout the state and has been documented several times within the last 30 years.

While conducting prescribed burns, it is important to leave portions of the prairie unburned. These areas can serve as refugia for organisms that are negatively affected by fire. Another important consideration while conducting a prescribed burn is the timing. Efforts should be made to burn a site during the time of greatest dormancy for plants and animals so new plant growth, eggs or young are not damaged or killed by fire.

Prescribed Burning

Most prairie sites require periodic fire for their maintenance. Without fire, weeds become established and woody plants begin to invade. Fire also reduces the accumulation of thatch, or dead prairie vegetation, from previous years, allowing sunlight to reach newly developing plants during spring. Fire is an excellent management tool, but by its own nature, it is potentially dangerous. Proper planning and coordination are essential in accomplishing the goals of each prescribed burn that include the safety and health of workers and the general public. In all prescribed burns it is important to remember that fires can be contained within a specific area, but the fire itself cannot be controlled.

Safety is always a primary concern with any prescribed burn. Proper clothing is essential during a prescribed burn, including gloves and boots. Boots with cleated soles help prevent individuals from slipping while carrying heavy objects or moving through rough terrain. Gloves help prevent injury to hands due to thorny vegetation or the fire itself. A potential source of a serious burn is a down or nylon jacket. These types of clothing burn easily. An ember from the fire could cause these to burn, enveloping the individual in flames before they could be removed.

First aid kits should be present on all prescribed burns so cuts, burns and other injuries can be treated quickly. These first aid kits should be well supplied. It is valuable to have individuals on the burn crew trained to administer first aid and CPR.

Crew selection is a very important part of the planning of a prescribed burn. Prescribed burning is strenuous and stressful. Consequently, it is best to not allow individuals with serious health problems, such as heart trouble or high blood pressure, to participate. The stress and strain could prove harmful to the individual. In addition, a medical emergency during a critical part of the burn could result in an escaped fire and potential damage to adjacent property.

Hazards

Prescribed burning presents a number of hazards that should be prepared for in advance. The amount of smoke produced during a burn depends on the type of vegetation and its moisture content. Smoke on roads constitutes a traffic hazard, and smoke blowing toward homes has the potential of creating a health problem. It is essential to consider wind direction. If possible, a burn should be held on a day with a "high ceiling" when the smoke will travel directly up instead of remaining close to the ground.

Power lines may also pose problems during prescribed burns. During dense smoke it is possible for electricity to arc from one line to another or from the line to the ground. When burning near power lines, select weather conditions that minimize smoke. Use backfires to burn under power lines if it is necessary to burn near these sites.

When burning along railroads, be cautious not to allow poles and ties to burn. Creosote burns quickly and easily and discarded ties can create enough smoke to cause a smoke hazard along roads a day or more after the actual prescribed burn. Burning railroad ties are not easily extinguished. Walk through the burn site and remove any railroad ties.

One of the greatest hazards facing burn crews is overconfidence. This overconfidence often results in an escaped fire, especially when just a few individuals believe they can contain a fire. Burns should be planned carefully with adequate personnel and equipment to contain the fire within the burn area.

Natural Hazards

Green grass, usually bluegrass or fescue, produces dense smoke during fall or spring burns. The presence of green grass should be noted in the burn planning and provisions made to adjust to the dense smoke.

Burning oak leaves can blow across firebreaks, spreading the fire out of the containment area. The same is true for embers from cedars or pines. Burning leaves can travel across 30-foot wide roads very easily. In addition to the wind, fires create their own wind and local weather conditions.

Fires burning through rocks or brush are difficult to extinguish. Logs also burn for an extremely long time. Sometimes water from a fire pump or a portable pump is the only way to extinguish these fires. Pre-burn planning should note the location of logs, rocks and large accumulations of leaves.

Dead-standing or living hollow trees have the potential of catching on fire and burning for hours or even days. Sometimes these trees are open at the base, causing them to draft much like a chimney. Burning embers often fly out of these trees. Hollow trees should be noted in the pre-burn planning.

Peat fires may develop in wet prairies, and they are very difficult to impossible to extinguish. The presence of peat deposits should be noted in the pre-burn planning, especially if the weather has been very dry for a prolonged time.

Local weather conditions sometimes promote the development of whirlwinds. These whirlwinds pick up the fire and become fire tornadoes capable of carrying embers a great distance. Once these develop, there is little that can be done to stop the whirlwind, allowing it to move out of the burn area and onto other land where it will start new fires.

Fire Equipment

The drip torch is the most practical and efficient method of spreading fire on most prescribed burns conducted in Illinois. This tool is often cylindrical in shape and capable of holding 1 ½ to 2 ½ gallons of fuel mixture. The fuel consists of a ratio of nine parts diesel fuel to one part gasoline. A drip torch is utilized on each fire line. Normally, this number is only two, but extra torches should be available so work can continue without having to take time to refill or in case one torch fails to work properly. Extra premixed fuel for drip torches should be available and close for refills when one torch is empty.

Fire or council rakes are very strong and durable rakes that have sharp cutting edges. They are capable of cutting down small trees and are useful in constructing firebreaks or fighting fires in woodlands. These tools should not be used to spread fire because of the potential for damage to the rake handle.

Leaf rakes, like fire rakes, are very useful in constructing firebreaks in woodland sites. However, they are most useful as “clean up” tools after council rakes or a leaf blower have initiated firebreak construction. This tool is not recommended for spreading fire.

Fire swatters or flappers are excellent tools for use in grass fires with small flames, such as a backfire. This tool consists of a long, strong handle and a thick piece of reinforced rubber about one foot wide and nearly two feet long. A “snuffing” motion is used as the person moves along the fire line. The rubber flapper portion of this tool should not be held in the fire.

Fire pumps are often the most important equipment on a prescribed burn. Most types hold five gallons of water and are available in rubber, galvanized metal or stainless steel. It is valuable to have an extra supply of water for the fire pumps during prescribed burns. Fire pumps may also be mounted on backpack frames to equalize distribution of the weight (50 pounds when full) of these pumps.

Weather radios are helpful in planning and conducting the burn. Most pocket-sized models give continuous weather information and are effective up to 50 miles or more from the weather station. Weather radios can provide critical information on wind direction and velocity changes during a burn.

Leaf blowers can be used in constructing firebreaks in woodlands. A large, five-horsepower model works best for this purpose. These blowers can also be used to extinguish woodland fires or backfires in grasslands.

Mop-up is the last stage of a prescribed burn. Most of the fire has ended by this time. It is essential to walk the firebreaks and look for signs of potential trouble. Any logs or trees within 75 to 100 feet of the firebreak that are on fire should be extinguished. Nothing should be left that has the potential of starting another fire after everyone has left the site.

Settlement and Drainage of the Prairies

Most settlers came to Illinois not knowing what to expect despite a profusion of “guide books” readily available to those seeking to establish themselves in the new land. When they reached the central and northern portions of the state, they encountered nearly treeless plains that had a monotonous, uniform flatness instead of forest-covered hills or mountains.

Prairies did not offer shade or wood for building and heating, so pioneers were naturally attracted to groves of timber along streams or in the midst of prairie. Many people thought that prairies were wastelands whose soils were infertile and incapable of growing good crops because trees did not grow on these sites. Others attributed the absence of trees to the severity of the winters, a belief that persisted for many years. Even James Monroe believed the prairies were infertile when he wrote: “the extensive plains have not had from appearances, and will not have, a single bush upon them for ages.”

Moving onto the open prairie was much more than just selecting a site and building a log home. It meant forsaking long established traditions, and breaking tradition was not an easy thing to do. Generations had lived in forests in Europe and the eastern part of the United States. Their homes were always established in timber or at the timber’s edge where fields were carved out of the forest. It was

brutally hard and dangerous work girdling and burning large trees, but cultivating forest soils with their crude plows was far easier than cutting through the dense, tough sod of the prairies.

The nearly uniform flatness of the prairies was not conducive to good drainage, causing water to pool in low areas. During times of high rainfall, mile after mile of prairie land was completely covered with water, especially in the Grand Prairie Region of east central Illinois where the abundance of wetlands restricted settlement until the 1890s.

There were also huge swarms of biting, green-headed flies on the prairies that would attack people and animals. These flies were so abundant in some regions that travel had to be restricted to night when the flies were not active. These insects are known today as deer flies.

If the green-headed flies were the plague of travelers during the day, mosquitoes were the plague of the night. They were in abundance in wet prairies, and huge swarms quickly made their way into the homes of pioneers. They did more than just bite. They brought a disease with them that infected many pioneers, causing a sickness that caused alternating fever and chills that was called "the ague." It was often fatal. Today we refer to this disease as malaria, and modern medicine has conquered it in this country, but it was a scourge of pioneers in the prairie regions of early Illinois.

After the frosts of autumn had killed the vegetation, the prairie grasses and wildflowers became dry and extremely flammable. Wildfires, driven by a strong west wind, raged across the flat lands, destroying crops, homes and rail fences and injuring livestock. Any pioneer who did not take proper precautions around his home during the fall was likely to be "burned out," an expression that meant that everything was lost in the fire.

Other pioneers were deterred from building on the prairie by an apparent lack of water for household and livestock use. It was a strange and contradictory statement considering the abundance of surface water on the poorly drained prairies. Time would pass before individuals realized that water was readily available most anywhere within the prairie regions by simply digging a shallow well.

