The Land that Time Forgot: Southern Flatwood Oaks and Associates of the Tinley Creek Forest Preserve of Cook County, Illinois

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Abstract

Recent botanical study has revealed the discovery of eleven southern disjunct species including putative hybrids typical of flatwood forests of the lower Mississippi River valley growing in northern Illinois. *Celtis laevigata* var. *smallii* (sugarberry), *Liquidambar styraciflua* (sweetgum), *Tilia heterophylla* (white basswood), *Quercus shumardii* (Shumard oak), *Quercus montana* (chestnut oak), *Quercus lyrata* (overcup oak), *Quercus texana* (Nuttall's oak), *Quercus coccinea* (scarlet oak), *Quercus* x *guadalupensis* (post oak x bur oak), *Quercus* affn. *falcata* (southern red oak putatively introgressed with black oak), and *Quercus* affn. *pagoda* (cherrybark oak putatively introgressed with black oak) were found growing in flatwoods forest within the 324 hectare(800 acres) Tinley Creek Forest Preserve of southwestern Cook County Illinois. They are presumed native and their occurrence may be the result of post glacial migrations up the Mississippi River Valley. Their persistence to the present may be attributable to a unique combination of soil, drainage, and microclimatic effects of Lake Michigan.

The Tinley Creek Forest Preserve (TCFP) lies at the lower end of Lake Michigan at the eastern edge of what is called the Prairie Peninsula, an ectonal region originally typified by tall grass prairie, savannah and forest communities (Transeau, 1935). Glaciation, shifting climatic changes, and anthropogenic influences over millennia have shaped the region into a mosaic of plant biota originating from all points of a compass. The local microclimatic effects of Lake Michigan have also played a key role in providing refugium habitats for taxa with more southerly or easterly affinities. The Tinley Creek Forest Preserve represents a rare tract of land that blends these elements together. Special attention must be given to preserve and maintain these rare plant communities before they disappear.

Climate

The Chicago region has a humid continental climate. The TCFP lies 24 kilometers south west of Lake Michigan. The average mean annual temperature is 9×C with a mean annual precipitation of 96 cm. The last frost date is approximately April 30th (Ruffner,1978). The area exhibits a slight lake effect of moderating temperatures in winter, and slightly greater precipitation compared to outlying suburban areas. (Fizzel, 2002).

Cultural History

European settlement at TCFP began in the 1830's with several land owners managing tracts of land mostly near what is now Camp Sullivan in the northeastern part of the preserve. The forested portion was originally called Betchelder's Grove

and then presumably renamed by New Englander Steven Rexford as Bachelor's Grove in the 1840's. German settlement proceeded through the 1850's with establishment of a post office around 151st and Harlem (Bettenhausen, 2002). In the 1860's, Asa Turner, T. Moss, and R. Schilling were the predominate landowners of the study area (Flower, 1861). Between 1858 and 1884 the population migrated eastward toward the village of Blue Island leaving the area with few residents. Later, the settlement of Goeselville (1884-1906) was established near what is now Camp Sullivan until it was abandoned (Bettenhausen, 2002). By 1904 there were over 30 individuals owning land in the preserve with Schilling, Hunstock, Lyttle, and Moss in possession of the larger tracts (Mitchell, 1904).

According to Dan Weber, real estate and license engineer of the Cook County Forest Preserves, initial purchase of land began around 1925 and continued through its completion in the 1950's. Aerial photographs taken in 1939 and 1940 (Illinois Air Photo Image Base, 2004) show sections of the flatwoods area cleared with evidence of patches of agricultural activity south of Tinley Creek. The photo also reveals the preserve surrounded by farms and small tracts of forest. In the 1940's and 1950's Camp Sullivan and Camp Falcon, located in the northeast corner of the preserve, were built for the boy scouts and are still utilized today. A grove of *Pinus resinosa* Ait.(red pine) was planted 2 kilometers to the west of Harlem Avenue at 151st in the 1960's. In the 1980's and 1990's, Cook County Forest Preserves installed biking trails, planted ornamental trees, and Eurasian grass along sections of a bike path. (Dick Newhardt, District Forester, Cook County Forest Preserve, personal com.)

