The Vascular Flora of Pilot Knob State Preserve

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Pilot Knob State Preserve is a 365 acre (147 ha) area lying within the boundaries of Pilot Knob State Park. Located in north central Iowa near the northeast corner of Hancock County, this preserve resides on the eastern morainal system of the Des Moines Lobe left from the Wisconsinian glaciation. The vegetation of the preserve is primarily a deciduous woodland on rolling hills interspersed with wetland habitats in the hollows. Iowa's only floating bog is present in one of these hollows and supports numerous vascular plants uncommon to the state. Two species, Carex aphlaeae (Bailey) Bickn. and Drosera rotundifolia L., are currently known only from this site. The vascular flora of the preserve, studied from both field and herbarium collections, totals 422 species.

INDEX DESCRIPTORS: Pilot Knob State Preserve, Pilot Knob State Park, Iowa flora, floating bog.

Prior to European settlement, the territory surrounding Pilot Knob State Preserve was part of the hunting grounds of several Indian tribes, most notably the Winnebago. In the 1850's, European settlement first began to expand into this region of the state displacing the Indians. A detailed history of early settlement is provided in "History of Kossuth, Hancock and Winnebago Counties, Iowa" (Anonymous 1884). With this settlement came an almost complete elimination of the native vegetation through cultivation and drainage of the land.

This paper documents the historical and current status of the flora of Pilot Knob State Preserve. The vascular plant collections of previous workers have been added to my own collections, and this information has been integrated with the pertinent botanical literature to construct a comprehensive floristic survey of the preserve.

LOCATION

Pilot Knob State Preserve is a 365 acre (147 ha) area lying within the boundary of Pilot Knob State Park. The preserve is located in Hancock County, approximately 3.5 miles (5.6 km) east of Forest City. The main body of the preserve occupies the NE 1/4 of section 4 and the NW 1/4 of section 3, with several smaller contiguous holdings all in T-97N R-23W Ellington Township.

HISTORY

Pilot Knob likely served as a "pilot" or reference point for pioneer settlers moving into and through this region, and at an elevation of 1450 feet (442 m), the knob is a prominent landmark above the surrounding terrain. Early settlers and natural historians initially referred to this geological prominence as Pilot Mound, but by the 1900's Pilot Knob had become the more widely accepted name for this local landmark. This name change may have been instigated by two local newspaper editors to distinguish the feature from a small town in Iowa also called Pilot Mound (Smith and Bovbjerg 1958, Balsanek and Stoneburner 1969), although this could not be verified.

First dedicated as a state park in 1924, the entire park was also given state preserve status on 23 September 1968. In 1978 an adjacent 160 acres (65 ha) in Winnebago County was acquired as parkland. This land is not included within the boundaries of the preserve.

GEOLOGY

The geological setting of Pilot Knob State Preserve is one of the most recent glacial landscapes in the state. Geological features in this area began forming approximately 14,000 years ago due to the movement into Iowa of the Des Moines Lobe of the Wisconsinian ice sheet which was nearly gone from the state 1,000 years later (Prior 1976). During its brief intrusion into the state, the ice sheet covered the location of the preserve and much of north-central Iowa.

As the Wisconsinian ice sheet retreated northward it left behind deposits of glacial drift which had been carried from regions to the north. In areas where the ice melted slowly, or was stagnant for some time, large amounts were deposited forming series of morainal ridges. Pilot Knob is the highest point of one of these morainal series, above almost 300 feet (92 m) of drift on the eastern lateral moraine of the Des Moines Lobe. The complexity of the glacial landscape in this area has led the Iowa Geological Survey to now refer to this moraine as the Altamont-Bemis (?) Moraine Complex (Kemmis 1981). The high relief landform is characterized by a range of rolling hills and interspersed hollows often lacking drainage outlets.

Kemmis et al. (1981) have tentatively classified the drift deposits of the Des Moines Lobe as the Dows Formation, consisting of four members with the preserve most likely underlain by the Pilot Knob Member. They state that where Pilot Knob Member deposits occur, they are always the uppermost glacial sediments in the area and are composed mainly of "...coarse gravel, glaciofluvial deposits, mostly sands and gravels, although till balls and/or thin beds of poorly-sorted, till-like sediments may occasionally occur."

