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Restoration from the Perspective of Recent Forest History

The woodlands of northeastern Illinois, particularly those associated with the Valparaiso, Tinley, and Lake Border Moraines that encircle Chicago and extend northward through Kenosha and Racine counties in Wisconsin, are extensive, constituting substantial remnants of the original forests of the area.[1] Oak dominated, they are similar in species composition from north to south. The soils that developed under them, principally the alfisols Morley and Blount silt loam, are also widespread, extending from Indiana well into southern Wisconsin (Hole 1976, Mapes 1979). These woodlands typically occupy north- and east-facing morainic slopes, and, as has often been noted, they are best developed on the east sides of streams (Gleason 1909, Woodard 1925, Bowles et al. 1994). Perhaps the large amount of forest in the area is related to the north-south orientation of many of its rivers, including the DuPage, the DesPlaines and the North Branch of the Chicago.

As Cowles (1901) pointed out almost a century ago, the landscapes occupied by these woodlands are among the most dynamic in the region. It is here that post-glacial stream dissection and the consequent maturation of drainage basins is most advanced. This maturation is expressed in the ravine topography characteristic of these woodlands, the "broken" lands of the Public Land Survey notes, and is largely a function of the interplay of forest and stream in these landscapes. The forest, once established, provides a land surface more conducive to stream development than does prairie sod. Resulting channel

[1] I am using the terms "woodland" and "forest" interchangeably, not as distinct community types separated on the basis of density, canopy closure, basal area, etc. There is some question as to the value of making this distinction for northeastern Illinois woodlands.

lengthening and valley widening provide not only avenues for forest advance, but an increasingly diverse set of interior forest habitats, ranging from floodplain and terrace, to mesic ravine slopes, to dry uplands and wet depressions as yet unaffected by stream dissection.

It is this assemblage of woodlands, all recognizably similar in physiognomy and composition but each subtly different from the others, that has become the principal target of restoration efforts during the last decade.

Forest History

Because forested landscapes, alone among terrestrial communities, have a readable history, we have the unique opportunity to place ecosystem processes in an historical context. This history can be read not only in Public Land Survey descriptions, but in tree rings, in fire scars, in changing species composition between canopy and understory, in size and age distributions. The meticulous reconstruction of Henry and Swann (1974) is an example of what can be done in this regard. Other studies in forest history are reviewed in Peterken (1996). Beyond the inherent value of such studies, it is critical for those of us interested in the morainic forests of northeastern Illinois to devote more time to their history, to understanding the forces that shaped them, and to the expression of these forces in the present-day forest. I say this because I believe the existing assumptions about forest history, the assumptions that are presently guiding restoration activities in these woodlands, are simplified at best, badly flawed at worst.

Pre-settlement History

First, I think we need to reevaluate some of our assumptions about historic disturbance patterns in northeastern Illinois. To begin with, we need to analyze critically the idea that these woodlands have some evolutionary relationship to fire, that they have "evolved [with fire] over the eons" (Packard 1993:8). As Hunter (1996) has pointed out, the time period since deglaciation, ~12,000 years, is not long enough for the evolution of species, no less the community-level evolutionary response to fire that has been suggested. Griffin (1994) makes the same point in reference to the origin and development of savannas about which similar evolutionary claims have been made. Moreover, the data that supports the frequent recurrence of fire is entirely anecdotal. We have no information on fire scars from the few pre-settlement trees still present in these woods. Fire or its effects are rarely mentioned in the Public Land Surveys, even though most were conducted in pre-settlement times in this region. Perhaps we need to approach the question of disturbance regimes from the perspective of the pre-settlement forest itself. For example, unpublished data on the size distribution of witness and line trees, 79 in all, from the 1834 Survey of Thorn Creek Woods in Will County, one of these morainic woodlands, includes individuals ranging in size from 7" (17.5 cm) to 24" (60 cm) in dbh, with all intermediate sizes represented. This distribution suggests an all-aged forest existing on the site prior to settlement. Anderson and Anderson (1975) found the same pattern in the forests of Williamson County in far southern Illinois. The implication of an all-aged structure is continuous recruitment, and this, in turn, suggests low levels of disturbance during what appears to be a relatively long period of forest establishment. Clearly, these results are preliminary, but I think they are sufficiently at variance with established

conceptions of pre-settlement fire-frequency, conceptions that are driving present day restorations in these same woodlands, that the whole subject might profitably be revisited.

