



How Natural is Nature?

The Effect of Burning on Presettlement Vegetation in West-Central Illinois

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The presettlement vegetation (c. 1820) of west-central Illinois in the Lower Illinois River Valley (LIRV) shows the influence of frequent burning (Kilburn et al. 2009). The region is included within a larger vegetation formation called “the Prairie Peninsula” (Gleason 1922). Ecologists have argued for a long time over the causes of the fires that seemed to dominate this region in presettlement times. Transeau (1935) believed that the Prairie Peninsula had a distinctively drier climate than regions to the north, south, and east. By contrast, Weaver and Clements (1938) believed that the Prairie Peninsula had a “forest climate” and that the prairies would revert to forest without the frequent Native American use of fire. Another factor to consider, though, is early U.S. government land surveys and the degree to which pre-Columbian landscapes were shaped by Native American burning.

Recognition of the impacts of such burning on Illinois vegetation might change our concept of the pre-Columbian landscape as pristine and free of human alterations. In fact, even before the arrival of Euroamerican settlers, the Prairie Peninsula may have been already a heavily modified cultural landscape.

The LIRV extends north from the mouth of the Illinois River where it joins the Mississippi. French settlement started along the Illinois River

when Rene-Robert Cavelier, Sieur de LaSalle, established Fort Creve Coeur at Lake Peoria near the Native American settlement at Starved Rock in 1679. Early French fur trappers frequently travelled the river, although significant settlement did not occur until the late 1700s. Illinois became a state in 1818, largely due to settlement in the St. Louis region (Howard 1972).

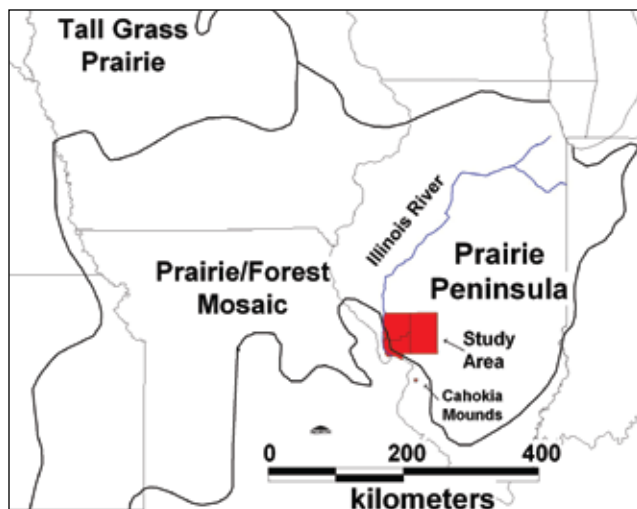
The LIRV was a productive habitat for Native Americans, providing abundant fresh water from the numerous streams flowing into the river and a reliable meat supply from large and small game animals, waterfowl, fish, and mollusks. The LIRV also provided first-rate cultivable bottomland on the river and stream floodplains for staple crops of maize, beans, squash, pumpkins, sunflowers, and amaranth (Warren 2000). There were abundant nut and acorn trees and understory shrubs, as well as supplemental food from other wild plants (Atwell 2000). The hydrology of the river was much different prior to modern modification, and floods occurred predictably every year in spring (Sparks et al. 1998). However, lands suitable for habitation on these floodplains were well above average river levels and rarely flooded. All these factors encouraged the location of numerous villages along the rivers and streams (Brown and Vierra 1983, Brown 1985, Buikstra 1988).

Native Americans in the Lower Illinois River Valley

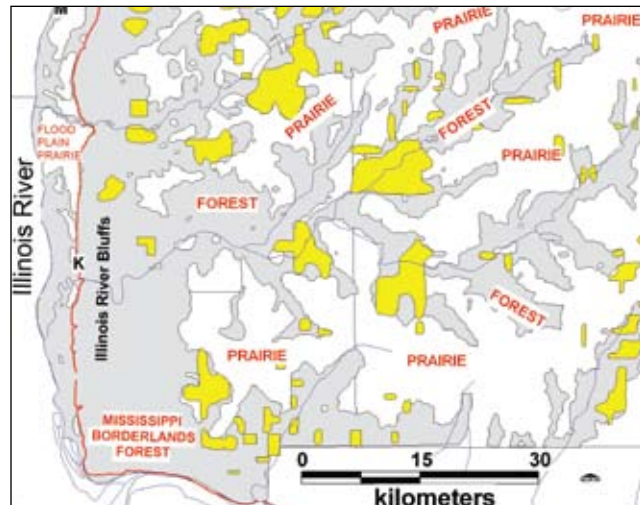
The Native Americans living in LIRV prior to the arrival of Euroamericans had reached the zenith of their Stone Age technology. They developed a lifestyle that fit well with their environment and maximized their use of natural resources without overusing them, as many earlier Native American groups had done (Lopinot and Woods 1993, Diamond 2005). They were sound agriculturalists and used lands near their villages to grow corn, beans, and squash to supply much of their food needs. They also were highly skilled hunters who could provide not only meat, but also skins and furs for clothing and other needs. They were adept at trapping and catching fish and capable of using other aquatic resources for supplemental food. These early inhabitants constructed efficient longhouses with connected rooms to provide warmth and shelter during inclement weather (Warren 2000). They also developed a wide variety of flint tools for cutting, scraping, drilling, chopping, hoeing, and grinding (Yerkes 1987). Their river location allowed ready access for trade in all directions. Their artistry allowed production of attractive yet serviceable pottery, dress, and decoration.