SETTLEMENT VEGETATION

At the beginning of European settlement, Pilot Knob and surrounding territory most likely supported a substantial deciduous woodland with numerous wetlands and prairie openings present. An early report of this woodland by Burnap (1903) recalls his journey by prairie schooner in 1857 beginning near Osage on the Cedar River; "I embarked upon a treeless sea of land... until after a 40 mile cruise we came to wooded land among the groves around Rice Lake and Pilot Mound."

The extent of this wooded land as mapped by Trygg (1964) from surveyor's original plats and field notes, shows a forested area interspersed with marshes of approximately 40 square miles (64 km²). This area, which includes Pilot Knob, is flanked on the west, south, and east by the Winnebago River (historically known as Lime Creek) which may have acted as a natural fire break, reducing fire occurrence and allowing forests to persist in an area otherwise dominated by tallgrass prairie.

In another account of the terrain, Upham (1881) describes "a very rough wooded belt two or three miles wide, for a distance of six miles west from Rhode's Mills to Pilot Mound." This apparent decrease of woodland, 25 years after initial settlement, may be explained by the ongoing exploitation of this wooded resource by the settlers of the region. Pammel (1925a), in relating the history of Hancock and Winnebago Counties, states "Probably all of the original trees of the Pilot Knob area were used for the construction of the pioneer homes in..."
Ellington Township."

PREVIOUS STUDIES

Several botanical investigations of Pilot Knob have been conducted since the turn of the century. MacBride (1903) presented an inventory and brief description of the woody vegetation of Pilot Knob and surrounding area. Pamell (1925b, c, d, e) provided a more focused discussion on the vegetation and chronicled a large number of woody and herbaceous species which he had observed in or near the present preserve boundaries. Unfortunately, few voucher specimens are known, and the literature concerning locality information is often ambiguous.

The first floristic survey at Pilot Knob was conducted by Grant and Thorne (1955) and encompassed Dead Man's Lake where they described a Sphagnum bog. A total of 75 species of vascular plants was reported. The physical and ecological aspects of the lake and bog were studied by Smith and Bovbjerg (1958) and also Smith (1962) who provided a lengthy discussion on the vegetation and occurrence of particular species in these habitats.

Blagen (1967) studied the habitat of the red-backed vole within the park. In the process he developed a substantial plant list for the area and states that specimens were collected and turned in to the Botany Department (Blagen 1967, in litt. 1987). However, no voucher specimens from his study have been located.

PLANT COMMUNITIES

The plant communities of the preserve have been subject to much human modification, both direct and indirect, through time. Beginning with the timber harvest by pioneers and also pasturing of cattle in the early 1900's (Smith 1962), modifications to the vegetation continued with work done by the Civilian Conservation Corps (CCC) active at Pilot Knob in the mid 1930's. The CCC built a number of stone structures including buildings, entrance portals, and a 35 foot (11 m) observation tower which still stand. They constructed roads and trails and also planted approximately 20,000 trees at Pilot Knob in 1934. Four thousand of these were "hard maple" from Rice Lake State Park (Anonymous 1934). Later, an additional 8,000 trees sent from the CCC camp at Eldora were planted by several county relief men. These were mostly seedlings and consisted of red oak, bur oak, and ash" (Anonymous 1935). This construction and landscaping clearly had an impact on the plant communities of the preserve.

Several other factors have impacted the vegetation including cultivation, wetland alteration, fire suppression, and additional species introductions each of which are discussed under the appropriate plant community.

Eight extant plant communities in Pilot Knob State Preserve are recognized in this study (Figure 1). In addition, an extirpated prairie community is also recognized.