Although we have much to learn about pre-settlement conditions, I believe we should focus most of our attention on post-settlement forest history, agricultural history, patterns of land use in the forest in the 160–170 years since settlement. These topics are more mundane perhaps than the romance of a pre-settlement Eden, but they are, at the same time, more germane to the organization of the forest we now see. The post-settlement agricultural period in northeastern Illinois has in recent years come to be characterized as nothing more than a misguided era of fire suppression (Packard 1993). By doing so, we have ignored two other factors—logging and grazing—whose impact on these forests was of equal or greater significance during the same period and whose long-enduring effects explain much about the structure of today's woodlands.

Logging

The trees of the pre-settlement forest, with few exceptions, are gone from northeastern Illinois woodlands. Most have been logged off, probably within the first eighty years or so of settlement. The principal legacy of logging, presumably in concert with early fire suppression, has been the emergence of the even-aged canopy we see in these woodlands today, a canopy composed almost exclusively of post-settlement trees or those of immediately pre-settlement origin. Cowles' (1901) photographs of typical morainic woodlands show two of these even-aged, second-growth stands as they appeared almost 100 years ago (Figures 1 and 2). At the present time, this canopy, whose success was made possible by the removal of the original forest, is now in full maturity region wide, approaching old-growth status in age.

Early plats show that many of the larger woodlands—Thorn Creek, Plum Creek and Messenger Woods in Will County, for example—were subdivided into numerous small (10–25 acre) woodlots owned by prairie farmers (Figure 3). A similar pattern was found in La Salle County, Illinois (Fuller 1923). Differences in the degree to which these woodlots were harvested created a mosaic of disturbance in these forests. Adjacent woodlots, for example, may have had wholly different histories of exploitation. The imprint of these differences are still detectable in present-day forests.

The implications of the post-settlement origin of our woodlands goes beyond simply the replacement of one generation of trees by another. There has most certainly been an increase in tree density, for example, even in the larger size classes, and with that, a change in tree form, individuals developing a straighter, more forest-grown shape. Restoring the pre-settlement woodland is impossible: the pre-settlement forest is gone. It is not there to be restored. The real management issue is whether it is desireable, or even possible, to recreate a pre-settlement facsimile from the existing forest, given the changes that have occurred.

Grazing

The effects of grazing on these woodlands have been equally profound and equally overlooked. Dairy farming in northeastern Illinois was restricted to morainic landscapes, the very same landscapes that supported extensive tracts of forest (Duddy 1929). I think we have underestimated the ubiquity of grazing in these woodlands. In 1925, for example, just prior to the period of rapid

Figure 1. An even-aged post-settlement stand in 1901. The trees appear to be about 40 to 50 years old. Only the stump in the foreground and possibly the larger tree in the upper left remain from pre-settlement times. Beverly Hills is in southwestern Cook County. Photo courtesy of the University of Chicago Press.

decline in regional agriculture, 92% of 23,000 acres of woodland in Cook County had been or was being grazed; similar percentages were recorded for DuPage, Lake, and Will Counties (Telford 1926, Duddy 1929). A survey of 430 northern Illinois farmers taken during this same period revealed that over 90% grazed their woods (Telford 1926).

The effects of livestock grazing in woodlands are varied, depending on the intensity and duration of the practice. These include soil compaction, which in extreme conditions results in stag-headed trees, and the replacement of the woodland herbaceous layer by bluegrass sod, Canada thistle, and other alien invaders. The stages of forest degradation under increasingly severe grazing pressure were outlined by DenUyl and Day (1939). The subject was recently revisited by Dennis (1997). One result emerges above all others: protracted grazing results in the elimination of the existing woody understory (Figures 4 and 5) and in the cessation of woody plant recruitment (Marks 1942, Dambach 1944, DenUyl 1962). Fuller and Strasburgh (1919:271) concluded that, as a result of grazing "... not over 5% of the oak and bottom forests show reproduction in progress" in La Salle County, Illinois. In the present-day forests of northeastern Illinois the most striking imprint of past grazing is the gap in the size distribution of virtually every species of tree in these woodlands (Men-

Figure 2. Another even-aged stand in 1901. Note the high stem density and the straight, slender forest-grown form of the trees. The tree on the left with the crooked trunk may be the only pre-settlement survivor. Photo courtesy of the University of Chicago Press.

delson 1994). The gap represents the period when, as a result of grazing, tree recruitment essentially ceased.