Farmers did not have any efficient method of getting their produce to market in the prairie regions until the arrival of the railroads in the 1850s and 1860s. Railroads brought cheap lumber for building, eliminating the need to be near a source of timber. Some farmers would haul wood for household use and rails for distances as great as 15 miles one way. It was a very time-consuming process.

Besides furnishing wood for building and heating, belts of timber along streams, in prairie groves or on valley slopes, often had reliable springs that furnished a continuous source of good water. The trees and slopes also offered protection from the winds of winter. The best timbered areas were the first sites to be selected for homesteading.

It was a beautiful new land, but it was also strange, causing a high level of anxiety among many individuals. They wondered if their crops could succeed on prairie soils, causing initial attempts to utilize prairies to be rather limited. Cultivating grasslands presented a far greater challenge to pioneers compared to the more traditional method of carving a field out of the forest. The roots of the prairie grasses, shrubs and wildflowers were dense and tough and early plows could not cut through these root systems. By comparison, they could plow through the timber soils with about any of plows that were available.

Cultivating the prairie was much more difficult. Breaking plows, six to 12 feet long, were pulled by five or six yokes of oxen or four horses. These plows could break from one and a half to three acres of prairie in a day for a cost of two to four dollars an acre. The person doing this work was known as a "sodbuster." Many farmers with little financial resources broke prairie in a far simpler way. After the 1840s when the high quality plows of John Deere and other manufacturers were available, prairie breaking could be done by an ordinary two-horse plow, especially if livestock had been grazing the prairie for a few years prior to breaking.

Breaking prairie was usually accomplished during the month of May. Farmers learned that prairie sod that was turned over during this month would die and rot, making it easy to work. Sod plowed at later dates did not die, but continued to grow and form a tangle of roots that proved frustrating to the farmers. Their frustration would grow when certain plants such as New Jersey Tea were abundant in their prairies. This plant had deep, tough roots and was difficult to plow through. Another small shrub called white root by the pioneers had to be grubbed out by hand before the land could be plowed. The plow, as it cut through these roots, made a characteristic clicking sound that one pioneer described as "the most sickening sound that he had ever heard."

These plants were not the only ones that had to be dug out before the land could be plowed. Oak and hickory trees at the edges of the prairies often existed as sprouts due to the repeated fires that top-killed them nearly every year. Though they were only sprouts, they had root systems as large as mature trees. These massive roots, known as "grubs," were very difficult to remove.

Breaking of the prairies was a landmark event for pioneers. Until that moment, the land had been prairie or an investment costing \$1.25 per acre. Now it was cultivated and would soon be productive. The investment was starting to pay dividends.

In other parts of the state, small prairies were the first ones to be cultivated. Dr. Robert Ridgeway described the disappearance of a small prairie in Richland County that he had used as a bird study site for many years:

"The first visit to Fox Prairie was made on the 8th of June, 1871, the writer and his companions arriving a little before noon. A rolling plain spread before us, the farther side bounded by timber, while the prairie itself was free from tree or brush, except where some intersecting stream was followed by a narrow line of thickets, interspersed with occasional fair-sized and gracefully formed elms; or along the edge, where the jungle of sumac, thorn bushes, wild plum, hazel, etc, backed by young oak and hickory trees, showed plainly the encroachment of the woodland.

A third visit to this prairie was made early in June, 1883-exactly twelve years after the first trip. The change which had taken place in the interval was almost beyond belief. Instead of an absolutely open prairie some six miles broad by ten in extreme length, covered with its original characteristic vegetation, there remained only 160 acres not under fence. With this insignificant exception, the entire area was covered by thriving farms, with their neat cottages, capacious barns and fields of corn and wheat, and even extensive orchards of peach and apple trees. The transformation was complete, and it was only by certain ineffectual landmarks that we were able to identify the locality of our former visits.

The same is the history of all of the smaller prairies in many portions of the state; and it will probably not be many years before a prairie in its primitive condition cannot be found within the limits of Illinois."

Cultivation of the prairies accelerated in the years following the Civil War as new settlers poured into Illinois. Some farmers wrote that breaking of prairie is occurring everywhere. Despite the activity, extensive amounts of prairie still remained during the 1870s, 1880s and 1890s, and botanists like Samuel B. Mead from Augusta in Hancock County continued to collect plants and make notes on their vegetation. Dr. H. A. Gleason studied the vegetation of the sand deposits in the early 1900s and found extensive amounts of sand prairie along the Green, Illinois, Mississippi and Kankakee rivers. He explained that farming in these dry regions was difficult and most dry years resulted in crop failures. For this reason, there was little interest in the sandy lands.

Once all of the available timberland was taken, other settlers began to move out onto the prairies. By this time, farms ringed the wooded margins of the prairies. There were also those who were not at all reluctant to purchase the prairie lands and begin farming. Large landowners, like William Scully of Logan County, acquired more than 250,000 acres of land in Illinois and Louisiana. His intent was to establish a large system of tenant farms.

Drainage of the Prairies

Once the woodland sites were purchased, new settlers had no choice but to locate their homes on the prairies. However, placing a home on the prairie was not without misgivings. Previous settlers had used woodland sites as sources for building, heating, and cooking. They also furnished shade during summer and helped break the winds of winter. Now only grasslands remained, and many still considered their soils to be inferior to those of the forests.

Initially, the small prairies were settled first. They were closer to the woodlands, and the materials needed to build and heat their homes. Most large prairies were not settled until the arrival of the railroads in the decade 1850-60. The arrival of the railroads meant transportation for farm produce, but it also meant the arrival of cheap lumber harvested from the pinewoods of the northern states. There were some counties in the Grand Prairie, namely Ford, Livingston and Champaign, that remained sparsely populated for several more decades. They were all characterized by flat, poorly drained land that made farming impossible.

Deputy surveyors working for the Public Land Surveys wrote in their field notebooks as they passed through these areas: "land this mile wet and swampy, covered with water, unfit for cultivation." Very few of the 94 counties that contained prairie lacked permanent wetlands. These sites, known as swamplands, were classified as sites that were not suitable for sale at the land offices throughout the state.

The permanent sites were known as swamplands, and many of them had colorful names like Devil's Hole in Mason County, St. Peter's Marsh in Bureau County, the Great Manito Swamp in Tazewell County, Big Black Slough in Massac County, Willow Island Lake in Carroll County, the Great Winnebago and Inlet Swamps in Winnebago County and Beaver Lake in Champaign County.

Almost from the beginning, swamplands were blamed for the poor health and general discomfort of the pioneers. Indeed, some of these sites were hideouts and breeding places of malaria-carrying mosquitoes as well as the notorious biting, blood sucking, green-headed flies, the scourge of the prairies. The vapors, or miasmas, that rose from these wetlands were said to be unhealthy to breathe. Some said the mere presence of the swamplands evoked feelings of great despondency and utmost desperation.

The wetlands were tremendous obstacles to travel, but most of all, they were unproductive, and unproductive land was regarded as worthless by the pioneers. Swamplands were given many disparaging descriptions, such as worse than valueless or the great water wastes of the centuries. They were excluded from the sales at the public land offices and were held as federal lands until September 28, 1850, when congress, wanting to divest itself of the swampy and overflowed lands, voted to donate all of the lands to the states, including Illinois. They were to be sold and the proceeds used to reclaim the land or to finance projects such as road or bridge construction.

In less than two years, the Illinois legislature, also wanting to divest itself of the swamplands, voted to donate the lands to the counties in which they were located. A county surveyor was to be appraised and survey these lands, and a drainage commission was to be appointed for each county. The salaries of the surveying crews was to be paid out of the funds generated from the sale of these lands, and any profits were to be used for roads or bridges.

From 1854 until 1858, the Division of Swamp Lands within the Public Land Office prepared lists of the location and size of swamplands. These offices and the acreages they reported were: Springfield 148, 248; Edwardsville 75,603; Kaskaskia 53,982; Dixon 269,776; Chicago 28,160; Shawneetown 518,310; Danville 29,993; Palestine 59,331; and Vandalia 46,317; for a total of 1,229,720 acres. Other lists would later add additional acreage to this total, as would county surveyors who surveyed the interior of sections while the public land surveyors worked the exterior along section lines.

Swamplands were offered for sale to the highest bidder at public auction. Adams County had 25,062 swampland acres for sale on December 4, 1854, but the auction did not attract much interest. Only half of the lands sold, requiring an additional sale on December 3, 1855. The proceeds from this sale, as well as one in McHenry County, were used to purchase "poor farms" for the county's orphans, their aged and their indigent. In Bureau County, which had 38,000 acres of swamplands, the public sale in September 1856 raised \$115,000, which was placed in a school fund. Kankakee County used money from swampland sales to build a courthouse, and Lee County used money from swampland sales to pay off some of its indebtedness. These actions caused some land purchasers to complain that the money from swampland sales was not being used to drain the lands as legislation had intended. The county governments believed, however, that the money could be used where there was a need, prompting the development of the adage: "The drainage acts were designed more to drain money than water."

The sales of swamplands continued from the 1850s until the turn of the century. Land sold in tracts of 40 acres for various prices, sometimes as little as a penny an acre. A total of 33 tracts sold for 5 cents per acre, 215 for 10 cents per acre, 62 for 15 cents per acre, 215 for 50 cents per acre, and 2, 971 for 75 cents per acre. Compared to the standard \$1.25 per-acre price being paid at the Public Land Sales Office for land "fit for cultivation," these were paltry sums. Speculators sometimes got involved with the swampland sales. They hoped to buy the lands for very little money, use swampland sales money to drain them and sell them at a large profit.