Floating Bog

Iowa's only known floating bog is located in the western half of Dead Man's Lake, in the southwestern corner of the preserve. It occupies approximately 3 acres (1.2 ha) surrounded by marsh. Smith (1962) reported the mean thickness of the floating mat to be 2 feet (0.6 m) and the pH of the interstitial water as acidic but variable. A low pH of 4.1 near the center of the mat can be 5.7 after spring thaw runoff with the basin receiving most of its water directly as rain (Smith 1962). The vascular flora of the bog supports several Salix spp. and an herbaceous layer commonly composed of Carex leucosticta, Thelypteris palustris var. pubescens, Triadenum frutes, and Tropa latifolia. Species common to the bog but not frequent in the state include Carex chordorrhiza, Eriophorum gracile, and Potentilla palustris. Two species on the bog, Carex echinata and Drosera rotundifolia, are reported nowhere else in the state. Grant and Thorne (1955) suggest that part of the mat may have been removed although Smith (1962) states the attempt was halted due to lack of funding.

Open Water

The areas of open water support an assemblage of submersed and floating-leaved vascular plants. Commonly encountered species include Nuphar luteum spp. variegatum, Nymphaea tuberosa, Potamogeton spp., and the free floating Lemna minor and Spirodela polyrhiza. The only natural body of open water in the preserve is the eastern half of Dead Man's Lake. It occupies approximately 4 acres (1.6 ha) adjacent to the bog and becomes heavily vegetated in the summer. Northeast of Dead Man's Lake is Pilot Knob Lake. This lake and connecting ponds form a larger expanse of open water and was constructed in 1938 using Works Progress Administration or National Youth Administration labor (Balsanek and Stonehurster 1969).

Marsh

Scattered marshes are found throughout the preserve in the undrained hollows between morainic hills, along the outer perimeter of the floating bog, and at the shoreline of both Dead Man's and Pilot Knob Lake. The vegetation is characterized by a flora composed of Carex spp., including C. atrovenosa and C. veicaria, Eleocharis spp., Polygonum spp., and Scirpus spp. Frequent along the shoreline is Sagittaria latifolia and the shrub Cephalanthus occidentalis at Dead Man's Lake.

Marsh, or a similar wetland community, originally covered what is now the site of Pilot Knob Lake. Fitzsimmons (1926) mapped and described a marsh meadow clearly coinciding with the present margins of the lake. His plan suggested "this area to be left un molested and at no time to be drained, as its value lies in its present open, boggy condition . . . ."

The marsh and surrounding vicinity of Dead Man's Lake has also been impacted as this area was historically used for recreation. Fitzsimmons (1926), in a description of Dead Man's Lake, states "Constant use as a pleasant picnic place and the ruthless hand of man, have destroyed some of its boundary plant life." This may explain why Parnassia caroliniana (= P. glauca) collected by Bohumil Shimek on 17 August 1912 in 'Woods bordering Dead Man's Lake" has not been collected there since.

Mesic Upland Forest

This forest occurs on the moist, sheltered north slopes of the morainal hills and ridges within the preserve. The canopy is dominated by Tilia americana, and to a lesser extent by Quercus borealis and Quercus ellipsoidalis. A frequent subcanopy component is Ostrya virginiana. Commonly encountered herbaceous species include Desmodium glatinosum, Dicentra cucullaria, Solidago flexuosa, and in spring an abundance of Trillium nivale.

Dry Upland Forest

This forest occupies dry sites elsewhere than within the preserve. The canopy is dominated by Quercus alba, Q. ellipsoidalis, and Q. macrocarpa although Q. alba is restricted to a grove in the southeastern portion of the preserve west of the amphitheater. Pupulus tremuloides is of lesser importance in the canopy and Prunus serrulata is common in the forest subcanopy. The herbaceous flora is characterized by species such as Agastache isophyllarifolia, Circaea lutetiana spp. canadensis, and Dentaria laciniata.

Second Growth Forest

Located in the more heavily used northwestern portion of the preserve, this forest community is recovering from past disturbance. Young P. tremuloides and scattered Quercus spp. are colonizing the available area already occupied by a number of thicket forming shrubs. Included in this shrub assemblage are Coriaria americana, Prunus spp., Rubus glabr, Rubus spp., and Zanthoxylum americanum.