Recovery of the forest presumably also depends on the previous duration and intensity of utilization. Complete recovery may be slow. Curtis (1959:154-5), who suggests that soil compaction might be the most damaging and the most permanent effect, mentions a lightly grazed red oak stand protected from cattle in 1932 whose recovery was still incomplete 25 years later. It is in this recovery phase that the woodlands of northeastern Illinois are today, and the degree to which they have recovered is inversely proportional to the severity of past disturbance.

Recovery

The most direct response to the cessation of grazing has been the explosive growth of the understory of these woods, beginning in the 1920s with the regional decline in agriculture. The understory that has emerged is clearly delimited from the older, canopy generation by a spatial gap: middle-sized trees of middle-age are largely absent from these woods. The regeneration of the forest which this understory represents may, at first glance, appear chaotic. We have been made all too aware of its less desirable aspects, particularly the inclusion of non-native, sometimes aggressive elements like buckthorn, multiflora rose, honeysuckle,

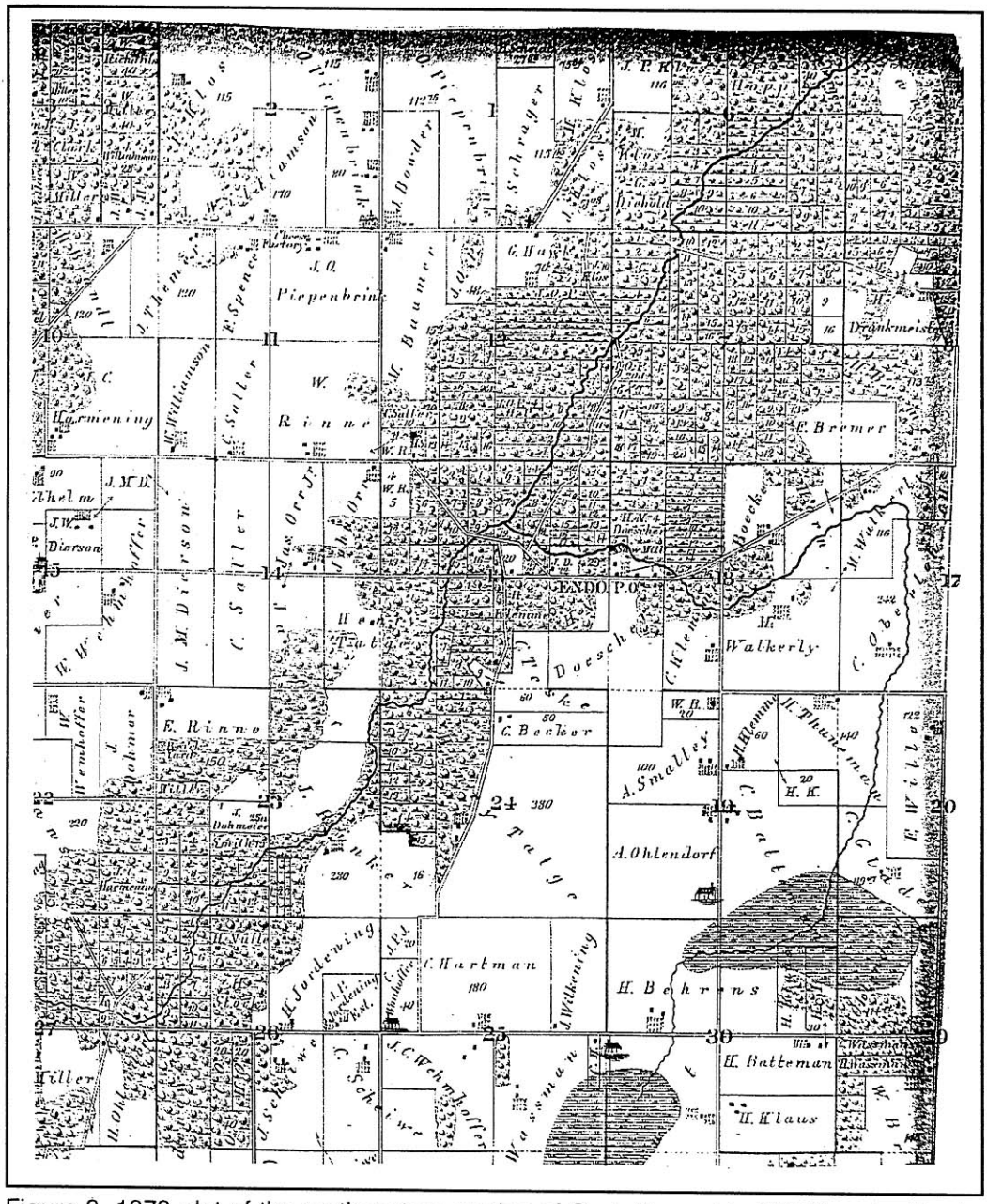

Figure 3. 1873 plat of the northeastern portion of Crete Township, Will County, Illinois, showing the forest along Plum Creek subdivided into many small woodlots. Note the sawmill in the northwest quarter of section 18. The map is from the Atlas of Will county published in 1873 by Thompson Bros. and Burr.

Figure 4. This photo is from "A Manual of Woodlot Management" by C. J. Telford, published in 1926. The woodlot is located in northern Illinois. Photo courtesy of the Illinois Natural History Survey.

Figure 5. Grazing continued in some forest preserves even after acquisition. This photo is from 1921. Deer Grove Preserve is located in northwestern Cook County. Note the browse line in the background and the virtual absense of understory. The plants in the right foreground appear to be Canada thistle. Photo courtesy of the Cook County Forest Preserve District.