As more pioneers came into the state, they attempted to drain the wet prairie and marsh sites. The initial feeble efforts only pooled water in ditches. Then more sophisticated drainage methods developed, and engineers were hired to plan the drainage. To drain the Inlet Swamp, engineers dug 39 miles of ditches and blasted a hole 18 feet wide and five feet deep at the inlet. According to the engineer's estimates, 1,544,817 cubic yards of dirt and 79,700 cubic yards of limestone had to be removed or blasted out to drain 115,000 acres of land. A contract was awarded in February 1888, and work was completed 13 years later, in May 1901. To the eyes and minds of many, the drainage effort

surpassed the greatest expectations. One Lee County historian described the transformations in glowing terms: “stately rows of corn now grow instead of wild rice, rushes, and other worthless vegetation.”

By 1856, some four years after the beginning of swampland sales by the counties, the secretary of the interior had yet to designate what constituted a swampland. The failure of the U. S. government to complete this task cast the burden back on the states, and Illinois decided to use the Public Land Survey notes to locate swamplands. County surveyors were responsible for surveying the sites and determining their value, but complaints were lodged against some surveyors, particularly those in Iroquois County, because they surveyed in the spring when water levels were high. Some prime agricultural lands were thus declared swamplands, excluding them from sales at the Public Land Sales Offices and making purchase necessary at public auction where it was sometimes more difficult to get the desired parcels of land.

Initial attempts to drain the swamplands were somewhat futile. In Ford and Christian counties, huge plows pulled by 16 yoke of oxen made a furrow about 16 inches deep as they attempted to drain the wetlands. Although these small ditches worked well at times, the lowlands flooded again during times of high rainfall. The call to conquer the swamps continued, though, and when Bucyrus developed the first successful steam-powered dredge in the late 1800s, swampland drainage became a reality. Engineers carefully mapped the location of drainage ditches and calculated the amount of earth and rock they would have to remove before the ditches would be functional. Then the swamplands, called “buds of promise,” would be converted to useable, productive land. One by one they were drained-Inlet Swamp in 1903, St. Peter’s Marsh in 1903 and Big Black Slough in 1912.

Though the dredges cut ditches to drain wetlands, the drainage was not complete until the installation of tile lines. Nearly every little town within the prairie areas had at least one tile factory, and the small community of White Hall in Greene County once had four. Production at one of these factories reached 10,000 tiles a day in 1876. The tile factory in small Sibley in Ford County eventually produced 1.5 million tiles per year after starting production in 1881. For many of these small towns, the only reminder of this once thriving industry is the pit where the clay was mined.

The tile line finished the drainage of the wetlands, causing many to applaud the loss. Some even stated that the changes that have occurred since the wetlands were drained have been both gratifying and illuminating,” for corn now grows where marsh grasses once stood. In less than a century, the swamplands were drained through brutally hard work by thousands of people. The lands were made productive, and the “buds of promise” had been opened.

Threats to Prairie Remnants

Compared to the 22 million acres of prairie present in Illinois about the year 1820, there is very little left. The Illinois Natural Areas Inventory, a statewide inventory of relatively undisturbed natural lands, concluded that only one-hundredth of one percent, or about 2,300 acres of prairie remains in the state. The black soil prairies that once occupied an area approximately 80 miles wide and 100 miles long have been reduced to narrow remnants along railroad lines or small patches between graves in pioneer cemeteries.

A great threat to the survival of the remaining prairies is provided by introduced plants that begin growing rapidly and displace the native species. Known as invasive exotics, these plants currently threaten nearly every community type known in Illinois, including forests, wetlands and prairies. Not all introduced plants are invasive. Corn and soybeans are very beneficial introduced plants that do not

spread into natural land. However, a select number are problem species that invade prairie remnants. These invasive plants usually have a competitive advantage over native plants, such as prolific seed production, early development of leaves or a vigorous growth habit. These are considered desirable features by some individuals, causing innumerable numbers of plants now known to be invasive to be intentionally planted for wildlife food and cover.

Invasive Exotic Species

The shrub autumn olive, a native of Japan, China and Korea, was introduced for wildlife food and cover, and many state agencies contributed to its current abundance. In 1982, Illinois state plant nurseries were producing and distributing more than one million autumn olive seedlings. This high level of production continued for several years certainly helped to establish autumn olive as one of the most common shrubs in open, grassy areas in Illinois, including prairie remnants. Its control and elimination is difficult because this plant has the ability to sprout prolifically from its root systems, and birds continue to carry seeds into areas once the older plants have been eliminated. Wild-growing plants tend to develop thorn-like spurs that discourage browsing by animals such as deer. Mature plants produce large amounts of bright-red, fleshy fruits that are readily eaten by birds.

Another European native that is invasive in prairie remnants is sweet clover. Two species, yellow and white, are present in Illinois and both are biennials, meaning they develop into a rosette from seed during the first year and flower and produce seed during the second year. Sweet clover plants are prolific seed producers, causing sweet clover populations in some prairie remnants to become so dense that the prairie vegetation is obscured. The presence of tremendous numbers of sweet clover plants severely impacts the prairie because the prairie plants are unable to get adequate sunlight and space for growth. Sweet clover control has been difficult because these plants are mixed with desirable native plants, often making use of herbicides impractical. They are usually too numerous to pull by hand and prescribed burns, a common management tool in prairies, stimulates the germination of sweet clover seeds, making the problem much worse.

Day lilies that were planted near the graves of pioneers have continued to grow and now cover relatively large areas within some prairie remnants. Nothing but day lily plants can be found within these areas. Past experience has shown that these plants are very difficult to eliminate due to their thick, matted leaves and abundant rhizomes.

Musk or nodding thistle is native to southern Europe and western Asia but is now widespread throughout pastures, rangelands, prairies and other open areas in the United States and Canada. This plant forms dense stands that crowd out desirable native vegetation. Once established, control is very difficult. Seeds can also remain viable for up to ten years in the soil. Control efforts have included close mowing and spot treatment of rosettes with herbicides. Beetles have been released as a biological control agent in some parts of the range of this thistle.

Sericea lespedeza is a legume native to eastern Asia that was introduced into the United States for erosion control, forage and hay. However, the tannic acid content of older plants tends to make them unpalatable to cattle. Like other herbaceous exotics, this perennial species readily invades prairies where it crowds out native plants. Repeated mowing and spot treatment with herbicides have been used to control this plant.

Two species of teasel are known to be invasive in some prairie remnants. This plant, a native of Europe, is a biennial or short-lived perennial that reproduces vigorously by seeds. Both species are sometimes

confused with thistles. Once established, it crowds out the native plants. Control efforts have included cutting, digging and pulling, and spot treatment with herbicides.

Crown vetch is another herbaceous perennial legume that is a serious invader of prairies due to its prolific seeding and spreading habits. Highway personnel have also used this plant to stabilize banks along roads. A native of Europe and southwest Asia, this plant is identified by its compound leaves that have an odd number of leaflets and pinkish lavender or white flowers that are produced in an umbel. The plant produces flowers from May through August.

Reed canary grass was introduced as a forage crop in the United States from Europe and Asia. It currently occupies drainage ways and wet prairie sites throughout the Midwest. It becomes so dense that the native vegetation is suppressed, eventually causing the loss of much of the native vegetation.

Buckthorns, smooth and common, are both shrubs native to Eurasia. Both species produce abundant numbers of black berries that are dispersed by birds. These plants readily invade wet and mesic prairie communities where they crowd out the native species. Both species are also capable of forming dense, nearly impenetrable thickets.

Siberian elm is a fast growing, small- to medium-sized tree native to northern China and Siberia. It was introduced into the United States in the 1860s and has since naturalized in many states, including Illinois. It flowers in the early spring and produces thousands of wind-dispersed seeds that germinate readily. It is capable of growing in a variety of conditions but does very well in dry habitats such as sand prairie.

Black locust is native to the southern tip of Illinois and other parts of the eastern United States. It produces clusters of white pea-like flowers in May and June. Once established, it produces tremendous numbers of root sprouts that eventually develop into a large stand of black locust. This tree was widely planted in the sand regions to reduce erosion during the 1930s, but the trees have spread into sand prairie remnants. Once established, it is very difficult to control.

Habitat Fragmentation

Illinois had approximately 22 million acres of prairie in the early 1800s. Some travelers that passed across the Grand Prairie remarked that it was "80 miles wide and not one tree could be found on the entire route." Now the amount of prairie has decreased to slightly over 2,000 acres that exist as widely scattered remnants that are mostly less than five acres in size. These small vestiges are in pioneer cemeteries, along railroads or in inaccessible places that make them unsuitable for agriculture.

Because of the small size of these prairie remnants, they lack the large-scale natural processes that once maintained them. The last vestiges of the bison herds that once roamed the state disappeared in the 1830s. The annual wildfires that used to keep the prairies free of trees and other woody vegetation ended in the 1860s. Their small size also makes them vulnerable to adjacent land uses and changes, such as drainage, herbicides or invasion by exotic plant species.

Their small size has also caused other problems. Many of them now contain invasive exotic plants that have crowded out native species. They have also diminished in quality due to the effects of herbicides, fire suppression or woody plant invasion and no longer contain a high diversity of prairie plant species. Research has also determined that small prairie remnants tend to lose plant species, thus becoming less

diverse. The reasons for these losses could be the loss of an insect pollinator, fire suppression, competition with invasive exotics or some other reason.