There is extensive archeological evidence of large populations of Native Americans in Southwestern Illinois. South of the LIRV lies the American Bottom, a broad portion of the Mississippi floodplain. The American Bottom was the location of Cahokia, a major Native American city that grew rapidly from 1050 CE, reaching

location of the study area (in red) and the Prairie Peninsula. The Cahokia site is indicated by a red square. (Photo: Modified from Wright 1968)



Photos opposite page, top left: Big Bluestem prairie in late summer where grass is often over eight feet tall. Top right: The first Euroamericans may have walked through tallgrass prairies like this in the fall. Bottom: Forbs dominate this part of a tallgrass prairie. Purple coneflower, yellow sunflower, and purple blazing star show their majestic beauty.



Detailed map of the study area showing forest (light gray) and barrens (yellow) as mapped by the GLO survey 1818-1820. The bluffs bordering the Illinois and Mississippi rivers are indicated by a red line. East and north of the bluffs, in the rough topography, is the Mississippi Borderlands Forest. Upland prairie, barrens, and forest form a vegetation mosaic going to the east. Atop the bluffs were perched extensive hill prairies which are now being overgrown by shrubs and trees. The Mound House (M) and Koster (K) archeological sites are indicated by letters.

a population of up to 40,000 people (Milner 1986), before it collapsed about 300 years later. The culture of the Cahokians has been traced throughout the Midwest by the spread of distinctive artifacts (Pauketat 2009).

Because of its large number of Native American archeological sites, the Illinois River has been deemed the “Nile of North America.” More than fifty years of intensive research, principally by scholars associated with the Center for American Archeology in Kampsville, Illinois, has documented over 10,000 years of human occupation and more than 3,000 sites in the lower reaches of the Illinois Valley alone (Brown and Vierra 1983, Brown 1985, Buikstra 1988). Two especially important archeological sites in our study area are the Koster Site and the Mound House Site.

Fire and Native Americans

A feature of Native American culture that was most influential in controlling vegetation was fire. Humans have occupied the LIRV since the retreat of the last glaciers 10,000 years ago (Brown 1985, Brown and Vierra 1983,



View of the Illinois River floodplain near the Koster Archeological Site. Formerly heavily forested, it is now cleared and the site of extensive agricultural land. The Illinois River is out of sight in rear of photo about four miles distant. (Photo: R. Brugam, SIU)

Hajic 1990). There is evidence that ancestors of Native Americans, the Clovis people, were in the St. Louis area as early as 10,000 years ago (Graham et al. 1981). It is likely that they also lived in the LIRV. Fire frequency increased as the Holocene progressed, and despite the cooling effect of the little ice age (c. 1450 CE to 1850 CE Brugam and Swain 2000), human-initiated fires actually increased during this period (Abrams and Nowacki 2008).

An extensive body of literature exists on Native American use of fire and its widespread effect on the vegetation of the Midwest (Gleason 1913, Day 1953, Pyne 1992, Stewart 2002, Williams 2003, Anderson 2006). The

Mound showing Woodlands period Native American burial site at the edge of the flood plain at the base of the bluffs. (Photo: R. Brugam)



reasons for burning were varied, and Williams (2003) lists eleven major purposes: hunting, crop management, improvement of growth and yields, fireproofing of specific areas, insect collection, pest management, warfare and signaling, economic extortion, clearing of areas for travel, felling of trees, and clearing of riparian areas. Several of these purposes were the chief causes of frequent burning later described in the study area.

Other investigators (King and Johnson 1977) showed that the prairie-forest border closely followed topography, with prairie on flat upland areas and forest on hilly sites and stream valleys. Many investigators have correlated these topographically controlled vegetation boundaries to variations in fire frequency. Flat areas dry equally and can carry fire for long distances. In contrast, hilly regions form effective firebreaks (Grimm 1984, Brugam and Patterson 1996).

Grasslands, found on the nearly level upland plateau portions, reflect frequent fire occurrence that maintained these prairies for many years (Wright 1968, Anderson 2006, Nelson et al. 2006, Zawicki and Hausfater 1969). In addition, these prairie fires burned into adjacent forests, reducing parts of these forests to nearly treeless barrens later recorded by surveyors (Kilburn et al. 2009). These fires often became ground fires in woodlands that formed fire scars on larger trees and killed new seedlings but allowed hazel and other woodland shrubs to survive in a more open forest. In addition, hill-prairies throughout the

A fall fire in the prairie is an awesome sight. Such fires do not hurt grass roots but kill invading woody plants.



Midwest located on the bluff tops overlooking rivers were undoubtedly kept free of woody plants by frequent burning (Robertson et al. 1995).

Could these fires have been started by lightning instead of humans? The frequency of lightning-caused fire is minor in the humid East (Curtis 1959, Anderson 2006, McClain and Elzinga 1994). Although common in the drier West, lightning strikes in Illinois are usually accompanied by rain that would quickly extinguish any lightning fires. It is likely that nearly all of these early fires were started by Native Americans.

