

WETLAND ASSESSMENT AND INVENTORY OF THE POKEGAMA CARNEGIE WETLAND STATE NATURAL AREA, DOUGLAS COUNTY, WISCONSIN

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Abstract: *The Pokegama Carnegie Wetland State Natural Area (SNA) is one of 590 properties designated as a state natural area in Wisconsin and has been infrequently studied. The Wisconsin Floristic Quality Assessment (WFQA) and the Wisconsin Wetland Plant Biotic Index (WWPBI), developed by the Wisconsin Department of Natural Resources (WDNR) were used during the assessment of the wetland plant community types found at the Pokegama Carnegie Wetland State Natural Area. The WFQA is a numerical value and was based on species diversity and composition. It was designed to compare the floristic quality between similar sites and for tracking changes at the same site over time. The WWPBI is a multi-metric index based on relative importance values (IV) (percent cover and frequency of occurrence) of nine community attributes based on taxonomic divisions.*

*The two primary measurements of the WFQA are the Mean C and the Floristic Quality Index (FQI). The alder thicket values had a Mean C of 5.42 (transects + meander searches) and 5.34 (transects only) with an FQI of 60.64 (transects + meander searches) and 50.70 (transects only). The sedge meadow values had a Mean C of 5.24 and a FQI of 45.37 (*Carex lacustris*) and a Mean C of 6.24 and FQI of 35.81 (*Carex buxbaumii*). These were exceptional values when compared to other wetland types surveyed in Wisconsin. The floristic quality assessment clearly indicated a wetland community of high value. Invasive species were infrequent and most commonly observed in disturbed areas. However, some of the rare, threatened and endangered species were also found in these same disturbed areas.*

The WWPBI values for the alder thickets were in the moderate range in comparison to other wetland types investigated in Wisconsin. This model was not as meaningful as the assessments discovered through the WFQA measurements described above. The characteristics of the alder thicket community did not match the vegetative conditions found in depressional wetlands for which this assessment tool was created.

The plant communities of the Pokegama Carnegie Wetland State Natural Area (alder thickets, boreal forest remnants, aspen forest groves and two types of northern sedge meadow) represent an outstanding natural resource for the region and State. A total inventory across all community types included 318 taxa, representing 161 genera and 56 families.

Keywords: wetland assessment, Pokegama Carnegie Wetlands, Wisconsin Floristic Quality Assessment, Wisconsin Wetland Plant Biotic Index, species diversity

INTRODUCTION

The Pokegama Carnegie Wetlands State Natural Area, hereafter referred to as Pokegama SNA, was located in Douglas County approximately 6.5 kilometers southwest of Superior, Wisconsin. The Pokegama SNA was created in 2006 and jointly owned by Douglas County and the Wisconsin Department of Natural Resources (WDNR). This wetland complex was comprised of a north and south unit of 632 hectares in the Lake Superior Coastal Plain. This study was primarily conducted on the 524 hectares of the south unit, where there were extensive alder thicket communities with infrequent and sporadic sedge meadows complexes. The north unit had extensive sedge meadows with large populations of the threatened species *Petasites frigidus* var. *sagittatus*. The north unit is also undergoing a large scale forest restoration, required by the WDNR to mitigate the impacts of transmission lines erected by the American Transmission Company. An 8-hectare, even-aged *Populus tremuloides* grove was being converted to a later-stage boreal forest consisting of *Picea glauca* and *Pinus strobus* with lesser amounts of *Abies balsamea* and *Thuja occidentalis*. In addition, a 16-hectare *Alnus incana* thicket was being converted to a coniferous forest of *Larix laricina*, *Picea mariana*, and *Thuja occidentalis*.

The Pokegama SNA was one of 590 properties designated as a state natural area in Wisconsin. It has received special protection due to its high concentrations of rare plants, some of which occur nowhere else in the Lake Superior basin of Wisconsin, as well as its sensitivity to anthropogenic disturbances. The WDNR had limited knowledge on the flora of the Pokegama region, as it does for the vast majority of its state natural areas (R. Hoffman, personal communication).