and others in the emerging community. The distribution of most of these alien species, however, seems closely associated with the degree of past disturbance: to a large extent, they have invaded the most disturbed sites, those which are also slowest to recover. Moreover, most of the aliens are shrubs or small trees. None have the capacity to become part of the upper canopy. Species having canopy-forming potential in these woodlands are all native, and all are participating to various degrees in forest regeneration. The early stages in the recovery from grazing are, first, the spread of existing thorny or unpalatable species, of which hawthorn is usually most prominent, which is followed by the arrival of light-seeded and bird-disseminated tree species: ash, slippery elm, sugar maple, basswood, and black cherry, among others. Oaks generally appear later in the process (Den Uyl and Day 1939, DenUyl 1962). This sequence seems to describe very well the pattern of species appearance in northeastern Illinois woodlands, where white ash, slippery elm, and black cherry are frequently found beneath a much older, oak-dominated canopy, and where once vigorous stands of hawthorn are already in decline. The spread of sugar maple from ravine enclaves onto the more mesic of upland sites has been widely commented upon. Maples are still largely absent from dry uplands, which are equally open to invasion, suggesting that edaphic factors, particularly available soil moisture, may be limiting. A recent reexamination of Illinois Natural Areas Inventory sites originally sampled in 1976 indicates an increase in sugar maple in the smallest size class on oak-dominated sites, but virtually no growth into larger size classes during the last 20 years (Bowles et al. 1998*a*).

Why oaks are slow to reestablish in previously grazed settings is not clear. It would seem to be related in part to soil compaction, the most persistent legacy of grazing, and its effects on germination and seedling

establishment. Certainly the extreme sensitivity of mature oaks in northeastern Illinois to soil compaction, as witnessed by their high mortality rates around construction sites, has been ajmply demonstrated (Ware and Howe 1974).

There seems to be fairly general agreement that oak populations can be self-sustaining on dry sites (Clark et al. 1996, Fralish, 1997). This seems to hold true for northeastern Illinois woodlands as well, especially where grazing appears to have been light. For example, at the Illinois Natural Areas Inventory (INAI) site in Thorn Creek Woods (Bowles et al. 1998*b*), an area that was apparently lightly grazed and has no history of fire, oak seedlings were present in numbers estimated between 2,500 and 6,500/ha.