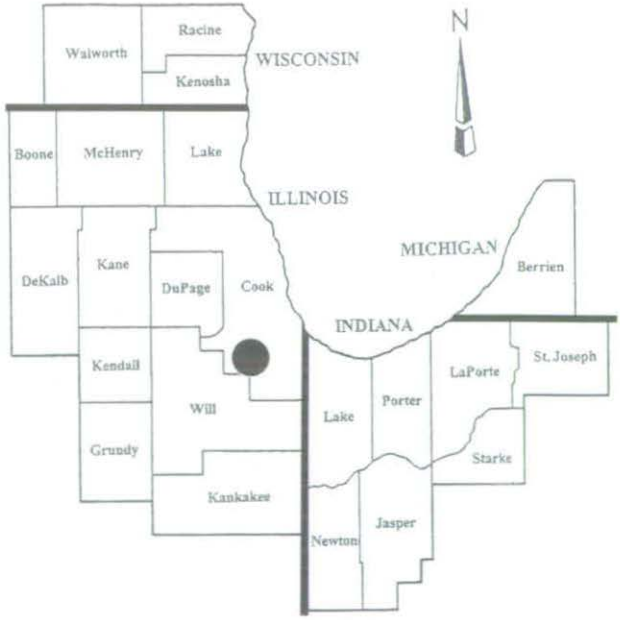


Figure 1. Map of the Chicago Region
Base Map: Swink and Wilhelm, 1994
Tinley Creek Forest Preserve highlighted

Table 1. List of southern taxa and putative hybrids of TCFP with Field Museum herbarium accession number given on left. (* indicates a southern form of the oak).

FM 2230274	*Celtis laevigata* Willd. var. *smallii* Beadl. (sugarberry)
FM 2230276	*Liquidambar styraciflua* L. (sweetgum)
FM 2230277	*Tilia heterophylla* Vent. (white basswood)
FM 2230278	*Quercus coccinea* Muenchh. (scarlet oak)*
FM 2246493	*Quercus* affn. *falcata* Michx. (southern red oak introgressed possibly with black oak)
FM 2252943	*Quercus* x *guadalupensis* Sarg. (post oak x bur oak)
FM 2230271	*Quercus lyrata* Walt. (overcup oak)
FM 2252945	*Quercus lyrata* Willd. x *Quercus macrocarpa* Michx. (overcup oak x bur oak)
FM 2230272	*Quercus montana* Willd. (rock chestnut oak)
FM 2246494	*Quercus* affn. *pagoda* Raf. (cherrybark oak introgressed possibly with black oak)
FM 2230275	*Quercus* x *saulei* Schneider (white oak x rock chestnut oak)
FM 2230273	*Quercus shumardii* Buckl. (Shumard oak)
FM 2252942	*Quercus shumardii* var. *stenocarpa* Laughlin (Shumard oak)
FM 2252941	*Quercus texana* Buckl. (Nuttall's oak)

Natural History/Ecology

TCFP harbors sixty five species of native Illinois arborescent taxa with eleven taxa having distinct southern Applachian and lower Mississippi River valley affinities (Table 1). Sixteen oak taxa including eight southern species with associated hybrids have been observed (Table 2). Notable Illinois endangered species are *Quercus texana* (Nuttall's oak) and *Quercus montana* (rock chestnut oak) (Herkert and Ebinger, 2002). Other southern taxa include *Celtis laevigata* var. *smallii* (sugarberry) and Illinois state threatened species *Tilia heterophylla* (white basswood). The area supports a mix of northern and southern elements in a mosaic of forest communities defined by topography, soil and moisture conditions. Over 350 native taxa have been found to exist (Shepard, 2001). The Illinois endangered species *Carex communis* Baily (common beech sedge), typically found in eastern forests, has been recorded from the ravines (Bowles and Radke, 1999). The southern taxa occur as scattered individuals and in groups occupying the flat to gently rolling forest communities outside the floodplain and ravines. These communities lie approximately 0.5 kilometer north of the creek floodplain and 1.5 kilometers to the south covering 90 hectares or twenty five percent of the preserve area (Figure 1). Individual populations of *Q. montana,* and *Tila heterophylla* are separated by as much as 2.2 kilometers.