Size also matters to many prairie-dependent animals, such as birds. A tract of land only five acres in size is far too small for use by prairie-chickens. Prairie-chickens had a population of approximately 10 million in Illinois in 1860. Today, there are approximately 100 birds, all in the Southern Till Plain. With this very small number of individuals, the continued existence of prairie-chickens in Illinois is precarious. Severe weather and drought have recently eliminated many individuals.

Research has determined that prairie-chickens must have large expanses of grasslands with an open vista free of trees. At sites where grasslands with open vistas exist, prairie-chickens have been faced with another problem. The introduced Asiatic pheasant lays eggs in prairie-chicken nests. Pheasant eggs do not require as much time to hatch, so the prairie-chicken hen leaves the nest with a brood of pheasants while the developing prairie-chicken eggs are left to die. Pheasants also harass the prairie-chickens and try to drive them off of their mating grounds. The key to the survival of any organism is successful reproduction, but the prairie-chicken is faced with many problems.

Other grassland bird populations are also declining in Illinois. During the period 1967 to 1989, habitat deterioration appears to be the reason why populations of meadowlarks, horned larks, dickcissels, bobolinks, vesper sparrows, song sparrows, grasshopper sparrows, field sparrows and sedge wrens declined as much as 60 percent. This trend will be very difficult to reverse due to current land use throughout the state. Most of these birds have a minimum size habitat requirement, and most of the prairie remnants in the state are not large enough for them.

Many plants continue to survive in these small fragments, but the insects that once pollinated them are now absent and the plants fail to produce fruit. Plants such as the prairie white-fringed orchid and other rare prairie plants must be hand pollinated because no insects pollinate them.

Thousands of insect species likely inhabited the prairies, including a number that are dependent upon the prairie environment. These species, such as the rattlesnake master root-borer, loosestrife root borer, Ottoe skipper butterfly, regal fritillary butterfly and many others continue to exist at only a few locations. Insects are also pollinators of many plant species, including plants like the prairie white-fringed orchid. Careful management will be required to keep these species from disappearing from the state.

Another effect of habitat fragmentation is loss of genetic diversity. Plants had no problem maintaining genetic diversity when the prairie was large, uninterrupted grassland. Animal populations could intermingle and insects could readily transfer pollen from plants over a wide area. Now these plant and animal populations are widely separated and an exchange of genetic material is no longer possible.

Perhaps the best-known example of the loss of genetic diversity due to habitat fragmentation occurred within the Illinois prairie-chicken population. The prairie-chicken population in Illinois was estimated at 10 million birds in 1860. This number had declined to 25,000 birds by 1933, but by 1962 only 2,000 birds remained, mostly in Marion and Jasper counties. This population declined tremendously in the 1980s to less than 200 birds, leaving managers puzzled and concerned. Some managers thought pesticides had caused the population decline. However, when the genetic composition of the existing population was compared to those from specimens from several decades ago, researchers found that genetic diversity had been lost from the population. This loss of genetic diversity had an adverse effect on the prairie-

chickens, and they were not able to compete as well. To remedy this situation, prairie-chickens were introduced into Illinois from Kansas, Minnesota and Nebraska. These states still have relatively large populations of this bird. Since this reintroduction effort, the prairie-chicken population in Illinois had been increasing until recent setbacks have caused serious declines again.

Another more recent example of the effects of habitat fragmentation upon animals involves Franklin's ground squirrel. This small mammal requires tallgrass habitat, but this habitat continues to decline in the former prairie region. A recent survey to locate populations of this mammal indicated that few sites supported any ground squirrels.

Effects of Woody Invasion

Another huge threat to most prairies is invasion by woody plants and the subsequent conversion of the sites to forest. All prairie types contain some woody plants, including prairie willows, hazel, leadplant, sumac, New Jersey tea and scattered individuals of tree species. However, woody plants present at the margins of prairie remnants often begin the conversion of these grasslands into woodlands. In hill prairies, this zone of shrubs grows in toward the center of the prairie, slowly converting prairie into forest. One of the worst offenders in hill prairies is rough-leaved dogwood. Though this is a native plant, it produces large numbers of edible fruits, and it also reproduces by producing sprouts from the root system. The result is often a large clone of rough-leaved dogwood. The shade from these shrubs kills the sun-loving prairie plants. The dogwoods also provide perches for birds that carry seeds from other woody plants. This process of conversion from forest to prairie is very subtle, but observations over a period of several years will reveal the loss of prairie.

Loess hill prairies are prominent features of the bluffs along the Mississippi River in Jersey, Menard, Pike and Calhoun counties. Robert A. Evers studied the hill prairies of Illinois during the late 1940s and early 1950s. Subsequent studies expressed concern about the loss of hill prairies due to woody plant invasion, and a study of five hill prairies in Jersey County indicated that they were reduced in size by nearly 62 percent in the 37-year period from 1937 to 1974.

The primary invaders were rough-leaved dogwood and flowering dogwood. Although hill prairies are much drier compared to forests, they are readily invaded by woody plants. The presence of the shrub zone creates increased shade, competition and humidity, causing diminished vigor of herbaceous prairie species. Left unchecked, the shrub zone continues to advance upon the prairie. These studies also predicted the disappearance of unmanaged prairies within 20 years. Recent studies have also determined that the loss of hill prairie is continuing despite use of fire management and brush removal.

During the 1970s, the Illinois Natural Areas Inventory (INAI) conducted a statewide survey to locate and characterize relatively undisturbed hill prairies. Using information from the study of R. A. Evers, the INAI recognized a small hill prairie located on the bluffs of the Mississippi River in Henderson County near the Village of Oquaka. Known as Hulsebus Hill Prairie, this site was 0.4 of an acre in size, and was classified as a "Grade B" hill prairie by the field ecologists based upon a field visit on August 10, 1976. At this time, little bluestem and sideoats grama and scattered prairie wildflowers characterized the vegetation. On September 22, 1993, personnel from the Department of Natural Resources and the Illinois Nature Preserves Commission visited the site and found that it was "barely hanging on" due to woody plant invasion. Their notes indicated that a large television antenna had been discarded in the middle of the prairie. In the summer of 1997, the nature preserves preservation specialist was unable to locate any prairie vegetation and questioned the locality information given in the files. A final field survey found

the discarded antenna, thus verifying the correct locality and confirming the complete absence of prairie in 1997.

This confirms predictions made regarding unmanaged hill prairie communities and documents the continued loss of hill prairie within Illinois. This loss of biodiversity can be expected to continue because many of the remaining hill prairies are small, privately owned sites without any type of management. The landscape setting within blocks of forest make most of these small prairies very vulnerable to woody plant invasion. However, the loss of hill prairie is not unique to small sites. Revis Springs Hill Prairie in Mason County, one of the largest hill prairies in the state, also experienced a 62 percent reduction in size during the period 1938-1984.

Active management and the use of prescribed fire do not always ensure a reversal of the trend toward forest. Perhaps the prescribed fires are too infrequent or too low in intensity. Brush cutting temporarily removes shrubs, but they return quickly because of a lack of funding and personnel time to prevent resprouting using fire or herbicides.

Future management for hill prairies must consider the landscape context of these sites. Many hill prairies are small openings located on hillsides in the midst of forest. Sites like these are highly vulnerable to invasion by woody plants because they experience diminished sunlight and wind action and increased humidity and shade due to the presence of trees. Both brush clearing and prescribed burning should be implemented using procedures that will increase air movement and sunlight.

Herbicides

Many prairie remnants within Illinois are located along railroad tracks or in pioneer cemeteries in close proximity to agricultural land. Lack of knowledge regarding these plants has caused many sites to be treated with herbicides to control what are perceived to be weeds. Other areas are subject to herbicide drift when chemicals are sprayed on windy days. The wildflowers are sometimes the plants most affected by the spraying because the chemical used is selective for the control of broadleaf plants.

Continued use of herbicides destroys the prairie community and allows invasion by weed species. Once the prairie is disturbed, it is very difficult to eliminate the weeds and restore the prairie community. Many railroad prairies have disappeared entirely, due mostly to herbicide damage, since the completion of the Illinois Natural Areas Inventory in 1978. Ironically, they are often called weeds at both locations and vigilant efforts are made to eliminate them by mowing or applying herbicides.

Prairie Preservation and Management

Historic Preservation Efforts

Unlike wetlands or forest, the concept of saving vast amounts of prairie within Illinois never developed into a well-organized preservation effort in the 1800s, despite the exceptional hunting that the abundant wildlife of the prairies offered to hunters. Perhaps most individuals believed that there was so much prairie that it would never disappear. However, some individuals, even in the 1800s, recognized the loss of the prairie. Dr. G. W. Minier of Tazewell County exclaimed: "Don't these people know what they are doing? The prairies are disappearing and the trees and woods are being cut down. It won't be long before nothing is left." He would be joined by A. W. Heere of Delavan in Tazewell County, who described the uncultivated prairies near Delavan in the late 1800s and stated that some of them should be preserved. Not long after the end of the Civil War, most of the prairie was gone from Illinois, except for the sandy areas along the Mississippi, Illinois, Kankakee and Green Rivers. These remained for several more decades, allowing scientists to study their flora and fauna.