In places we see the beginnings of an all-aged structure in these woodlands, with the establishment of a variety of canopy species, including oaks, beginning perhaps 60–70 years ago and continuing today.

These are only a few of the many changes that have come about since the cessation of grazing, changes that are still unfolding, and about which we still have much to learn. To dismiss these complex developments as nothing more than forest deterioration due to fire suppression is a misreading of the past.

Restoration

Such a misreading would be of only academic interest were it not the main justification for restoration efforts in these woodlands, efforts aimed almost exclusively at altering or removing the understory, at reversing the degradation that this outpouring of vegetational energy is supposed to represent. At first, reintroducing fire, the process under which these woodlands allegedly evolved, was the principal method employed. Now, woody species in the understory are routinely cut or girdled first, and then treated with herbicide, usually prior to the application of fire. The latest device to come into use is the Seppi mower, a variant of the brush hog, which leaves a litter of wood chips, and almost certainly compacts the soil of the forest floor, mimicking, in an ironic way, the hooves of cattle. Lack of a sufficient fuel load, and hence the inability of these woodlands to carry a fire hot enough to do its job, is usually offered as the explanation for employing these increasingly severe methods of control. Species that are removed include not only aliens like buckthorn and honeysuckle, but many natives as well: ash, elm, black cherry, sugar maple, and basswood. Most of these are early colonizers after the cessation of grazing.

Reintroducing chronic disturbance into these woodlands has had some unpleasant results. One is the reappearance of species that thrived under heavy grazing. White snakeroot, which can form virtual monocultures in restored woodlands, is an example (Marks 1942). More alarming is the recurrence in restored woods of some of the most pernicious agricultural weeds: Canada thistle, burdock, and mullein among others. This is particularly evident in parts of Swallow Cliff Forest Preserve, Cook County's currently most ambitious restoration. These species are found only in the most degraded of woodland pastures and are eventually eliminated as the forest recovers. They are never part of a healthy woodland flora. Thus in many cases, we appear to be replacing what have been deemed aggressive woody species, including many natives, with equally aggressive herbaceous ones. This is not surprising: with disturbance-based management come disturbance-adapted species, and many of these are aggressive competitors.

It has been suggested that garlic mustard, the latest scourge of our woodlands, also may be favored by disturbance-based management (Anderson et al 1996). Frequency of garlic mustard was significantly higher in burned INAI sites than in those that had not experienced fire management (Bowles et al. 1998*a*). Fire may open seed beds, thus facilitating the spread of this species.

More dangerous than the spread of undesirable species, a process which presumably would be reversed with the cessation of disturbance, is the permanent effect restoration is having on forest structure. Under current management practices, we continue to widen the age gap between an increasingly elderly canopy and what will forever be an immature understory. We are, in other words, prolonging the even-aged condition which itself is an artifact of post-settlement logging and grazing. This takes on particular significance when we consider that some canopy species, notably red and black oak, may be approaching, at 150–180 years of age, the end of their life span. If oak reproduction is not enhanced by current management—there is yet little evidence that it has been—and we continue to remove almost every other native tree species, we may be having impacts on these woodlands more damaging and more permanent than those of the preceding agricultural period. These unexpected effects are the result of our one-dimensional interpretation of recent forest history, and our failure to take into account the sequence of changes that follow the removal of livestock from the land.

I think it is fair to ask, therefore, whether it is wise to continue to impose disturbance-based management on woodlands that have so recently emerged from a long post-settlement period of disturbance. After all, in their entire post-glacial history, these woodlands had never before been cut. Nor had they experienced as intense a period of grazing as they have since settlement. Given this history, might it not be equally appropriate to let biotic interactions, particularly interspecific competition, in this emerging forest determine ultimate forest structure? If so, then management should emphasize stability and reduce chronic abiotic disturbance. The successional trajectory under these conditions may never return us to pre-settlement structure or composition. But then, neither will current management practices: these forests have gone too far down a different road. What we will have, if we manage for stability, are all-aged woodlands, woodlands with greater species diversity in the canopy than we see at present, woodlands that have developed under the natural disturbance regime of this time and place.

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