These attributes amongst others, led to a partnership between the University of Wisconsin – Superior, the Lake Superior Research Institute and the WDNR/SNA program in selecting Pokegama Carnegie Wetlands for this combined wetland assessment and floristic inventory project. Collaborated objectives of the project were: field test the Wisconsin Floristic Quality Assessment for Biotic Integrity; field test

the Wisconsin Wetland Plant Biotic Index; and to document the vascular species of the Pokegama SNA including mapping any rare plants.

Site Description

The Pokegama SNA is a diverse wetland on the Lake Superior Coastal Plain that is composed primarily of two plant communities: alder thickets and boreal forests. These level, red-clay plains are poorly drained and are situated between the headwaters of the Pokegama and Little Pokegama rivers. These two rivers flow approximately 10 kilometers into the St. Louis River Estuary at the head of Lake Superior (Figure 1).

The tall shrub wetlands of *Alnus incana* and *Salix spp.* had the greatest coverage on the Pokegama SNA with small patches of open sedge meadow dominated by coarse leaved *Carex spp.* and *Calamagrostis canadensis*. Small, boreal forest "islands" dot the wetland with *Pinus strobus*, *Pinus resinosa*, *Picea glauca*, *Larix laricina*, *Betula papyrifera*, *Populus balsamifera*, and *Populus tremuloides* being the most common. Of special significance are the numerous populations of rare plants occurring within the wetlands. Rare species observed by Epstein, et al. (1997) included: *Caltha natans*, *Eleocharis nitida*, *Geum macrophyllum*, *Juncus vaseyi*, *Mertensia paniculata*, *Petasites frigidus* var. *sagittatus*, *Ranunculus gmelinii*, *Salix planifolia*, and *Sparganium glomeratum*.

METHODS

Movement through the site was difficult as more than 60% of the area consisted of 3 to 5 meter tall alder thickets. Gas-lines, snowmobile trails and non-designated ATV trails criss-crossed the Pokegama SNA.

These disturbed areas were surveyed along with the natural plant communities, and species were recorded when observed. These disturbed areas were divided into wet or dry sites by level of soil saturation.

We employed two primary sampling techniques in order to collect information about the plant communities. These sampling techniques are described below. Unknown specimens were collected and identified in the lab. All unknown specimens were transported temporarily to the University of Wisconsin-Stevens Point for positive identification by Drs. Emmet J. Judziewicz and Robert Freckmann.

Meander Search for Rare, Threatened, Endangered (RTE) Species

The Pokegama SNA was delineated and classified into six separate field sections based on plant community homogeneity and practical access to alder thicket aggregates. Five of the six field sections were investigated during the mid-late summer months of 2008. The final field section was surveyed in the spring of 2009. A random pattern was walked within each field section with a focus on covering all unique areas (Goff et al. 1982). Species were recorded when observed, and listed by plant community or disturbance zone. Geographic positioning system (GPS) readings were taken and recorded for all rare, threatened and endangered species. During these searches, a special note was taken to list non-native species including information on the size and extent of populations impacting the Pokegama SNA wetland complex.

Each field section was visited once (9-10 hrs/section). It would have been desirable to re-sample each field section several times to capture phenological intervals. Though we are confident that the species list was comprehensive, we are less confident in providing a complete geographic representation of the rare plant species, as some were likely in a dormant or less conspicuous state when surveys were conducted.

Wisconsin Floristic Quality Assessment (WFQA)

WFQA was conducted on the alder thicket and northern sedge meadow plant community types found on the site. This assessment is one method for evaluating the biotic integrity of a site. It should not be construed that the WFQA is a final measurement or a complete analysis of the study area. The technique

can be used to compare the floristic quality between similar sites and for tracking changes at the same site over time.

This WFQA method requires an accurate and complete species inventory of the site based on homogeneity of community type. The method is based on species conservatism. Bernthal (2003) described species conservatism as, *“the most conservative species require a narrow range of ecological conditions, are intolerant of disturbance, and are unlikely to be found outside un-degraded remnant natural areas, while the least tolerant conservative species can be found in a wide variety of settings and thrive on disturbance”*. A numeric value from 0-10 has been designated by leading experts for each vascular species in Wisconsin and is called the Coefficient of Conservatism (C of C) (Bernthal 2003).