There were preservation efforts in the late 1800s that would have resulted in the preservation of considerable amounts of prairie. One site was in Lee County where a large wetland along the Green River, known as the Inlet Swamp, was the focus of a well-organized attempt to preserve a large amount of land. The Inlet Swamp, which encompassed an area estimated to be 30,000 to 50,000 acres in size, received its name from a series of limestone ledges known locally as the "Inlet." The shallow waters of the Green River flowed through a series of vast marshes, eventually reaching the Inlet and cascading over the ledges on its way to the Rock River.

Although it was called a "swamp," the area was much more than a wetland. There were variations in topography and soil types that resulted in dry, mesic, and wet sand prairies, marsh communities, ponds, and groves of oaks and hickories. The low ground was generally flooded during the spring and early summer, but it became progressively drier throughout the summer and fall. With the coming of the frosts of autumn, huge prairie fires swept across the area, causing much of the terrain to be devoid of trees.

There were no buildings, for no one lived in the Inlet Swamp. The floods of spring and the wet soils made this impossible. In addition, who would risk the danger to crops, buildings, fences, people, and animals, posed by the roaring prairie fires? Also, there were the biting insects and the mind-set that the swamp was a major cause of overwhelming despondency and frequent, very violent lightning storms.

However, a man named Valentine Hicks of Bradford, a person who had been successful in starting a hunting club in New York and a hunting preserve in North Carolina before coming to Illinois, recognized the significance of the Inlet Swamp, and began efforts to preserve it as a hunting reserve. He quickly gained the support of several Lee County inhabitants, and others in Chicago and New York. The work of preservation started, resulting in the formation and incorporation of The Rising Sun Park Association on December 24, 1887, with capital stock of \$50,000. Valentine Hicks was listed as the major shareholder. A constitution was prepared and bylaws were adopted, and offices were established at Ashton. Eight directors were elected, including Samuel Dysart, John Nelles, Samuel F. Mills, U. Grant Dysart, Valentine Hicks, William A. Hunt, and Dr. Nicholas Rowe. At a meeting on December 7, 1888, the shareholders agreed to increase the capital stock of The Rising Sun Park Association to six million dollars for the purpose of purchasing more land. These individuals claimed that the preservation of 50,000 acres of land as a hunting and fishing preserve would bring many visitors and much money to the area, but there had been several "years of agitation" with another group favoring the drainage of the swamp. In the late 1880s, a contest for supremacy began.

Ira Brewer, a prominent landowner in the area and an organizer of a local fire insurance company, led the group favoring drainage. Brewer and other individuals believed that the land should be turned to profit, regardless of pleasure, hunting, fishing or other considerations. Brewer joined with John Nelles of Viola and A. B. McFarland of Mendota to form the Inlet Swamp Drainage District in 1887, a few short months prior to the incorporation of the park association. Nelles, one of the directors of The Rising Sun Park Association, apparently changed his mind or was persuaded by Ira Brewer that the best use of the land was to drain it for farming. The loss of Nelles proved to be very detrimental to the park association, for it was his skillful diplomacy that cleared away the preliminary difficulties and obtained the good will of the landowners toward drainage.

Through the work of Nelles, the concept of draining the land gained the greatest favor, and the drainage district moved quickly to enlist financial support from the legislature. By 1901, the Inlet Swamp was gone. Some said that the advantages of a hunting preserve were never fully understood by the

landowners or the general public. It may have succeeded ten years earlier, but now the idea of drainage had too strong a hold on the people. One can only wonder about the final outcome if the influential John Nelles had campaigned for the game preserve instead of drainage. Even in the 1880s, many people believed that the idea of a hunting preserve had been advanced too late.

There was yet another site where the concept of a hunting preserve was attempted, St. Peters Marsh in Henry County. Like the Inlet Swamp, it was a large prairie wetland that was home to many thousands of ducks, geese, prairie-chickens, snipe, and other water birds. During the late 1800s, a man named Tyler Mapes lived there and depended upon the marsh for a living. Anyone wishing to hunt there had best make friends with him because he had horses, boats, stables, and living quarters to rent, and food and ammunition to buy. Tyler was a tall, strong man known for his square shoulders and long, flowing hair. Because of his appearance and profession, many regarded him as the ideal frontier scout. His prowess as a hunter and guide had earned him the title, "genius of the swamp."

The historical records indicate that Tyler was born in Henry County in 1843. He was one of the youngest of many children, including several older brothers that supplemented their farm income by hunting. The 1850 census listed his father as a farmer, and it is likely that Tyler also helped on the family farm. However, it was St. Peter's Marsh and the abundant wildlife and vegetation that held the greatest attraction to Tyler.

The importance of St. Peters Marsh as a hunting area and a refuge for plants and animals was recognized by many individuals, but none more fervently than Tyler Mapes. It is likely that he was instrumental in the formation of a park association in the 1890s, which raised a capital stock of 200,000 to be used to purchase 20,000 acres of land. Little information is now known of the association, but they had organized and they were to take possession of the land in 1901. It was not to be. In just two short years, dredges were operating to create ditches to drain the marsh and wet prairies.

With the beginning of the dredging operations, some said derisively that a "new order of things" now possessed St. Peter's Marsh. The old order was gone, and "we shall see it and Tyler Mapes no more, forever." When the vegetation, ducks, geese, mink, muskrats, duck hunters, and other water birds were gone, one man realized and remarked in a somewhat surprised voice that he had not seen Tyler Mapes for years, but when St. Peters Marsh vanished, so did Tyler Mapes. He would be remembered by the mocking words of a poem:

Farewell to you O Tyler Mapes! So changed are ancient forms and shapes, so new and strange that I declare, I half believe you've cut your hair.

Tyler Mapes would never be seen again in Henry County.

The reasons why the preservation attempt failed are not known, but the collapse of the efforts at the Inlet Swamp in nearby Lee County could have had a domino effect upon the efforts at St. Peter's Marsh. At this same time, the so-called swamplands were regarded as of little value, and they were being sold to the highest bidder by the counties with the intent of acquiring money for poor farms, schools and roads. Thus, the idea of a preserve would have been a contradiction to the policies and procedures of the federal, state, and county governments, and to the current thinking of most of the general public.

Well over 100 years ago some individuals said that it would not be difficult to save part of the prairie, even suggesting that fencing would help prevent overgrazing by livestock. The area could then be used

as a hay field, thus allowing a profitable use of the land while saving the prairie wildflowers that were such a delight to many pioneers. It might have been an easy task, but no one ever took the action to save 320, 160, 80, or even a mere 40 acres out of the 22 million that were once present in Illinois.

Even if some pioneers wanted to protect some prairie, setting 5 to 20 acres aside for preservation might have been more than most families could manage. The Government Land Office sold land in 40-acre parcels, and many families could not afford more than 40 or 80 acres, despite the seemingly low cost of \$1.25 per acre. Pioneer families, by necessity, had to be self-sufficient and literally live off of the land. Wild game graced the table, wild fruits, berries and nuts were made into jellies and pies, prairie hay was used for livestock, timber was used for building, cooking and fences, maple sap was made into sugar and syrup and the hogs ran wild. A dependable horse and a self-scouring John Deere plow meant the end of most of the prairie on these small tracts of land. Thus, the task of land preservation would have fallen upon the more affluent, large landowners that did not need all of their acreage to survive.

Friends of Our Native Landscape

There was not much prairie left when the “Friends of Our Native Landscape” began to meet shortly after the end of World War I. This group, comprised of landscape architect Jans Jensen, botanist Herman Pepoon, Natural History Survey Chief Stephen Forbes, plant ecologist Henry Cowles and southern Illinois author Clarence Bonnell, formed a committed whose objective was to locate and recommend the preservation of high quality tracts of land by a system of state parks.

To accomplish these goals, a good procedure was needed. It was Herman Pepoon who figured prominently in the development of selection criteria when he stated that all potential sites should: 1) be in a relatively undisturbed condition; 2) have diverse topographic features; 3) have abundant, high quality forest cover; 4) have natural and pure water; 5) be easily accessible; 6) have historical value; 7) be near the necessities of life; 8) have a local citizenry friendly to the concept of a state park.

Their preservation efforts did not specifically target prairie sites. There was little left to preserve by 1920, but their selections did include sites that contained prairie remnants. One of these was the forested terrain east of Havana in Mason County that is known today as Sand Ridge State Forest. There are sand prairie openings within this site that contain representative plants and animals of this part of Illinois.

Though little prairie remained, the “Friends” recommended a prairie park near Effingham in Fayette County that included former prairie land and rolling woodland that bordered the Little Wabash River. This would open the possibility of restoring 2,000 acres of prairie to maintain the plants and animals of the prairies of this part of Illinois. There is now a site, known as Prairie Ridge State Natural Area, which does contain considerable amounts of restored grasslands. It is also the last refuge of the prairie-chicken in Illinois and habitat for numerous threatened or endangered grassland birds.

There were also disappointments. The “Friends” recommended the preservation of Lima Lake, a 13,320-acre wetland complex in Adams County that included wet prairie, marsh and lake communities. Though considerable effort was made to preserve the site, the lake, marshes and wet prairies were drained and converted to farmland in the 1920s. Its loss also meant the loss of the prairie communities that surrounded the site.

The Illinois Nature Preserves Commission

Although some prairie sites had been preserved when large tracts of land were purchased for state parks, the year 1963 would arrive before systematic efforts began to protect remnants of the original vegetation of Illinois. At this time, there were those, including George B. Fell of Rockford, who believed that biological resources, like cultural resources, were an important part of our heritage. Losing these resources would be like losing important pages from a rare book. This year saw the organization of the Illinois Nature Preserves Commission whose mission is the long-term protection of relatively undisturbed, biologically diverse sites representative of the various geographic regions of Illinois. A nature preserve, according to the statutes, could be either publicly or privately owned. Such a parcel of land has legal protection to preserve its natural features that could include rare species, high quality natural communities, and geological or archeological sites.