The flatwoods represent a second-growth forest that has had a history of agriculture, logging, clearing, grazing, and in presettlement times, fire (Bowles and Radke, 1992; McClain and Elzinga, 1994). The biodiversity of the area is hidden and masked by the Eurasian weeds and shrubs that proliferate in sections of the understory and ground layers. Disturbance has brought invasive buckthorn (*Rhamnus cathartica* L.), oriental bittersweet (*Celastrus orbicularis* Thunb,), and multiflora rose (*Rosa multiflora* Thunb.) into the understory, choking out natural recruitment of native trees. Field garlic (*Allium vineale* L.) and more recently garlic mustard (*Alliaria petiolata* (M. Bieb) Cavara and Grande) have invaded the ground layer.

Table 2. List of oak taxa and putative hybrids found at Tinley Creek Forest Preserve

Quercus alba L.	(white oak)
Quercus bebbiana	C. K. Schneider (white oak x bur oak)
Quercus bicolor Willd.	(swamp white oak).
Quercus coccinea Muenchh.	(scarlet oak)
Quercus ellipsoidalis E.J. Hill.	(Hill's oak)
Quercus affn. *falcata* Michx.	(southern red oak introgressed possibly with black oak)
Quercus x *guadalupensis* Sarg.	(post oak x bur oak)
Quercus x *jackiana* Schneider	(swamp white oak x white oak)
Quercus lyrata Willd.	(overcup oak)
Quercus macrocarpa Michx.	(bur oak)
Quercus montana Willd.	(rock chestnut oak)
Quercus muhlenbergii Englm.	(Chinkapin oak)
Quercus affn. *pagoda* Raf.	(cherrybark oak introgressed possibly with black oak)
Quercus x *paleolithicola* Trel.	(Hill's oak x black oak)
Quercus palustris Muenchh.	(pin oak)
Quercus x *riparia* Laughlin	(Shumard oak x northern red oak)
Quercus rubra L.	(northern red oak)
Quercus x *saulei* Schneider	(white oak x rock chestnut oak)
Quercus shumardii Buckl.	(Shumard oak)
Quercus shumardii var. *stenocarpa* Laughlin	(Shumard oak)
Quercus texana Buckl.	(Nuttall's oak)
Quercus velutina Lam.	(black oak)

Native species characteristic of these wet woods still persist, however. Sweet scented bedstraw (*Galium triflorum* Michx.), Greendragon (*Arisaema dracontium* (L.) Schott), lady fern (*Athyrium filix-femina* L., sensitive fern (*Onoclea sensibilis* L.), yellow violet (*Viola pensylvanica* Michx.) and Missouri violet (*Viola missouriensis* Greene) are prevalent in the herbaceous community. Downy serviceberry (*Amelanchier arborea* (Michx. f.) Fern.) and Allegheny shadblow serviceberry (*Amelanchier laevis* Weig.), more typical of eastern and southern forests, are occasionally found in clearings and the understory (Shepard, 2001).