There are two formulas that were used in order to create a **Mean C** and a **Floristic Quality Index** (FQI) for each plant community type.

$$\text{Mean C} = \Sigma (c_1 + c_2 + c_3 + \dots c_n) / N$$

In the formula, **c** represents the Coefficient of Conservatism for each native species, while **N** is the total number of native species on the site.

$$\text{FQI} = \text{Mean C} * \sqrt{N}$$

The Floristic Quality Index is calculated by multiplying the Mean C by the square root of the total number of native species.

Non-native species were included in the species list and received a Coefficient of zero (0), but had no influence on the Mean C or FQI calculations.

Wisconsin Wetland Plant Biotic Index (WWPBI)

The WWPBI was developed as a rapid assessment of the plants found in depressional wetlands in Wisconsin. Nine plant community attributes were selected based on their response to human land use practices and disturbances. There is a heavy emphasis on the aquatic plant zones and their dominance and importance values (i.e. emergent, submergent, floating leaf).

Quantitative analysis was used for the WWPBI assessing frequency, percent cover, and importance values for individual species in the alder thickets. A series of 41 (1m x 1m) quadrats were randomly placed for evaluation. A gas pipeline crosses through the Pokegama SNA from the southwest corner to the northeast center of the study area. Twenty of the forty-one quadrats were placed along four transects that ran parallel to this central gas pipeline. These transects started at least 20 meters east and west of the pipeline, to avoid any edge effects. In addition, the quadrats were approximately 200 meters apart along these transects to cover the entire length of the pipeline. The other 21 quadrats were randomly selected independent of the gas pipeline and penetrated further into the alder thicket plant community.

Index calculations

There is a heavy reliance on importance values (IV) in the development of the WWPBI metric. Relative frequency (RF) is calculated by the presence of an individual taxon in each quadrat, measured against the total number of quadrats surveyed. Relative Cover (RC) is based on total amount of coverage in all plots per taxon, measured against the total amount of coverage available in all plots. The importance value provides a quantifiable number in order to rank the more significant taxon to the function of the wetland. In order for a taxon to receive a high IV, both the RF and RC must have high values.

We used the vegetative sampling techniques and importance value calculations of the alder thickets to calculate the WWPBI in comparison to other wetlands. Hauxwell, et al. (2004) field tested the WWPBI and developed a ranking system from very poor to excellent utilizing data on 17 depressional wetlands in Wisconsin.

Transect/quadrat Sampling

Quadrats sampled were used to further assess the dominance and cover of species present in the alder thickets. Within each quadrat, all vascular species were identified to the lowest taxonomic level possible. Percent cover was estimated visually for each taxon according to a modified Braun-Blanquet cover class method (Braun-Blanquet, et al. 1932): 1 to <5% (rare), 5 to <25% (occasional), 25 to <50% (common), 50 to <75% (abundant), 75 to 100% (dominant). Total percentage in each quadrat could exceed 100% because canopies of different species overlap one another. If a plant was not identifiable in the field, it was collected, and identified at the Donald W. Davidson Herbarium (SUWS). Plant nomenclature was based on *Flora of North America* (1993+). When the *Flora of North America* was not available, Wetter et al. (2001) was consulted for nomenclature.

RESULTS

Wisconsin Floristic Quality Assessment (WFQA)

A WFQA of the alder thickets and northern sedge meadows types was conducted at the Pokegama SNA. The WFQA measures species richness and tolerance/intolerance of species due to anthropogenic disturbances.

Mean C and FQI are reported in the following ways:

- a) Alder thickets – include meander searches and belt transect/frame quadrat techniques

- b) Alder thickets – belt transect/frame quadrat
- c) Northern sedge meadow (*Carex lacustris*) – meander search
- d) Northern sedge meadow (*Carex buxbaumii*) – meander search

Alder Thickets

Eggers and Reed (1987) correlated floristic diversity in alder thickets with the degree of shrub canopy closure. They found that with a denser canopy, species diversity declined. At Pokegama SNA there were extensive areas of extreme canopy closure, but patches of sedge meadow and numerous forest islands punctuated even these thickets. These features of Pokegama SNA characterize the following results.