Vegetation at the Time of Euroamerican Settlement

Our study area is Jersey, Greene, and Macoupin counties along the LIRV. Jerseyville, the county seat of Jersey County, has an average annual rainfall of 98 centimeters (Natural Resource Conservation Service 2002), more than double the amount needed to support forest at these latitudes (Bourne 1820). Furthermore, the soils are deep on the uplands; today, abandoned fields are rapidly invaded by trees and shrubs, much as they are in other locations where Native American burning is suspected as a factor in shaping landscapes (Peter and Shebitz 2006). Prior to European settlement, large portions of these counties located away from the rivers had frequent fires and consisted of treeless prairies of considerable biodiversity (Sampson 1921). Forests were restricted to ravines and other areas of rough topography or in the bottomlands where they covered all but swamps and sloughs that were frequently flooded.

The western edge of the study area is located along the Illinois River Floodplain. Common trees are pin oak, cottonwood, hackberry, and overcup oak (Kilburn et al. 2009). These trees are very intolerant of fire but resistant to flooding. Open and lower parts of the floodplain flooded frequently and were mapped as prairie by the surveyors. Small areas of open lands in the higher parts of the flood plain may have been kept open by Native American cultivation and burning.

The river bluffs separate the floodplain from heavily wooded areas for five to ten kilometers to the north and east on the rough topography. Dominant species in this forest were white oak, black oak, and various hickory species (Kilburn et al. 2009). This area is called the Mississippi Borderlands Forest because it is contiguous to forests on the east side of the Mississippi (Schwegman 1974). In the deeper ravines and moister lower parts of valleys, elm, ash, black walnut, and sugar maple became co-dominant with the oak-hickory forest dominating the uplands (Kilburn et al. 2009).

Farther east, post oak and black jack oak became common members of the oak-hickory forest (Kilburn et al. 2009). In this region, the forested ravines are separated by broad upland areas of nearly level prairie grassland (Sampson 1921). Prairie grasslands dominate the uplands. Today, these upland prairies have been converted to agricultural fields.

The government land surveyors also noted a specialized vegetation type that they called “barrens.” These were dominated by small oak and hickory “grubs”—small trees formed by frequent burning of crowns but with root systems that remained intact. The surveyors interpreted these shrubby trees as long-term survivors of periodic fires (Kilburn et al. 2009).

The Prairie Peninsula

The central part of Illinois and Indiana is part of a unique vegetation formation called the “Prairie Peninsula” that consisted of a mosaic of forest and prairie. Since Gleason’s time (1922) there has been controversy among ecologists over the joint roles of climate- and human-caused fires in determining the boundaries of the Prairie Peninsula.

Later investigators have demonstrated that the climate of the Prairie Peninsula is indeed unique (Bryson 1966, Wright 1968). This location receives little precipitation from the winter storms that follow the moist tropical air associated with the Gulf of Mexico. It is also missed by heavy snowstorms following the Alberta storm track that passes over northeastern Illinois. Thus, by spring, Prairie Peninsula soils have lower moisture content than areas to the north, south, and east. The Prairie Peninsula was also more susceptible to summer drought than other areas in eastern North America (Wright 1968).

Hill prairies at Pere Marquette State Park in deep loess soils above the limestone bluffs. Behind the hill prairies, oak-hickory forest covers the rugged topography. The upper left corner of photo shows some of the Illinois River floodplain, which today is mostly agricultural.

(Photo: P. Kilburn, 1965)



The contrasting views that the origin of the Prairie Peninsula was anthropogenically formed or that it was a climate-induced phenomenon are not mutually exclusive. The human presence probably increased the likelihood of fire ignition beyond natural lightning (Abrams and Nowacki 2008) in a climate that was already dry enough to support fires.

Was Prehistoric Illinois a Pristine Wilderness?

It is clear that North America was not a pristine wilderness at the time of European contact, but was a human-managed landscape (Denevan 1992, Botkin 2004). In Illinois, Native American populations took advantage of the specialized Prairie Peninsula climate to create a fire-managed landscape that supported their lifestyles. The result was an increased fire frequency beyond what would be expected from natural fire sources.

This suggests that the native peoples who lived, farmed, and hunted in west-central Illinois had a significant impact on the vegetation present at the time of the General Land Office (GLO) survey in the early nineteenth century.