Old Meadow

The majority of the old meadow community is located west and
south of the campground on a rolling terrain of small hills. The area was cleared and cultivated in 1912-13, and planted to grains for wildlife after 1925 (Blagen 1967). By 1935-40 the area was a hay meadow (Johnson, A., pers. comm. 1986) and Blagen (1967) states that mowing ceased in 1961.

Presently, the vegetation is dominated by an herbaceous flora composed of early colonizers of mesic habitats. Included are *Asclepias syriaca*, *A. verticillata*, numerous *Aster* spp., *Conyza canadensis*, *Lespedeza capitata*, *Monarda fistulosa*, and an abundance of *Solidago* spp. Several species have been introduced for aesthetic reasons. A population of *Liatris ligulistylis*, occupying a meadow hillside, was transplanted from Myre Slough located northwest of Forest City. Other species found in the south ditch along the road to the campground were probably planted, as evidenced by their placement and/or low number of ramets. These taxa include *Gentiana andrewsii*, *Liatris pycnostachya*, *Phlox maculata*, and *Solidago riddellii*.

**Ruderal**

The ruderal community occupies areas of recent or ongoing disturbance. The ruderal species, many of Eurasian origin, form an herbaceous flora inhabiting lawns, mowed areas, trail and road edges, and other disturbed areas. Representative of this community are *Digitiaria sanguinalis*, *Lotus corniculatus*, *Lythrum nummularia*, *Matricaria matricarioides*, *Nepeta cataria*, and *Taraxacum officinale*. Also included in this community are non-indigenous woody plants such as *Pinus* spp., *Picea glauca*, and *Platanus occidentalis*. In addition, *Panicum virgatum* and *Sorghastrum nutans* have been seeded into disturbed areas of the preserve for erosion control. These populations are not native to the preserve and are also included in the ruderal community.

**Prairie**

Originally, native prairie occupied the summit and some flanks of Pilot Knob itself. This community is now extirpated within the preserve boundaries. This habitat is first alluded to by MacBride (1903) when he described a journey to the top of Pilot Knob: "Forests of oak and ash, linden and hickory spread all around diminishing as we ascend, until we reach the wind-swept summit, perfectly bare..." Fitzsimmons (1926) also recounts a prairie habitat on Pilot Knob when he stated "its summit, as it now exists, pierces through its timber cloak and provides an open expanse of sod-covered ground..."

With the suppression of fire, the surrounding forest gradually invaded the prairie. In a dedication speech for Pilot Knob State Park, Pammel (1925) briefly mentions a woody invasion by stating "Pilot Knob is the climax of the material left by the ice. Once a small bit of prairie, now overrun with hardy introduced plants. May it be restored." As recently as the late 1950s (ca. 1958), prairie vegetation still existed on the south slope, but was being invaded by trees and sumac (Johnson, A., pers. comm. 1986).

Bohumil Shimek made a number of voucher collections from this prairie knoll on 27 September 1902, 17 August 1912, and 30-31 August 1927. Representative taxa include: *Aster sericeus*, *Gentiana puberula* (= *G. puberulenta*), *Petasites hybridus* (= *Dactylis glomerata*), and *Polygala verticillata*.
The annotated catalogue of the vascular plants of Pilot Knob State Reserve is based upon field and herbarium research. Field study was conducted by the author during one full season from 29 May 1984 through 13 May 1985. Five additional collecting trips were taken on 23 August 1985, 1 May, 4 June, 15-16 September 1986, and 8 June 1987.

Two herbaria were searched completely for specimens from the study area: The University of Iowa (IA) and University of Northern Iowa (ISTC). Iowa State University (ISU) was searched in part for targeted families, genera, and species.

In the catalogue, nomenclature at family rank and below follows Eilerts and Roosa (in manuscript) and is arranged alphabetically. Pertinent synonyms, where necessary, are in brackets; common names are found in parentheses after the scientific binomials. An asterisk (*) preceding a binomial indicates an exotic Eurasian species. A plus sign (+) preceding a binomial indicates a species native to North America and usually Iowa, which has been introduced into the preserve.