The WFQA of the alder thickets was measured in two different ways. The first WFQA analysis was conducted using only plant transect/quadrat data. The second WFQA analysis combined the results from the transect data with meander searches.

In the first analysis, the Mean C measurement was 5.34 (transects only), while the second analysis was 5.42 (transects + meander searches). The FQI measurements were greater during the combined methods at 60.64 versus 50.70 for transects alone. The increase in FQI was based on an addition of 40 taxa from the meander search. Species with high C values such as *Caltha natans*, *Carex disperma*, *Zizia aurea* and others were found only during the meander searches, elevating the FQI in the combined survey. *Achillea millefolium*, *Corylus cornuta*, *Trillium cernuum* are edge species from the numerous islands of the northern dry-mesic forest spilling into the alder thickets. These additional species resulted in an elevated number of species in the FQI calculations.

When compared with other wetland types found in Wisconsin, the results of the FQI for the alder thickets were unusually high. In 2002, Emmet Judziewicz (WDNR), field-tested the WFQA measurement for

seventeen depressional wetlands throughout the state. His results were compared with our results from this study in Tables 1 and 2. The results for the alder thickets were higher in each category (Mean C = 5.42, # of Native Species = 126, and FQI = 60.64). There are several explanations for these very high numbers.

1. Our amount of time spent surveying on this one site was greater than the earlier field-testing of the FQI on the 17 depressional wetlands, resulting in higher numbers.
2. Our survey activities included mapping of rare plants over the 524 hectares of the Pokegama SNA. Covering this additional ground versus simple transects increased our odds of finding lesser-known species resulting in elevated FQI values.
3. More than 97% of the Pokegama SNA is undisturbed, resulting in species found that are highly intolerant to disturbance.
4. Northern wetland types as a rule have less disturbance activities (i.e. agriculture, urban development, highways, etc.) than the wetlands in other portions of the State. These disturbances result in a decline in species diversity often resulting in non-native invasive species increasing, which was not observed at the Pokegama SNA.

Sedge Meadows

The two sedge meadow communities (*Carex lacustris* and *Carex buxbaumii*) make up less than 3% of the site.

Carex lacustris meadows represent 95% of all sedge meadows on site, and the best homogenous examples are in the northern unit. A total of 75 native species and 4 non-native invasive species were found during our meander searches. We were able to include a private contractor's information to our late season list to provide a more complete inventory for this plant community type (G. Walton, personal

communication). Like the alder thickets, these sedge meadows had high numbers with a Mean C of 5.24 and a FQI of 45.37.

We were only able to locate one *Carex buxbaumii* community to investigate in the south unit and the survey was conducted in early June of 2009. As expected the Mean C was high at 6.24, but the FQI was lower than the *Carex lacustris* meadow at 35.84. It is likely that this smaller FQI value reflects our survey limitation and not the community as a whole.

Wisconsin Wetland Plant Biotic Index (WWPBI)

The plant biotic index is a multimetric index based on relative importance values (IV) (percent cover and frequency of occurrence) of nine community attributes based on taxonomic divisions (Lillie 2000). This tool was initially developed to investigate depressional wetlands that hold water less than one year and are isolated from other bodies of water. Prior to investigation of the Pokegama SNA, we anticipated large numbers of small pools that would fit into this category based on earlier descriptions of the SNA (Epstein, et al. 1997). These pools may have been present in the spring, but our study was restricted to surveying after July 1st. During the next two months, no pools of any size were located. Instead, we focused our investigation in the saturated, but not wet scrub/shrubs of the alder thickets. The results listed in Table 3 are based on cover, frequency and importance values and applying the WWPBI metric.

The WWPBI values we identified were in the mid-range in comparison to other wetland types investigated in Wisconsin (Lillie 2000). This model was not as meaningful as the assessments discovered through the FQA measurements described above. The alder thicket community characteristics do not match the vegetative conditions found in depressional wetlands, for which this assessment tool was created.