Evidence of such impact is ecological,

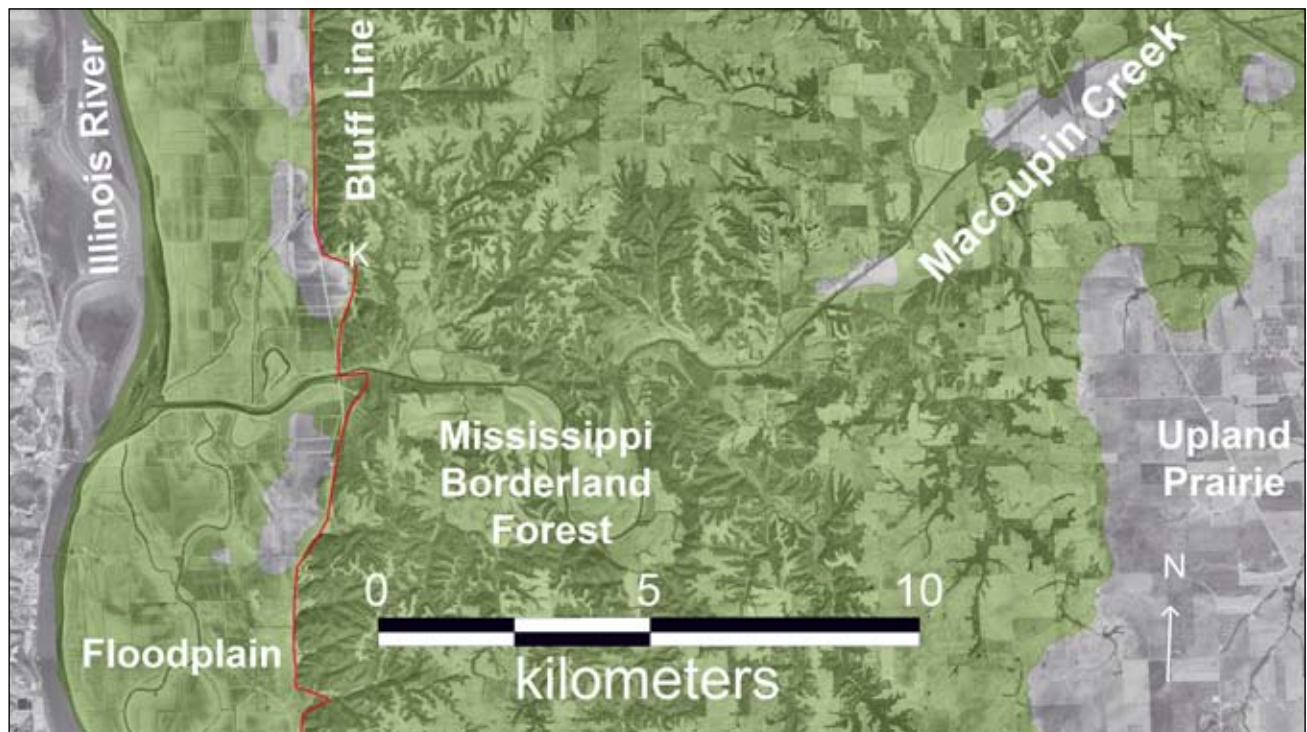
anthropological, and archeological based on GLO survey vegetation maps, tree data, and on written comments by early explorers who witnessed burnings throughout the Prairie Peninsula. Our hypothesis is that Native American fires exerted strong control on the vegetation of the Lower Illinois River Valley. It is most likely that the nature of the vegetation reported by the early surveyors was heavily influenced by human activities prior to Euroamerican settlement.

The General Land Office (GLO) Survey and Study Area

The 1818-1820 survey of these counties provided a great deal of plant ecological information. Based on a formula dating back to the 1787 Northwest Ordinance, the U.S. GLO survey divided unoccupied federally-owned land into “townships,” measuring six miles (c. ten kilometers) on a side. Each township contained 36 “sections” that were one mile (c. 1.3 kilometers) square. Surveys were conducted primarily in winter. The surveyors marked the section corners by two blazed trees. They also marked the section boundary lines at quarter-mile intervals by blazing two trees at that point, and blazed additional trees, usually two, along each section line. They kept a

Composite aerial photo of a transect along the border between Greene and Jersey Counties. The forested areas are indicated in green shading. The bluff line is indicated with a red line. The large letter K indicates the location of the Koster archeological site. Clearings in the borderland forest show where agriculture has taken place on the more level areas. The eastern area, where prairies formerly dominated, is now almost totally agricultural.

(Photo: Illinois Natural Resources Geospatial Data Clearinghouse, Illinois State Geological Survey, <http://www.isgs.uiuc.edu/nsd/home> (2005 Illinois Orthophoto Quarter Quadrangle Maps)



record of each species, and its size and distance from the surveyed point. In a prairie, the surveyors made a three-foot high mound of earth and placed a wooden post in it to indicate a survey point. Microfiche copies of the surveyor notebooks, *Federal Land Survey Field Notes*, are readily available in libraries around the state.

The surveyors also summarized specific information noted after traversing each section. They noted vegetation types such as prairie, forest, scattering timber, and barrens, grading soil features with terms such as “good,” “thin,” and “2d rate.” They noted topography, whether level, gently rolling, or “broken,” and undergrowth, often describing the shrub cover including hazel, vines, briars, spice, sassafras, and others. Most important, the surveys reported whether the land surrounding the section line was cultivable. A great deal of information was packed into these short summaries, which have proven useful in assessing the presettlement vegetation.

After fieldwork was completed, the survey administrators prepared a map of the vegetation of the county, showing the boundary of the forest and prairie and, occasionally, indicating barrens and other features.

The study area is approximately fifty kilometers north of St. Louis and includes all of Jersey, Greene and Macoupin counties in Illinois, and counties located adjacent to the Illinois and Mississippi rivers in west-central Illinois. The area forms a rectangle ranging from about sixty kilometers north and south, and approximately seventy kilometers east and west. The area includes river floodplains with forests, prairies, lakes, and swamps stretching through rugged ravine forest to the nearly level uplands dominated by prairie in eastern Greene, Jersey, and Macoupin counties.