Illinois Natural Areas Inventory

With the enactment of the federal Land and Water Conservation Fund (LAWCON) Act in the 1960s, funds were available to the states, including Illinois, for land purchases for outdoor recreation. Each state had to develop a Statewide Comprehensive Outdoor Recreation Plan (SCORP) to qualify for LAWCON funding. The Illinois SCORP identified a need for an inventory of natural areas to guide the expenditure of funds for natural areas purchases. LAWCON funds were available for such an inventory, and the Department of Conservation's Long Range Planning Division initiated the Illinois Natural Areas Inventory (INAI) in 1975.

In order to meet staffing needs, the INAI relied extensively upon recent graduates from several universities. Once these ecologists were hired, they completed an intensive three-month training period to prepare them for the field surveys. This training included aerial photography interpretation, soil and vegetation sampling techniques, natural community classification, natural community quality grading, natural community mapping, procedures for detecting disturbance and data form instruction.

These ecologists searched for: 1) relatively undisturbed terrestrial or wetland communities; 2) sites with relict species; 3) sites with threatened or endangered plants or animals; 4) outstanding geologic features; 5) nature preserves or sites used for natural science studies; 6) sites with unique natural features; and 7) outstanding aquatic sites. All of these categories were to be regarded as being of statewide significance. Information would be assembled by reviewing literature, interviewing knowledgeable individuals, reviewing maps and aerial photography, and by conducting aerial and ground surveys. Most terrestrial and wetland communities, such as forests, had to be 20 acres in size to be included. This size requirement did not apply to prairies or to communities that were normally smaller than 20 acres.

Ground surveys within prairie communities could detect disturbance not seen during the aerial surveys. Disturbance was indicated by low densities of grasses or forbs, dense stands of a single species and the absence of species that are known to decrease with disturbance, such as purple coneflower, leadplant or the prairie clovers. A "grade A" prairie had to be at least 0.25 of an acre, and a grade B prairie had to be at least 1.0 acre in size. Out of 22 million acres of prairie in 1820, the INAI ecologists had only 0.25 acre pieces left in some parts of the state.

Destruction of prairies continued unabated while the inventory was underway. Field ecologists witnessed three stands of prairie being bulldozed as they flew over them during the aerial surveys. Another three-mile stretch of prairie was plowed two weeks after it was identified. A previously

unknown 60-acre prairie in northeastern Illinois was destroyed by bulldozing on Labor Day weekend in 1976 as negotiations were underway for its preservation.

Preserving the pitifully small amounts of prairie that remain in Illinois is often a challenge. Prairie preservationists are asked to compromise to allow even more of the last few acres of prairie to be lost. Some individuals regard the prairie plants around graves in pioneer cemeteries as weeds that are an unfitting tribute to the pioneers buried there. Somehow, the perceptions of prairies have changed from beautiful wildflowers to unwanted weeds, much to the detriment of the prairies.

Use of the NAI

Since the Illinois Nature Preserves system was developed in 1963, individuals, forest preserves, park districts, conservation districts, townships, cemetery boards, educational institutions, the Illinois Department of Natural Resources and cities have dedicated parcels of land. By the time the 1960s were coming to a close, some of the best-known natural areas were already dedicated as nature preserves. Although the number of nature preserves continued to increase, there was lingering doubt that not all of the state's natural areas were known.

Knowing the location of all natural areas was critical of one of the goals of the Illinois Nature Preserves Commission: the preservation of representative communities in each of the natural divisions and section of Illinois. Knowing the locations of these sites would also identify areas where preservation activities were needed. Land acquisition money was also scarce, so each dollar had to be put to its best use.

The INAI gave land preservation a focus in Illinois. Illinois Nature Preserves Commission could now utilize this statewide inventory to select sites for preservation. It was not a random process. One of the goals was to select the best example of each prairie type within each natural division. That was the only way to ensure the preservation of the prairie heritage in Illinois.

Efforts to preserve the last remnants of our natural history have been diligent. The INAI enabled Illinois to become the first state in the nation to have a comprehensive natural heritage preservation program. The INAI has guided the preservation of natural areas for over 25 years. At the time of the survey, there were 69 nature preserves. This number had increased to 171 by 1988, and 289 by the end of 1999. In addition, there were 39 registered land and water reserves, a new type of preservation method used by the Illinois Nature Preserves Commission.

Preservation Methods

One type of preservation tool available for owners of prairie sites included on the Natural Areas Inventory is the Natural Heritage Landmark Program. Under this program, the landowner agrees to protect and preserve the significant natural resources on their land. No restrictions are placed on the land and the owner also agrees to notify the Department of Natural Resources if they are considering a sale of the property or if there will be a change in the use of the site. The landowner or the Department of Natural Resources may cancel this program by giving 30 days written notice to the other party.

Another method of preserving land is the Land and Water Reserve Program. This type of preservation offers legal protection for the site while permitting traditional land uses such as hunting or fishing. This type of protection is available to areas that are on the Illinois Natural Areas Inventory or to sites that have threatened or endangered species. Compared to the nature preserves program, it is a relatively new method of protecting land. These sites are used for education and scientific research following approval by the owner.

Illinois Nature Preserves Program

The Illinois Nature Preserves program began in 1963 based on legislation written by George B. Fell and signed into law by Governor Otto Kerner. This preservation program offers permanent legal protection for sites, but it is more restrictive in what uses can be made of the land. Hunting and fishing are not permitted, and plants or animals cannot be removed from the site. Nature preserves are used for education, nature study and scientific research. Special use permits are required for research conducted on these sites.

Management

There was once the belief that no maintenance is required for prairie sites once they have been purchased. It was believed that the tough prairie sod in combination with the hot, dry winds of summer would prevent invasion of trees, various shrubs or invasive exotic plants. Studies completed within the last 45 years clearly demonstrate that trees, shrubs and aggressive exotic plants readily invade prairies. In fact, some prairies up to an acre in size have been permanently converted to forest in less than 20 years. Other larger sites have lost more than 60 percent of their prairie to invading trees and shrubs in the last 50 years.

In order to maintain prairies, including all plants and animals, managers must use a combination of prescribed burning and the wise application of herbicides. Sometimes the selective removal of woody plants is required. These management options will maintain and often enlarge the size of prairie remnants. However, selecting the optimum time to conduct a prescribed burn or to apply herbicides to a specific invasive plant is critical. A prescribed burn on a date when plants and animals are vulnerable could severely impact their populations or totally eliminate a rare butterfly species that is sensitive to fire. Prescribed burns must also be effective in killing invasive woody vegetation. A prescribed burn conducted on a day when the vegetation is too wet or when the ambient air temperature is too low may not achieve the desired results.

Prescribed Burning

Most of the prescribed burns conducted on prairie remnants are scheduled for the late winter or early spring, usually from late February through the middle of April. Due to its geographic location, the first prescribed burns of the season are completed in extreme southern Illinois and move northward as weather permits. This season has been the traditional time for prescribed burns because it allows valuable wildlife cover to remain throughout the winter months. This is also a time when much animal and plant life is dormant, thus minimizing adverse impacts upon these organisms.

Some prescribed burning is completed during the fall of the year during October and early November, especially in forested communities that contain a high percentage of oak species. Fall burns have also been completed on numerous prairie sites throughout the state. Although fire does remove much of the vegetative cover on prairie sites, it does not burn individual grass clumps as thoroughly as a spring fire because frosts have only recently killed the vegetation and they are still partially green and moist at the base. Certain insect species that are sensitive to fire have a greater chance of surviving these fall burns.

Most managers usually do not burn all prairie present on a site during a single growing season. This policy allows animals, especially insects, to recolonize the burned area before the other portion is burned. The interval between prescribed burns is generally two to three years. It is considered to be bad management to burn all of a site every year for many years in succession. This burning could negatively impact insect populations at the site. Generally, areas within a prairie that do not burn during a

prescribed fire are allowed to remain, forming a mosaic of burned and unburned prairie. This management is thought to be similar to fires during historic times when unburned areas served as refugia for animals throughout the winter months.

Prescribed burns during the spring also seem to favor the big grasses, Indian grass and big bluestem. Their biomass increases, causing the wildflowers or forbs to be diminished in size due to competition. Some managers advocate a prescribed burn during the summer months, when possible, to reduce the vigor of the big grasses. This procedure has been used with success on a number of sites throughout the Midwest, resulting in a greater diversity and abundance of wildflowers.

Prescribed fire can also be used to control invasive exotic species, especially those that are cool season plants like sweet clover or Kentucky blue grass. Managers wait until the sweet clover or Kentucky blue grass has grown to a height of three to four inches before conducting the prescribed burn. The hot flames kill the succulent plants, greatly reducing their abundance in the prairie community.

If the objective of a prescribed burn is to kill the invading woody plants, a day must be selected with weather conditions that will produce a fire that will burn through the woody growth with hot flames. These flames will burn through the site with sufficient heat to kill the cambium of the shrubs and young trees. A fire on a day when the vegetation within the area of woody growth is wet will not achieve the desired results.

Herbicide Use

The careful application of herbicides is a valuable option available to managers of prairie preserves. Because of the sensitivity of prairie plants, herbicides are selected that do not persist in the soil or water. In general, these herbicides are also applied at a time of the year when negative impacts to prairie species are minimal.