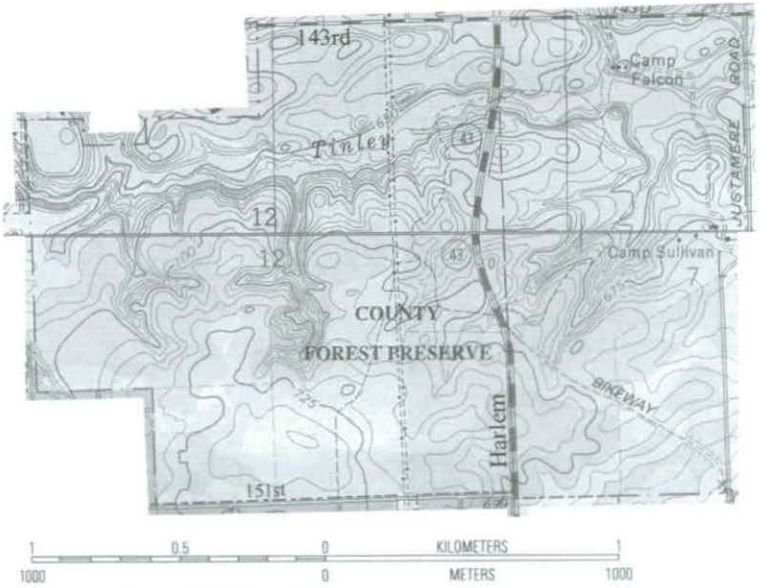
Glacial History/Topography/Forest Soils

The topography of northeastern Illinois is the result of the Wisconsinan Glacier that arrived 75,000 ybp and departed 12,000 ybp. This glaciation left the Chicago region with a complex of ancient beach ridges, outwash plains and a complex morainal system forming the periphery around the southern end of Lake Michigan. TCFP is situated on the Tinley Moraine of the Northeastern Morainal Division of Illinois (Schwegman *et al.*1973;Willman and Frye, 1970). During the last stages of Wisconsinan glaciation, four meltwater lakes were dammed by the Tinley Moraine. One of these lakes, glacial Lake Tinley, cut a drainage outlet through Tinley moraine east to Stony Creek and the Sag Channel forming Tinley Creek. A series of steep bluffs and ravines rising from 650 feet at the stream bed to 700 feet at the ravine edge illustrate the erosional effect of the meltwater (Bowles and Radke, 1992).

The ravines are surrounded by flat to gently rolling topography with perched water tables and generally poor drainage described as flatwoods.

Soils of the TCFP formed over an ancient glacial lake bed under wetland, prairie, and forest conditions. Flatwood soils are underlain with a rather semi- impervious layer of clayey glacial till promoting vegetation adapted to periodic high water tables and wet/dry conditions. Trees growing in these soils must adapt to seasonal water availability because both flooded and droughty conditions occur during the growing seasons (Mapes, 1976). Knolls and slightly elevated topography can support species associated with better drainage. The flatwoods are represented by Morley/Ashkum and Beecher/Markham silt loams on mostly two to five percent topography.

Minor topographic, drainage, and soil patterns segregate the flatwoods into a mosaic of forest associations. The species compositions found at TCFP are similar to those found in the lower Mississippi River Valley, Appalachian forests and forests of more eastern distribution, albeit on a much more fragmented, smaller scale. The Society of American Foresters lists several forest types with species associations found in southern bottomland forests, southern Appalachians and northern wet forests. Remnants of these forest associations that have been observed in the flatwoods area are Type 93 (sugarberry – American elm – green ash; Beecher/Markham silt loams 0-5% slope), Type 52 (white oak – black oak – red oak – scarlet oak – chestnut oak; Markham silt loam 5-10% slope), and Type 39 (black ash, - American elm – red maple; Morley/Ashkum 2-5% slope with perched water table) (Erye, 1980; Mapes, 1974). Braun (1950) and Bryant (1990,1999) discuss Tennes-



CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
Tinley and Palos Park Illinois Quadrangles, 7.5 Minute Series
USDI Geological Survey, 1993

Figure 2. Topographic map of the study site and areas of botanical interest.

see and Kentucky bottomland forests dominated by *Celtis laevigata* with component species *Q. lyrata, Q. shumardii, Q. palustris, Q. pagoda, Q. stellata,* and *Q. falcata. Quercus coccinea* and *Q. montana* are also mentioned but are more typical of surrounding uplands (Fralish and Snyder, 1993; Bryant, 1999). The bottomland forests of the Middle Tennessee, and Kentucky discussed by Bryant (1990, 1999) and Chester and Schibig (1997) possess many species seen on TCFP silt loam soils. Among those found at TCFP are *Celtis laevigata* var. *smallii* (sugarberry), *Celtis occidentalis* L. (hackberry), *Ulmus americana* L. (American elm), *Fraxinus pennsylvanica* Marsh (green ash), *Fraxinus americana* L. (white ash), *Tilia heterophylla, Q. palustris, Q. bicolor, Q. muhlenbergii,* and *Platanus occidentalis* L. (sycamore).

Southern Oaks

Among the TCFP oaks found growing with *Celtis laevigata* var. *smallii* is *Quercus lyrata.* It is found in southern Illinois and in scattered disjunct populations along the Mississippi River in west-central Illinois (Mohlenbrock, 1986). At TCFP, there are over one hundred trees of this species represented in all size classes spread out over a 1.5 square kilometer area. The tallest trees range between 20-23 meters in height. The oldest tree examined was 112 years old, aged with a resistograph coring device handled by forester Jim Tresouthick. The tree's DBH was 28in (0.7m), the largest of the southern oaks (see photograph). Putative hybrids between *Q. macrocarpa* (bur oak) and *Q.lyrata* have been found in the preserve with specimens deposited at the Field Museum of Natural History in Chicago. *Quercus* x *megaleia* Laughlin, another hybrid, has been reported from TCFP, but is now thought to be just a form of *Q. lyrata. Quercus lyrata* also associates with *Q. texana, Q. macrocarpa, Ulmus americana, Fraxinus nigra* Marsh (black ash), and *Acer rubrum* var. *trilobum* K. Koch. (red maple), in the northern part of the preserve in a wet forest analogous to American Society of Foresters type 39 (Eyre, 1980).