The floodplain bordering the Mississippi River is narrow, usually less than one kilometer wide. However, along the Illinois River, in northern Greene County, it ranges from two kilometers to more than five kilometers

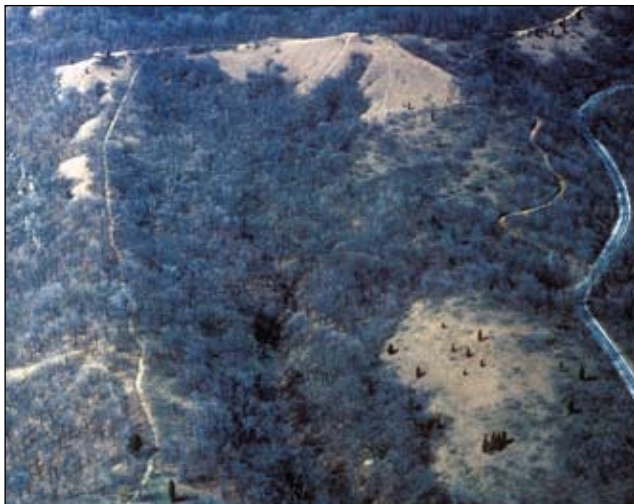


Hazel branch showing ripening nuts. The nuts were a staple food of the indigenous people.

(Photo: John Taft, Illinois Steward)

Mississippi River Bluffs in Jersey County, Illinois, showing remnant hill prairie.

(Photo: R. Brugam, Southern Illinois University)



wide. Limestone bluffs rise 65-80 meters above the rivers at this point in both Jersey and Greene counties and are capped with up to twenty meters of post-Wisconsin glacial period wind-blown loess (Kilburn et al. 2009).

Numerous streams cut deep ravines through the loess and limestone forming rough topography approximately five to ten kilometers east of the bluffs. Farther from the rivers the topographic variation lessens and the land levels out until it becomes a mostly rolling to level plain, cut only by gentle ravines at the heads of the streams.

Native American Impacts on Vegetation

The most significant Native American impact on vegetation was the burning of prairies, which in presettlement times formed nearly half (45 percent)

of Jersey, Greene, and Macoupin counties (Illinois Natural History Survey 2005). A second major impact was extension of fire into the forest at the edge of these prairies, causing barrens, a dwarfed and open forest community. This distinct vegetation type recognized by surveyors covered approximately a fifth of the forest area of these counties. A third major impact was caused by ground fires burning throughout the remaining forest, opening up the canopy and allowing sun-loving shrubs such as hazel to flourish. A fourth impact from burning was the maintenance of open hill-prairies on the loess caps atop the limestone bluffs. These prairies, too small to be recognized in surveyor notes, were abundant on the south- and west-facing slopes overlooking the rivers.

At the time of the GLO survey, much of the upland eastern portions of the area away from the rivers consisted of treeless grasslands. These grasslands were undoubtedly dominated by big bluestem (*Andropogon gerardi*) and Indian grass (*Sorghastrum nutans*), tall grasses with flowering stalks often above two meters in height. Such grasslands were later termed “tallgrass prairie” (Sampson 1921, Madson 1993). Some early travelers told of riding horses through these grasslands in the fall when grasses were often above their heads (Schoolcraft 1821). Interspersed among the grasses was a wide variety of forbs, including many plants in the Sunflower Family and many legumes, together with fewer numbers of species from other plant families (Madson 1993). These forbs,

with far lesser coverage than the native grasses, created a rich mixture of plants.

A band of forest, five to ten kilometers wide, termed the “Mississippi Borderland Forest,” occupied the heavily dissected land adjacent to the rivers (Schwegman 1974). Nearly all the prairie existed on level land east of this band. Stream valleys and areas of hilly topography adjacent to the streams formed sizeable timbered galleries within the upland prairie matrix. In the westernmost counties, Jersey and Greene, 23 percent of the land was covered in prairie (Kilburn et al. 2009). Macoupin County to the east had 63 percent prairie cover (Illinois Natural History Survey 2005). To the north and east of Macoupin County, the percentage of prairie cover rose until it often exceeded ninety percent in what was termed the “Grand Prairie” of central Illinois (Schwegman 1974).

Clearly, these prairies burned frequently and fires stopped only at the ravines and streams, which acted as firebreaks, or when winds shifted direction. Early seventeenth-century travelers recorded the immensity of some of these fires. McClain and Elzinga (1994) quote several of these descriptions, including LaSalle in the 1670s, who noted, “On the right hand and on the left stretched the boundless prairie, dotted with leafless groves and bordered by gray wintry forest, scorched by the fires kindled in the dried grass by Indian hunters . . . At night the horizon glowed with distant fires.”

View of limestone bluffs along the Mississippi River near Elsah in Jersey County. Atop the bluffs is fifteen-meter-thick loess cap. A remnant hill prairie can be seen on right. (Photo: R. Brugam)





Indians covered with wolf skins stalking bison, who tolerated wolves to clean up dead bison. Indians hunting without horses used ingenious methods to kill their prey, as portrayed here by George Catlin.

(Photo: Beineke Library Digital Collections, Yale University).

A major reason for anthropogenic burning of prairie was bison hunting. Bison had existed in Illinois for at least the last 8,000 years (McMillan 2006), but greatly increased in numbers about 1500 CE. They ranged throughout



the Prairie Peninsula and even to the East coast. They were abundant grazers on this land until the eighteenth century when extensive hunting by Euroamericans, who desired the skins as well as the tongues for sale in eastern markets, eliminated the bison east of the Mississippi River (Belue 1996). We postulate that for several thousand years, burning as a hunting tool kept the Prairie Peninsula predominantly grassland.