When a woody invasive exotic species, such as black locust or buckthorn, is the target species, work is done during the winter months when prairie plants are not actively growing. The trees are cut and herbicide is applied to the cut surface within a few minutes after the cut has been made. By applying it to the cut surface, the effects of the herbicide are restricted to the individual tree that has been treated. The herbicide is applied to the outer part of the trunk near the bark to kill the cambium which is the plant tissue that produces new growth.

Spot treatment procedures are also used with herbaceous species such as sweet clover or teasel. Sweet clover is a cool season plant that begins growth while the prairie species are still dormant. Prescribed fire often stimulates the germination of sweet clover seeds, resulting in a profusion of seedlings during March or early April. It is sometimes possible to spray these seedlings and eliminate them before the prairie plants begin growth. Repeating this process over a period of several years will greatly reduce the amount of sweet clover seed in the soil.

Monitoring

One of the key components of management is assessing the effects of prescribed fire or the removal of invasive exotics upon the prairie community. Sometimes the monitoring consists of counting the number of individuals, like butterflies or birds. If done over a period of several years, it will be possible to determine trends in their populations. The same procedure is used with threatened or endangered plant species. When conducting a census of rare plants, it is helpful to count flowering and non-flowering or young plants. An analysis of the data will indicate how management is proceeding.

Monitoring of prairie communities is done differently. Quantitative data is required, so randomly located transects are placed within the study area. These transects could vary in length from 25 to 100 meters (approximately 100 yards). Along each transect, one-meter square plots are located at one-meter intervals, odd-numbered plots to the right even-numbered to the left. A random numbers table is used to determine the number of meters (0 to 9) a plot is located right or left of the transect line. The amount of area occupied by each species within the plot is visually estimated. The locations of transects are recorded and the same plots are analyzed every three or four years. An analysis of the data will indicate how well the community is responding to management.

Prairie Restoration

Prairie restoration begins with site selection and the determination of the size of the project. Ideally, a level to gently rolling area, which was once prairie, should be selected. For assistance in determining if prairie soil is present at a site, consult the original Government Land Office Survey Records, which are available in county courthouses, universities and the Illinois State Archives Building in Springfield. These surveys will delineate the boundaries of prairie and timber about the time of settlement in the 1820s and 1830s.

Once the site for the prairie has been selected, the size of the restoration needs to be determined. A site that is one acre or less is large enough to represent prairie flora, but larger sites are more desirable if you want to create several prairie types and more wildlife habitat. Keep in mind that larger restorations will require considerable manpower during the site preparation, planting, and initial maintenance. If you do not have the time, money, manpower, or machinery to establish and maintain a large tract, it would be best to establish a smaller, more manageable plot.

Seed Selection

Once you have selected a site and determined the acreage to be planted, you will need to acquire sufficient quantities of seed for your restoration. Several Illinois commercial nurseries specialize in the production of prairie plant seeds. Some individuals believe that it is best to purchase or collect seed from a site that is within 100 miles of the restoration site in order to preserve the genetic integrity of local plant populations. When buying seed, avoid distant sources or “improved” or “selected” strains of prairie grasses and forbs. These strains are often very aggressive, a trait that enables them to crowd out desirable plants.

Although some prairie grasses may be purchased commercially at a reasonable cost, many grass and forb seeds are expensive. For this reason, you may want to supplement your commercially grown seeds with those that can be collected locally from degraded prairie remnants. If you wish to collect seeds on private property, you should obtain permission before you do any collecting. Also, please remember that it is illegal to collect seeds or other plant materials on Department of Natural Resource properties or in any Illinois Nature Preserve.

If your objective is to duplicate the original prairie of Illinois, select seeds of those plants that formerly grew in your part of the state. Illinois has a large variety of prairie types, which have certain characteristic plants. Plants of the northern prairies, such as prairie smoke or pasque flower, have no place in your restoration in southern Illinois. Likewise, the plants of the southern prairies do not belong in prairie restorations in the north. A good guide to follow is the natural divisions concept described earlier, and search for seeds with the natural division where your prairie establishment site is located.

For information on the prairie plants that are native to your county, consult *Prairie Plants of Illinois* by the Illinois Department of Natural Resources, *Plants of the Chicago Region*, *Distribution of Illinois*

Vascular Plants by Mohlenbrock and Ladd, *Vascular Flora of Illinois* by R. H. Mohlenbrock or *Plant Species Composition of Wisconsin Prairies* by R. Henderson.

Never dig any prairie plants from any remnant prairie unless it is about to be destroyed. Most prairie plants can be propagated easily from seed. Leave the plants where they are growing so others can enjoy them in the prairie. Prairies continue to be lost in Illinois due to development, road construction, herbicides, woody invasion and neglect. Taking plants from these prairie remnants makes these sites less diverse and forever diminishes the experience of visitors.

Seed Storage

Some seeds, such as grasses, lose viability if they are stored dry for a period in excess of one year, but other seeds require exposure to cold temperatures, a process called stratification, before they can germinate. For most prairie plants it is best to dampen the seeds slightly, place them in plastic bags and put them in cold storage at a temperature of about 34 degrees F immediately after collection where they should remain until planting time. Moist stratification generally results in a higher germination rate for most prairie species.

While in storage, be alert for growth of fungi, which could damage seeds. Other seeds, such as pale purple coneflower, can be stored in a dry condition, but better germination is usually achieved through moist stratification.

Seedbed Preparation

Preparation of the seed is one of the most important steps in prairie restoration. Proper preparation will reduce weeds, facilitate planting, and provide a suitable bed for seed germination. A good seedbed will increase the success of a prairie planting while a poor seedbed will promote failure.

If you are planning a spring planting, begin seedbed preparation in the fall prior to planting the following spring. Small parcels can be prepared with a garden tiller, but larger tracts, one-quarter of an acre or larger, will require the use of large farming implements. Preparation of the site in the fall will damage the root systems of perennial weeds and expose them to freezing temperatures and the dehydrating action of winter winds. In the following spring, the ground should be worked at a shallow depth at least twice to break up clods and eliminate annual weeds.

Large planting can utilize a disc to cultivate the soil. Final ground preparation immediately prior to planting can be done with a cultipacker, a disc-like farm implement that cultivates only the upper few inches of soil. Once again, a garden tiller can be used on the smaller parcels. Be sure to cultivate only the upper few inches of soil. Deep cultivation exposes more weed seed, eliminates the firm underbase necessary for prairie establishment and may cause the prairie plant seeds to be planted several inches deep, making it impossible for seedlings to reach the surface.

If the site has a dense sod of fescue, bluegrass or orchard grass, or some other cool season perennial grass, you should consider the application of short-lived, non-selective herbicide such as Roundup (glyphosate). A two percent solution of this herbicide is sufficient to kill most grasses and broad-leaved plants. The application of this herbicide should be made when the weeds or grasses are growing rapidly to be most effective, but good results can be obtained as long as the plants are actively growing. If this is not done, portions of the plants remaining above ground will re-establish themselves and create weed problems in the future. As with all herbicides, be sure to read the label carefully.

If you do decide to use an herbicide, use a non-persistent type and allow several days to elapse before final soil preparation. A persistent herbicide could damage the prairie plants. By allowing several days to elapse after the application of the herbicide, you are assured of little or no herbicide carry-over.

Conservation Tillage or No Till Planting

The use of no till drills in prairie establishment is increasing because of the time, reduced erosion and cost savings of this method. With the no-till procedure it is possible to plant directly into an agricultural field or a site with a dense sod without the plowing, discing, and other site preparation of traditional planting methods. One of the big advantages of no till planting is that it does not disturb the soil very much, ensuring the firm underbase necessary for successful plantings. Prairie plant seed must be planted within one-half inch of the soil surface. If the seeds are planted deeper, the planting runs the risk of failure because the developing seedlings are not vigorous enough to grow through several inches of soil.

If the planting is going into an agricultural field, first make sure that the soil is free from herbicide carry-over that may be harmful to germinating prairie plants, especially wildflowers. If the field has high, standing corn stubble, shred the stalks so they will not interfere with the coulters or planting devices of the prairie seed drill. Soybean stubble generally does not present a problem for no till planting.

One of the first tasks is weed control. If the planting site is an abandoned agricultural field, allow the vegetation to grow to a height of about six inches and then spray it with a non-selective. A two percent solution will be sufficient to kill most herbaceous weeds, including agricultural weeds. If weeds become a problem after the planting, they can be mowed at a height of six to eight inches to reduce the competition with the developing prairie plants. If only parts of the field have concentrations of weeds, mow these areas and leave the rest of the field undisturbed.

Planting Dates

Like with home gardening or large-scale agriculture, planting dates for prairie seeds are relative. The scheduled planting date should allow for shallow tilling or discing of the plot to eliminate weeds once the soil warms up in the spring. The ideal spring planting date on a statewide basis includes a two-month period from April 15 to June 15, with the earliest planting being made in the southern part of the state. Plantings made after the middle of June run the risk of encountering hot, dry weather, which will reduce seed germination and seedling survival.

It is also possible to plant during late September, October or November, thus allowing the seeds to stratify naturally in the soil. If you decide to plant in the fall, be sure to plant late enough so the seed germinate the following spring. The freezing temperatures of winter could kill the young seedlings if planted too early.