Many trees growing in the flatwoods appear to be genetically mixed with *Q.macrocarpa* as one of the parents. One of the more confusing is the putative hybrid *Q.* x *guadalupensis* Sarg., involving a cross between *Q. stellata* and *Q. macrocarpa. Quercus* x *guadalupensis* is known only from populations in Texas where it was first discovered (Nixon and Muller, 1997). The range of variation in this apparent hybrid swarm tends to both extremes. Their more stunted growth, smaller outer diameter of the acorn cupules (<20mm), and more cruciform leaf morphology identify these trees. Field observations indicate that these putative hybrids may be found scattered across southern Cook County in wet forests. *Quercus stellata* is typically a southern species occurring in habitats ranging from dry sterile soil to hardpan clay flatwoods. It has been found as far north as central Illinois and north central Indiana (Mohlenbrock, 1986; Nixon and Muller, 1997).

Quercus shumardii is a species of floodplain terraces and moist alluvial bottomlands of the southern U.S. (Braun. 1950). It is found in the southern third of Illinois growing as far north as Jersey County (Shepard, 1993). Disjunct populations of the species purportedly grow in Lower Michigan and northern Indiana (Jensen, 1997). At TCFP, the *Q. shumardii* population numbers under 30 mature trees where it is found on Beecher silt loam. Individual trees frequently attain 22-24m, and 0.6 DBH (see photo). One tree was aged at 85 years with a resistograph. Acorn variation is seen within the population including an ellipsoid shaped form with a shallow cupule resembling the description of *Q. shumardii* var. *stenocarpa*

Laughlin. Leaf forms range from typical forms to those resembling *Quercus acerifolia* (E.J. Palmer) Stoynoff & Hess.

A common tree growing with *Juglans nigra* L. (black walnut) on the poorly drained Beecher soil is the putative hybrid *Q. rubra* x *Q. shumardii* (*Q.*x *riparia* Laughlin). Like flatwood populations of *Q. macrocarpa, Q. rubra* populations are genetically mixed. Many display bark, leaf, and acorn morphology intermediate with *Q. shumardii*. *Quercus rubra* populations growing in the better drained ravines represent typical northern expressions of the taxon.

Photo © David Shepard

Quercus lyrata 112 years old growing in wetland

Quercus montana has the widest range of the southern oak taxa within the preserve covering 2.2km between populations. It is found in American Foresters type 93 and 52 associations. It grows with *Celtis laevigata* var. *smallii, Q. lyrata,* and *Q. shumardii* on Beecher silt loam and *Acer saccharum* Marsh (sugar maple) and *Tilia heterophylla* on the better drained sites of Morley/Ashkum. On more upland Markham silt loam, *Q. montana* occurs with *Q. rubra, Q. coccinea, Q. alba, Q. velutina,* and *Q.* x *guadalupensis*. Although it numbers fewer than 40 mature trees, seedling recruitment is frequently observed. *Quercus montana* is on the endangered species list in Illinois where it grows stunted on dry slopes in the Shawnee National Forest. The nearest population to Tinley Creek is in unglaciated Brown County, Indiana where it grows with *Q. coccinea.* A tree of the hybrid *Quercus x saulei* (*Q. montana* x *Q. alba*) aged at 93 years was found growing with *Q. coccinea, Q. alba,* and *Q. bicolor* (see photo).

Photo © Guy Sternberg

The author standing next to *Quercus shumardii* in flatwoods

Among the most interesting and controversial oak taxa of the Chicago region is *Q. coccinea.* Populations of this taxon at TCFP represent a southern form or variety of the species whose center of distribution lies predominately in the southern Appalachians and Ozark Mountains. The closest populations reside in the Shawnee National Forest of extreme southern Illinois. Data from studies of *Q. coccinea* (Shepard, 1993, 2001) reveal major morphological differences between southern Appalachian/Ozark forms of this species and those identified as *Q. coccinea* or *Q. ellipsoidalis* (Hill's oak) in northern Illinois. These more southern forms are typified by larger 6 to 8mm long buds with pubescent tips, acorns with prominent concentric rings, and greater height. The trees also illustrate more southern characteristics by holding their brilliant red foliage through late November (cover photo).