James Smith (Darlington 1907) described a ring hunt for bison by Ottawa hunters on a large prairie in Ohio. “They expected rain to put out the fire after hunting but the wind arose, it extended through the whole prairie which was about fifty miles in length.” Also instructive was Father Hennepin’s (1680) description of a bison hunt by Miami Indians using a ring fire to confine the animals, near the present site of Kankakee, Illinois.

When they [Native Americans] 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 [open] on purpose, and where they take post with their bows and arrows. The buffalo, seeking to escape the fire, are thus compelled to pass near these Indians. Bison attempting to escape in these narrow passages were subject to a barrage of arrows and often more than six-score were slain (Hennepin 1698) fulfilling the purpose of both the burning and hunting, and providing meat and hides for the tribe for another year.

Another early traveler in Ohio (Hildreth 1971) noted that

The yearly autumnal fires of the Indians, during a long period of time, had destroyed all the shrubs and under growth of woody plants, affording the finest hunting grounds; and in their place had sprung up the buffalo clover, and the wild pea vine, with various other indigenous plants and grapes, supplying the most luxuriant and unbounded pastures to the herds of deer and buffalo which tenanted the thousand hills on the borders of the Ohio.

An entire Native American village was often vacated while everyone participated in the annual bison hunt (Warren 2000). To be such an important food item, the bison population must have been considerable. Marquette and Joliet (1673) describe “herds of 200 and even 400 wild cattle” (their term for bison). An eyewitness in 1718 (Evermann 1916) states that “from the summit of the hill at Ouitenon [Tippecanoe County, Indiana] nothing is visible to the eye but prairies full of buffalo.”

Bison had considerable impact on the prairie. How great this impact was depended on the number of bison, as well as the number of Indians, neither of which is known. In the plains states west of the Mississippi, the vast herds encouraged native prairie. In Illinois, one can only speculate on the influence of these large grazing animals on the prairie and the composition of the various species found thereon (Knapp et al. 1999, Anderson 2006). Our view is that large animal grazing was important in maintaining the prairie, but how important is open to conjecture at this time.

While barrens covered only about a tenth of the study counties, they did form almost twenty percent of the presettlement forest area. Fire has long been recognized as the cause of this vegetation type through much of the eastern United States. Frequent fires reduced the forest to communities of stunted and scattered trees, shrubs, hickory, and oak “grubs” (Heikens and Robertson 1994, Bowles and McBride 1994, Edgin 1996, Edgin 2000). In short, barrens are a fire-adapted community, and while precise definition of a barren varies owing to their wide geographic location and considerable variation, early surveyors saw them as clearly distinct from dense timber and forest.

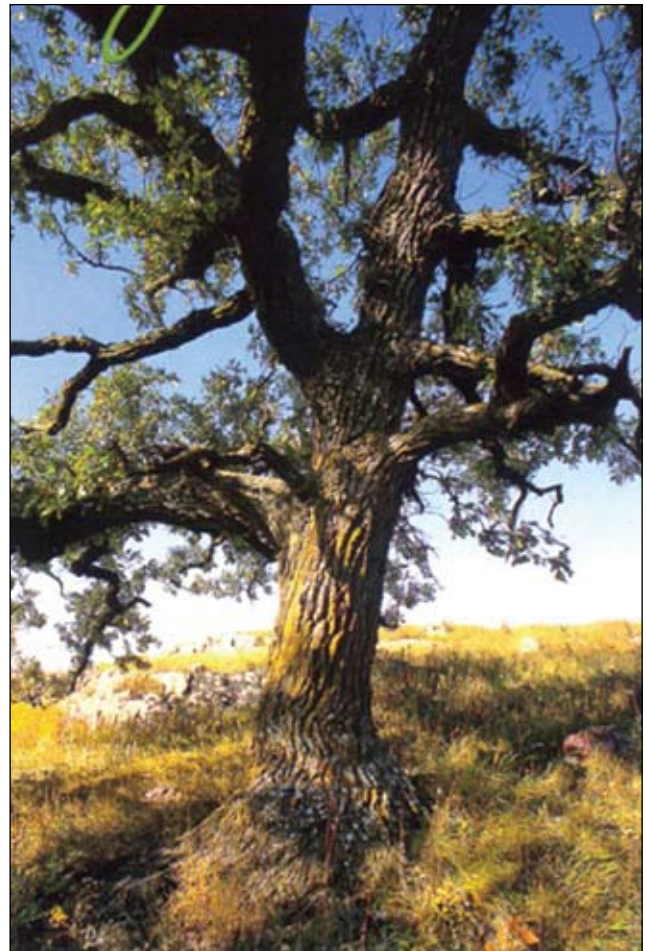
In the study area, barrens usually abut the prairies, which dominate the level uplands, resulting in barrens often found in the adjacent rolling and rougher topography (Kilburn et al. 2009). This indicates that prairie wildfires burned into the forests repeatedly, reducing them to the stunted, widely spaced patches that were present at the time of the GLO survey. The soils in barrens areas are predominantly forest soils, further supporting this conclusion that barrens are degraded forests (Natural Resources Conservation Service 2007, Kilburn et al. 2009).

Frequent and extensive ground fires occurred in the forests of the eastern U.S. before Euroamerican settlement. Early English visitors were impressed by the annual and sometimes semiannual burning of forests in southern New England (Cronon 1983) and in the southeast portion of that region (Silver 1990). Documentation of human-initiated fires in other eastern forests is also extensive (Pyne 1982, Williams 2003).