Seeding Rates

Seeding rates per acre may vary according to your objectives for the planting. If you want a pure stand of grass, a seeding rate of six to eight pounds per acre should be sufficient for this purpose. If you desire a mixed stand with numerous prairie wildflowers, reduce the amount of grass seed to two to four pounds per acre, especially the larger grasses such as Indian grass and big bluestem. Increase the amount of wildflower seed until the mixture is about 60 percent grass and forty percent wildflowers by weight. In addition to reducing seed of the big grasses, also reduce the amount of seed of downy sunflower, false sunflower, drooping yellow coneflower and New England aster. These plants are very prolific seed producers, and they will crowd out desirable prairie plants.

By using a seed drill specially made for light fluffy seeds such as those of most prairie plants, it is possible to reduce the amount of seed required to complete the planting. Several commercial drills are manufactured specifically for this purpose, and most of these have no till features.

It is also possible to further reduce the volume of grass seed by utilizing a process known as “debearding.” In this procedure, the seed of big bluestem, Indian grass or little bluestem is processed in a machine that removes the awns or “beards.” The removal of the awn permits the seed to pass through seeding devices more easily.

When planted together, the total weight of the grass seed should not exceed more than six pounds. This is a recommendation. The ratio of grass to forb seed will often be a matter of personal preference, seed availability, and cost. Some individuals prefer a planting where forbs are predominant and conspicuous. Wildflowers have a great aesthetic appeal throughout the growing season.

Planting Methods

The seed of prairie plants may be planted by a variety of methods, including specially made drills, rotary spreaders or hydraulic mulchers. Hand broadcasting can be utilized on sites less than an acre in size. The important element here is the even dispersal of the seed over the area. Any large scale planting which does not drill the seed into the ground will require the use of a harrow and roller to “set” the seed. This can be accomplished on small plantings by using a rake and a roller attached to a garden tractor. If the conditions are suitable, and the seed viable, it should germinate within two or three weeks.

The use of no till prairie seed drills has increased dramatically in recent years. These drills are made by a number of different manufacturers, and all of them will provide the no till planting that is desired. Using no till planters reduces costs, saves time and prevents disruption of the soil that could be experienced with the traditional methods of planting. Sites that are to be planted with this method must be free of large, high standing vegetation that will clog the planters on the drill and reduce the overall effectiveness of the planting effort.

If you plan to use a rotary spreader or drill to plant your prairie seed, make sure that the seed is dry and relatively free of large (three inches or longer) pieces of leaves or stems. If the seed is wet or full of debris, the spreader or drill will not operate properly. Drying and cleaning can be accomplished by placing the seed on a concrete floor. Spread the seed out so it forms a layer about two inches thick. Turn the seed with a rake frequently to aid the drying process. Stems, sticks, and other debris can be removed at this time. If conditions are satisfactory, the seed should be dry with one or two days or less, depending on quantity and drying conditions.

During the first year of the restoration, do not expect to see much growth from the prairie plants. It is during the first year of growth that most prairie plants establish their root systems. Have patience. After two or three years, if survival is good, the prairie plants will be well established. Both Betz and Schramm, two pioneers in prairie restoration, describe the importance of establishing the prairie matrix, a group of easily established prairie plants that represent the initial stage of succession that eventually leads to the development of a planting much like a native prairie remnant. Schramm describes four stages: 1) Initial Downgrow Weedy Stage characterized by prairie annuals; 2) Intense Competitive Stand Establishment Stage in which yellow coneflower or false sunflower are prominent; 3) Closeout Stage in which rattlesnake master, compass plant and prairie dock are prominent; and 4) a Long-term Adjustment Stage in which the conservative species such as lead plant and prairie dropseed begin to flower. Betz describes the introduction of second, third and last stage plants. In his last stage, conservative plants like prairie

gentian, prairie lily, and Mead's milkweed, will be introduced. These conservative prairie plants can be seeded into less diverse areas of the planting by hand sowing or by a prairie seed drill as the planting matures.

The Curtis Prairie at the University of Wisconsin was planted between 1936 and 1941 using the single species concept. In this method, seeds or plants of a single species were placed into plots with the belief that the plants would mature and spread with time. Now, sixty years after the initial planting, certain species such as big bluestem, Indian grass, rattlesnake master, Canada goldenrod, rosinweed, and white false indigo have spread through the plantings. Established prairies, like remnant prairies, are going to be dynamic communities that will change with time.

Transplanting Techniques

The seeds of many prairie grasses and forbs may be planted, following stratification, in flats or peat pots for eventual transplantation in the prairie restoration. Flats filled with a 50/50 mixture of sand and commercial potting mix can be used to start plants. Finely ground sphagnum moss can be dusted on the surface of the planted seedbed to reduce the incidence of damping off fungi. Initial watering of the seedbed should be accomplished by a mist nozzle, which will prevent disruption of the young seedlings. Once the plants have attained enough growth, individual plants may be transplanted into small (2 ½ inch-diameter) peat pots.

The seedlings should be planted in peat pots in the fall so they are ready for transplanting into the prairie restoration site in May or early June of the following year. The roots of the plants should be well developed and the shoot (above ground portion of the plant) should have four or five leaves. When planting, make a small hole in the soil large enough to accommodate the biodegradable peat pot. Be sure to place the pot low enough in the hole so that soil can be firmed around the plant to prevent water loss from the sandy potting mixture.

In addition to the transplanting of seedlings, it is also possible to transplant mature one or two-year old plants, which have been grown in a nursery. The plants can be lifted from the soil by using a shovel or spade. The bare root plants can be packed in sphagnum or wrapped to prevent moisture loss from the roots if planting will be delayed. If you decide to use mature plants to increase diversity in your planting, the following suggestions may be helpful.

1. It is much easier to plant in existing stands after a prescribed burn. You will not have to contend with the dense thatch of grasses and forbs.
2. Select the highest points on the site that are generally free of standing water throughout the year. Place plants that require a dry habitat here. Place others according to their moisture requirements. Be aware that standing water will cause the roots of most prairie plants to rot.
3. Also, select areas that are open and mostly free of the large grasses, big bluestem and Indian grass. Otherwise, these grasses will crowd out the prairie wildflowers. It is possible to create openings in existing stands of grass by using Roundup to kill grasses or other undesirable vegetation. This should be accomplished the year before planting.
4. Make sure the plants are placed deep enough so the buds are covered with one inch of soil. Exposed buds or crowns will be killed by winter temperatures or dehydrated by the summer sun.
5. Make sure the hole is completely closed around the plant to prevent dehydration of the root system.
6. Some prairie plants initiate growth in early spring (March or April), so it is best to plant in the spring so the plants will be established before the hot, dry temperatures of summer arrive.

Planting can be accomplished by using a shovel, spade, or, if one is available, a tree planting bar. For most plants, it is not necessary to dig a hole. Simply push the blade of your planting tool into the ground to a depth that will accommodate the longest roots of the plant. Alternately push and pull the shovel or spade to widen the cut so the roots will fit into the hole. Insert the plant deep enough so that the buds are one inch below the soil level. In the case of some plants, such as the coneflowers, compass plant, or prairie dock, several individuals may be planted in a single hole. Close the hole by pressing firmly with your foot.

Like other propagation methods, the survival rates vary from one species of prairie plant to another. Excessive moisture and competition from other plants will reduce the success of the planting. Blazing star and rattlesnake master transplant easily and have high survival rates. The use of transplants is very labor intensive, however, their use does have application on small restorations or the enrichment of larger ones.

Based on several years of observation, it is known that small mammals locate and eat the corms and roots of blazing stars, prairie clovers and sometimes compass plants and prairie dock. If you plant these in an area having a high density of small mammals, you can expect to lose several of these plants. Fall burning may help with this problem by eliminating cover, as depredation seems to be greatest in the winter months.

Weed Control

1. Late Planting - In southern Illinois, the ideal time to plant prairie seeds is from April 15 to May 15 while May 15 to June 15 are more ideal for northern Illinois. Shallow cultivation up to planting time will help to eliminate weeds; deep cultivation will expose more weed seed. While this method will help to eliminate weeds, late plantings run the risk of encountering hot, dry weather, which will threaten the success of the entire planting effort.
2. Mowing - If dense weeds such as giant foxtail develop, mow the plot at a height of 8 to 12 inches with a rotary mower when the weeds reach a height of two to three feet. In the case of sweet clover, mow while the plants are flowering. It is important to use a rotary mower because of its shredding action. The vegetation cut by a sickle type mowers could smother the seedlings of the prairie plants. Mow only those parts of the planting that have a weed problem.
3. Herbicides - The use of a selective herbicide for broadleaf plants can have application when there are scattered, dense stands of particularly troublesome weeds such as sweet clover. Care should be taken to avoid spraying desirable prairie plants. In the case of sweet clover, it can be sprayed early (March or April) before the prairie plants break dormancy. Sweet clover begins its growth early and will be one of the few green plants on the restoration site.
4. Fire - Prescribed burning helps to eliminate the alien cool season grasses and weeds. For this reason, a prescribed burn should be planned for March or April of the year following the planting of the prairie seed. Burning in the spring allows the prairie vegetation to remain throughout the winter providing excellent cover for wildlife during this critical period.

In the case of alien, cool season grasses such as bluegrass, late burns (early April) are more beneficial than burns conducted in February or early March. The same applies to sweet clover: early fires seem to stimulate the germination of seeds of this troublesome plant. Burns conducted at the time of "bud break" may also prove to be helpful in reducing invasion of rough-leaved dogwood and other shrubs.