The plant communities in which a species is found, are indicated in the catalogue by the following numbers: Floating Bog (1), Open Water (2), Marsh (3), Mesic Upland Forest (4), Dry Upland Forest (5), Second Growth Forest (6), Old Meadow (7), Ruderal (8), and Prairie (9). A question mark (?) in place of a numeral denotes unreliable plant community information from a voucher collection.

Capital letters following the numerals represent individuals who have collected at least a single specimen from the study area not reported by other collectors. Initials with corresponding name and period of collecting activity are as follows: (B) E. M. Begres (1968), (G) M. L. Grant (1952-59), (P) J. H. Peck (1981), (S) B. Shimek (1902-27), (T) R. F. Thorne (1952-57), (W) W. C. Watson (1984-87), (WO) B. O. Wolden (1948).

Bohumil Shimek has a series of collections dated 30 August 1927, and labeled Pilot Knob, Worth County. These collections have been included in the catalogue and it is presumed this was simply a mistake in labeling since (3) no prominence or feature of any kind called Pilot Knob has been found, past or present, within Worth County, 2) several other collections by Shimek bearing the date of 30 August 1927 are labeled Pilot Knob, Hancock County while still others of the same date are labeled Pilot Mound, Hancock County, and 3) the southwest boundary of Worth County is only 2.5 miles (3.5 km) away and may have caused confusion. These taxa collected by Shimek labeled Pilot Knob, Worth County which do not have another voucher specimen whose location is given as either Pilot Mound or Pilot Knob, Hancock County are indicated by an open circle (o) preceding the binomial.

A total of 422 species have been identified from Pilot Knob State Reserve, and each species is represented by at least one voucher specimen. The author's voucher specimens are deposited in the University of Northern Iowa Herbarium.
Excluded Flora

Numerous species have been excluded for a variety of reasons. Three excluded species are reported by Grant and Thorne (1955): Potamogeton illinoensis Morong. (Thorone 14581) which was evidently collected but the voucher was not located; Pyrus malus (Michx.) Wild. [= Aronia malus (Michx.) Ell.] (Grant 12534) was a misidentified Prunus sp. seedling, probably P. serotina; and Triglochin maritima L. which was reported from the bog mat. However, it was stated this species was overlooked and not collected.

Voucher collections of seedlings have been excluded as was a putative hybrid Aster (Wolken s.n.) because of questionable parentage. A 1940's report of Cyrtopygium reginae Walter (Cole, D., pers. comm. 1987) is lacking a voucher collection and has also been excluded.

Unvouchered species reported in the literature have been excluded (McBride 1903, Pamml 1925b, c, d, e, Smith 1962, Blagen 1967). Many of these citations lack specific locality information and cannot be reliably confined to the present boundaries of the preserve. The literature citations which do have adequate locational information are given with habitat description if available.

Both McBride (1903) and Pamml (1925b) lack sufficient information for location of species within the preserve. Pamml (1925c) reports "black currant" (Ribes americanum P. Miller) and "alternate-leaved dogwood" (Cornus alternifolia L. f.) to occur within the present boundaries of the preserve. Pamml (1925d) also reports "wild rice" (Zizania aquatica L.) "which at one time was common in Dead Man's Lake" and "patience dock" (Rumex palacontus L.). In addition, Pamml (1925e) reports Scirpus atrovirens Willd., Menyanthes trifoliata L., and Lythrum alatum Pursh "in the bog of Dead Man's Lake." He probably also included the open water habitat of Dead Man's Lake in this description. Smith (1962) reports Potamogeton folius Raf. from Pilot Knob Lake.


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References


1934. Trees will be moved to Knob from Rice Lake. Forest City Summit. May 10. 68(21):1.


ADDENDUM

During the 1988 field season, plot sampling was conducted by D.R. Farrar and C.L. Johnson-Groh at Pilot Knob State Preserve for the Iowa State Preserves Advisory Board. This work revealed an additional species of note: Botrychium dissectum Sprengel f. obliquum (Muhl.) Fern. (Grape fern). A voucher specimen collected by D.R. Farrar is deposited in the Iowa State University Herbarium.