A recent fire-scar study of an oak woods in Hamilton County, Illinois, which was probably typical in Illinois forested lands before settlement and which included many oaks more than 200 years old, shows ground fires resulting in fire scars created at a mean interval of 2.82 years (McClain et al. 2009). This evidence of the frequency of ground fires in the forests of Illinois provides major support for the notion of frequent presettlement burning in forested lands.

The reasons for starting these fires included clearing forest understory, facilitating travel, reducing insect abundance, stimulating forage, increasing mast (such as acorns and beechnuts) production, and facilitating hunting

This old open grown bur oak has a larger spread than height, a feature rarely found in the much denser forests of today.



(Stewart 2002, Williams 2003). In addition, it is probable that sparks and coals from campfires escaped into the surrounding woods where there was little incentive or means to put out fires, and such fires added to intentional ignition for hunting game and other purposes. It is possible that nearly every square foot of the presettlement forest of these counties burned frequently, at least every three years (McClain et al. 2009), and perhaps even more often in many places. The heavy leaf cover present in these woods provided ready fuel for this burning.

One of the reasons for Native American burning of forests was to increase mast production from trees and shrubs (Abrams and Nowacki, 2008). It is unlikely, however, that burning focused on trees in these counties, inasmuch as the dominant trees in this region were oaks and hickories, heavy mast producers. Burning was beneficial to growth of the most frequently cited understory shrub, American hazel (*Corylus americana*), a major nut producer.

The GLO survey notes summarize undergrowth in most of forested sections. Most of the surveyor notes list hazel as the dominant and often the only undergrowth shrub. Typical entries on all lands other than floodplains are “undergrowth hazel & vines”; “undgr hazel”; and even in prairies “tufts of hazles in places”; and “a thicket of hazles, vines & c.” Hazel was often recorded in prairies and barrens as well. “Vines and briers,” certainly grape (*Vitis* spp) and raspberry (*Rubus* spp.), were often mentioned, though less frequently than hazel. All three thrive only in open forests.

In the almost 200 years that has elapsed since the GLO survey, the understory vegetation has changed drastically. Fires kept the woods open, the trees farther apart. The open nature of the woods encouraged sun-loving shrubs, and hazel, vines, and briers flourished. Hazel tolerated ground fires, and though the aboveground portions of the shrub were often burned, its extensive root system encouraged vigorous sprouting and quick replacement of burned shoots. Today hazel has nearly disappeared from these woods. Its disappearance in Illinois has been described by McClain (2008):

Now it is possible to drive along roads or walk for miles through timber where hazel was once abundant and not find a single plant. Individuals must diligently seek hazel populations along roadsides, in the less populated counties. Perhaps no other shrub in Illinois has experienced such a tremendous decline as the American hazel.

McClain further describes Native American uses of the plant:

American Indians utilized hazel as a source of food and medicine. The nuts, which are high in protein and vitamin E, were gathered in the fall and eaten raw or roasted. The bark was used to make a tea to treat hives and

fevers and the leaves were crushed and used in a poultice to treat varicose veins.

To encourage the spread of this shrub and increase mast production from the frequent clumps was another reason for human-initiated fires. McClain goes on to describe the abundance of this native nut, often called filberts. He quotes a pioneer resident of Pike County who, in the early 1830s, noted the abundance of hazelnuts and who claimed that “during the first two years of our residence . . . my children gathered bushels of them.” The abundance of hazel is also described by Farnam (1846). It is clear that hazel could have provided abundant food for the Native Americans, and it is also likely they realized that fire encouraged hazelnut production.

A further important piece of evidence for human-initiated forest ground fires is that many of the few remaining original trees, those that are probably over 200 years old, are clearly open-grown, with very long branches and wide crowns. Such trees were undoubtedly small at the time of the survey and the frequent fires during the nineteenth century kept the forest open. The growth form of these ancient trees indicates growth in an open forest, one completely different from the denser forests of today. Clearly these old-growth trees developed in a fire environment (Faison et al. 2006).

Burning of hill-prairies overlooking the rivers, those small south- and west-facing grasslands that often existed on the deep loess caps atop the limestone bluffs, was a fourth fire impact on the presettlement vegetation.

Hill-prairies are a unique plant community dominated by native prairie grasses and colorful prairie perennials in Illinois and adjacent states (Braun 1950, Evers 1955). In Jersey and Greene counties, the most abundant species on such grasslands are little bluestem grass (*Schizachyrium scoparium*) and side oats grama (*Bouteloua curtipendula*). These grasses are interspersed with a wide variety of native prairie forbs, the term given to native perennial plants. These botanical gems, often less than an acre in size today, though formerly much larger, occur mainly on these hot and dry south- and west-facing exposed slopes. They are common atop the bluffs in both Jersey and Greene counties. Because of the scenic views from these high points often overlooking large rivers, they have long attracted human interest, from Native Americans who used them as burial sites in presettlement times (Perino 2006), to people today who enjoy their fine vistas.

It is clear from studies over the past fifty years (Robertson et al. 1995) that woody plants invade and overrun these grasslands unless checked by fire, clearing, or herbicides. It is most likely that in the years prior to settlement, frequent fires were necessary for the maintenance of the hill prairies. Ground fires in the adjacent woods no doubt spread into the hill-prairies, aiding in keeping them open.