While *Q. coccinea* is generally associated with dry upland sites in the Appalachians, it occasionally can be found in flatwoods or low mesic forests of alluvial terraces (Bryant, 1990) (see photo below). At TCFP it grows in a mixed mesophytic forest community with *Q.bicolor, Q. alba, Fraxinus pennsylvanica, Fraxinus americana, Tilia americana* L. (American basswood), *Tilia heterophylla* and *Acer saccharum* Marsh.(sugar maple) (see photo on opposing page). In another part of the preserve individual trees grow with a 100 year old *Liquidambar styraciflua*. On 5-10% slope Markham soil it forms a component of a remnant white oak - black oak - red oak- scarlet oak – chestnut oak association (Eyre, 1980).

Growing with *Celtis laevigata* var. *smallii, Q. palustris,* and *Quercus* x *riparia* are single specimens of *Q.* affn. *pagoda* and *Q.* affn. *falcata.* Both trees show distinct introgression with *Q. velutina* particularly in bud pubescence, and the more glabrous abaxial surface of the leaf. Leaf forms of both trees are unique and stand out among the other oaks. *Quercus* affn. *pagoda* is one of the larger diameter species of the southern disjuncts measuring just over 0.6m DBH. Putative hybrids of both taxa can be found at TCFP with most involving either *Q. rubra* or *Q. velutina.* Both *Q. pagoda* and *Q. falcata* can be found in the extreme southern Illinois counties (Mohlenbrock, 1986).

Most unusual among the oaks is the occurrence of *Q. texana,* represented by eleven trees. At TCFP it grows alongside *Q. lyrata, Fraxinus pennsyvanica, Ulmus americana, Acer rubrum* var. *trilobum,* and *Fraxinus nigra* on Morley silt loam with a perched water table. The trees average between 20 to 24 meters in height and hold their leaves green through late November. It wasn't recognized as a species until 1927 and was formerly known as *Q. nuttallii* (Jensen, 1997). It is a bottomland species typical of the lower Mississippi River Valley occurring in Tennessee, Arkansas, Louisiana, and Texas. The acorn and leaf morphology are unique in this species.

Photo © David Shepard

Wet flatwood forest with a 30-meter *Quercus coccinea* at center.

Analysis of southern species

The historical information, species diversity, distribution, forest ecology, hybridization, and age coring presented in this paper concerning the southern forest species at TCFP suggest that they are native and not planted or introduced. There are no records of these trees being planted by the Cook County Forest Preserve District, (Dan Weber, personal com.) or by individual land owners dating back to the 1860's (Bettenhausen, 2002). The southern oak taxa occurring at TCFP are not and have not been typical trees used in forestry or the landscape industry in the Chicago area or elsewhere in Illinois. (Central Illinois Tree Council, 1998; Paul

Photo © David Shepard

The upper crown of the 93 year old *Quercus xsaullii.*

Deizmann, Illinois Department of Natural Resources, Forester, personal com.). Most are difficult to identify let alone grow several hundred kilometers north of their range (Dirr, 1983). Aerial photos from 1939 and 1940 reveal some land clearing and agricultural activity, but lack sufficient detail to identify any nursery plots or the existence (or non existence) of individual trees. Moreover, many of the southern species growing in the purported agricultural and cleared sites have existed since 1925 with at least one dating back to the late 1890's. The degree of hybridization and introgression observed between northern and southern taxa points to their intermixing over many generations. Horticulturally establishing and maintaining such a complex flatwoods forest following precise species associations, soil variations, and moisture gradients is unlikely.