During the early to late woodland period ending about 600 CE, the tops of these loess-covered bluffs were favorite Native American burial sites due in part to their scenic location and were likely kept open by burning

during the time when the burials were done. It is doubtful, however, that subsequent tribes of Native Americans paid much attention to these graves after the last burials, and these burials do not explain existence of the hill-prairies today (Perino 2006, Hamilton 1919, Titterington 1935).

It is possible that frequent burning of the ravine forests spread into hill-prairies and maintained them as grassland. Such fires, either intentionally or not, keep the woods open and reduce insect populations. Some of these fires likely spread upwards from the base of the bluffs where many of their villages were probably located. Fall fires, when the vegetation was at its driest, would readily spread, particularly in windy conditions, through any grassland. Early twentieth-century photos, and even earlier drawings, attest to the openness of these bluff areas. Today, these hill-prairies are being invaded by woody plants, and some have completely disappeared (McClain et al. 1909). In conclusion, it is almost certain that frequent fires started by Native Americans kept these hill-prairies open.

Native American Populations

Were there enough Native Americans living in LIRV from 1200 to 1800 CE able to carry out a burning program that resulted in the presettlement vegetation as described by the GLO surveyors? The answer to this question is key to determining vegetation impacts at the time of the GLO survey.

Nearby Cahokia was at its peak around 1200 CE (Pauketat 2009), and it is likely that villages in the LIRV were at maximum size. For obscure reasons, population decline began at Cahokia at that time, but the population at LIRV may have been little affected, as geography and vegetation were far different from the American Bottom at Cahokia. Nevertheless, during this interval, archeological evidence is sparse in LIRV, and this question must be carefully examined.

First, epidemics may have played a role in population reduction in the LIRV (Blasingham 1956). Tanner (1987) describes one possible impact from disease as early as 1692-3 when “during the winter all of the Illinois tribes suffered high child mortality.” Tanner (1987) also notes another disaster in 1714 when “Epidemic disease killed hundreds of Illinois Indians at Kaskaskia” Such epidemics could severely limit the organization, population, and activities of Native Americans in the LIRV area, but it is questionable how major these epidemics were or how long their effects were felt. Certainly not all Indians perished from epidemics. Survivors gained some immunity, new families were started, and the resultant population likely grew.

Another potential effect on population numbers was the devastation of Indian wars (Blasingham 1956). Tanner describes one such attack in the area:

In 1680 the Iroquois attacked tribes in the Illinois River valley, beginning at Kaskaskia and pursuing the retreating Illinois Indians along the river. All of the Illinois except the Tamaroa fled across the Mississippi River. The

Tamaroa were defeated, with more than 700 captured or killed.

This battle likely destroyed many of the LIRV villages. It seems probable, however, that many Native Americans fled river areas until the war parties left and then returned and reestablished their way of life and increased their population once peace was restored. Some of these remnant tribes later were relocated to Kansas, where they are today on reservations.

Tanner (1987) shows 33 maps of the location of Indian villages from 1641 to 1889 in the Great Lakes area, including Illinois. These maps show numerous Illinois villages at Peoria and others northeast of Peoria along the Illinois River. They show many villages around St. Louis, near the confluence of the Missouri and Mississippi rivers, and east and west of the Mississippi. But the maps show no villages in the LIRV. One might conclude the lands along LIRV sustained few Native American villages at the time, even though there had been extensive Native American use of this area during the previous 10,000 years. These maps, though immensely useful, hardly indicate all Native American settlements, especially the smaller ones. Any number could have existed a mile or more from the Illinois River, in the higher parts of the floodplain, without being noted by early travelers whose accounts were sporadic and selective at best (Warren 2000). Euroamerican settlers were concentrated around St. Louis; by the time they expanded into the LIRV, the Native Americans had been relocated. Vast areas were passed by travelers who took no notes. In short, while early accounts are immensely valuable, they reveal only a fraction of the Indian activity in the LIRV.

As described in the previous sections, vegetation patterns indicated Native American use of this area nearly up to the time of the GLO survey. Traveler notes provide evidence of widespread Native American presence along the rivers. While vegetation impacts may have lessened after 1200 CE, they were sufficient during the following 600 years to provide the effects noted on the presettlement vegetation at the time of the GLO survey.

Conclusion

Analysis of the presettlement vegetation of Jersey, Greene, and Macoupin counties in west-central Illinois reveal major fire impacts by Native Americans. In present settlement times, almost half of these counties were covered with prairies maintained by the frequent burning by Native Americans for hunting big game, especially bison. As the prairie fires invaded the adjacent forest, a sizeable portion of the remaining forest became barrens. Fires continued to burn through much of the remaining forest areas as ground fires that did not kill the larger trees but did girdle and kill the smaller trees and shrubs, allowing ready access through the woods, a forest that was much more open than many of the second- and third-growth woods of today. This fire regime promoted hazel dominance of the understory, a shrub that sprouts readily

after fires. Grapevines and raspberry shrubs were also abundant and are largely absent in today's forests. The surveyors, who carried tools, food, tents, clothing, and other supplies in a wagon, moved easily through the open forest before roads existed. This ease of passage suggests

that much of the vegetation in these counties was burned frequently, perhaps annually, at least on the uplands and over the gentler topography. Fires, probably unrelated to bison hunting, also caused the burning of the hill-prairies isolated atop the river bluffs.



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