The occurrence of these southern disjuncts should not be unexpected. Species with typically southern and eastern affinities are not uncommon to the southern Lake Michigan region and have been well documented. Migrational paths of southern species have been discussed by various botanists. Peattie (1922), and Catling and Spicer (1988) have cited populations of coastal plain flora occurring throughout various localities. Evidence of migrations of southern forest taxa into the upper Midwest is apparent when one looks at the number of disjunct species seen at the lower end of Lake Michigan from southern Cook County Illinois across northern Indiana to southern Michigan. *Styrax americanum* Lam.(American snowbell), *Populus heterophylla* L.(swamp cottonwood), and *Fraxinus profunda* Bush (pumpkin ash) occur as disjunct populations in the Kankakee River valley of northern Indiana and Illinois (Phillippe et al., 2003). Disjunct populations of *Q. shumardii* occur scattered throughout northwest Indiana and lower Michigan (Jensen, 1997). Microclimatic effects of Lake Michigan have allowed *Sassafras albidum* Nutt.(sassafras) and *Nyssa sylvatica* Marsh.(black gum), more typical of forest communities much further south, to grow on sandy ridges in southern Cook County Forest Preserves (Shepard, 2001).

So how did all these southern trees get up into northern Illinois, if someone didn't plant them? The same way bogs, prairies, and deciduous trees got there - migration during major climatic shifts. It is known that deciduous trees migrate up river valleys. The range distributions of *Carya illinoensis* (Wang.) K. Koch (pecan) and *Q. lyrata* are good examples (Mohlenbrock, 1986). One possible hypothesis suggests a Gulf Coastal Plain route (Reznicek, 1994).

The deciduous Forests of the Northeastern Morainal section of Illinois developed sometime between 8-11,000 ybp in waves of migration from the unglaciated forests of the Coastal Plain, Appalachian, and Ozark Mountains following the retreat of the Wisconsinan glacier 12,000 ybp (King, 1981; Anderson, 1991). Forest ecosystems began colonizing the morainal regions probably around 11,000 ybp beginning with cool and wet ash/elm/maple communities and ending with the progressively warmer and drier oak/ hickory associations. Migrations of southern deciduous forests with Appalachian/Ozark affinities may have developed around the lower end of Lake Michigan just prior to or during the early stages of the Hypsithermal Period which was the warmest period beginning about 8,000ybp (Fuller, 1935). These southern bottomland species may have followed a migratory path of extensive alluvial silt loam deposits along the postglacial Mississippi – Illinois - DesPlaines - Kankakee River – Stony Creek (Cal Sag Channel) – Tinley Morainal Lakes/Creek bed (Wilman, 1971; Reznicek, 1994). The warmer temperatures, higher relative humidity and ample soil saturation levels contributed by ancient glacial morainal lakes may have provided the habitat for species that flourish on silty clay loams . Progressively drier climatic conditions (grassland formation of 5-8000ybp) of the period, coupled with annual burning by native Americans may have prevented further development and expansion of these taxa (Anderson, 1970). An 1834 land survey indicated that the Tinley Creek forest was surrounded by tall grass prairie in presettlement times (Bowles and McBride, 2002).

As the climate shifted again to cooler temperatures of the present day, widespread hybridization with northern species such as *Q. macrocarpa*, *Q. rubra*, and *Q. velutina* may have begun to occur. This may have resulted in the subsequent disappearance of genetically "pure" forms of *Q.stellata, Q. pagoda,* and *Q. falcata*

which left only their genes behind (no pun intended). Sensitive forbs, shrubs, and grasses typical of southern wetlands would have been the first to disappear leaving only the deeper-rooted hardy trees. The most adaptable species survived by incorporating themselves into the savannah/forest ecosystems around suitable sites of the Tinley moraine. Their persistence may be due to the milder microclimatic effects of Lake Michigan, higher moisture levels in the soil, and delay in urban development of the region. Land clearing may have actually helped regeneration of these oak species when the native Americans and their fires were gone (Fralish and Snyder, 1993; Mclain and Elzinga, 1994). The dense second growth of the present day flatwoods indicates a substantial seedbank of biodiversity after disturbance. The heights of the canopy trees and their reproductive capacity illustrate the richness of the soil and the acclimatization of these southern species to the area as a whole. Recruitment is impeded by exotics not by soil oxidation or erosion caused by agricultural practices.

The origin of the southern species can only be hypothesized at this point. They may exist as last vestiges of forest communities long since gone. The initial remoteness of the area coupled with the taxonomic confusion of oak species in general may have kept the trees hidden from botanists for years. Just as northern Illinois bog species are considered examples of a previous colder climatic age, so are these southern species representatives of a warmer age. Their presence truly makes them ancient relicts in a land that time forgot.

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