Table Attributes

Total taxa was in the high value with 94 species found in 41 quadrats

Carex spp. were mid-range in diversity and IV's were lower

Reed Canary Grass was absent

Typha was absent

Lemna was absent

Calamagrostis canadensis was abundant and mid-range in importance value in almost every quadrat

Good Taxa (*Carex*, *Utricularia*, *Potamogeton*, *Calamagrostis*, *Sagittaria*, *Persicaria*, and *Equisetum*) were mid-range in IV due to the fact that emergent and submergent zones were absent in this wetland community

Pondweed was absent

Floating Leaf was absent

Of the nine attributes, only four were present in the scrub/shrub alder thickets of the Pokegama SNA. The WWPBI metric misrepresented the ecological value of these wetlands. Three of the attributes resulted in high metric scores based on the ecological integrity of the wetland. On the other hand, the values for the pondweed and floating leaf attributes distorted the overall metric score due to their absence.

Using the same plant sampling data as used for the WWPBI metric, the next section provides additional evaluation of the composition, dominance, importance values of all taxa found during the vegetative survey of the alder thickets.

Transect/Quadrat Analysis (Alder Thickets)

The two most dominant taxa in the alder thickets were *Alnus incana* and *Calamagrostis canadensis*; these taxa constituted more than 50% of all cover value in the survey. The remaining 50% cover value was

represented by 92 other taxa identified in the 41 quadrats surveyed. Other dominant species identified in Table 4, included *Carex lacustris*, *Rubus idaeus*, *Equisetum sylvaticum*, *Impatiens capensis*, *Salix petiolaris*, *Dryopteris cristata*, and *Salix pyrifolia*.

Total taxa were divided into five classes based on the modified Braun-Blanquet method (dominant, abundant, common, occasional, and rare). The dominants (9 taxa) represented 10% of the floral diversity. Abundant, common and occasional combined classes consisted of 73 taxa representing 78% of the floral diversity found in these thickets. Lastly, the rare category had 12 taxa present representing 13% of the floral diversity, though these were not necessarily rare plants.

The rare cover plants discussed in Table 5 indicate the scarcity of these species in our quadrat surveys. Patches of sedge meadows and numerous forest islands punctuate the alder thickets, creating more opportunities for edge species to be present in the quadrat surveys. Some of the species in this table are from other plant communities and they are not typical representatives of the alder thickets. These species included: *Betula papyrifera*, *Lactuca biennis*, *Ribes cynosbati*, *Thalictrum dioicum*, *Uvularia grandiflora*, and *Viola sororia*. Rather surprisingly, other species common to northern wetlands, but rarely found in our survey, were: *Cirsium muticum*, *Lysimachia ciliata*, *Scutellaria galericulata*, *Scutellaria lateriflora*, and *Sium suave*.

As listed in Table 6, only two of the seven rare, threatened and endangered species were found in the transect surveys. Both species were part of the **common** cover class indicating that the habitat conditions (i.e. wetland soils, topography, hydrology, plant associates) in concert with low anthropogenic stress resulted in healthy populations of these two species.

Plant Communities

There were five major plant community types found at the SNA: alder thickets, boreal forest remnants, aspen forest groves and two types of northern sedge meadows. Alder thickets were the dominant plant community. Figure 2 shows the site with plant communities delineated.

Alder Thickets

Representing the largest plant community on the Pokegama SNA with 61% land cover, the alder thickets were a minerotrophic wetland community dominated by tall shrubs, especially *Alnus incana*. Shrub associates included: *Ilex verticillata*, *Rubus idaeus*, *Salix petiolaris*, *Salix pyrifolia*, *Viburnum opulus*, and *Viburnum lentago*. Characteristic herbaceous species present included: *Campanula aparinoides*, *Comarum palustre*, *Eupatorium perfoliatum*, *Impatiens capensis*, *Galium trifidum*, *Galium triflorum*, *Onoclea sensibilis*, *Persicaria amphibia*, *Persicaria sagittata*, and *Symphyotrichum puniceum*.

The alder thickets at Pokegama SNA were well-established, occupying large areas formerly covered by coniferous swamps that were logged in the early 1900's; since that time water tables have risen. Stands of alder that originated following logging and wildfire will usually revert to forest, but at Pokegama SNA, the soils are heavy and poorly drained and forest re-growth is problematic owing to "swamping effects" (Karamanski 1989). Curtis (1959) and Heinselman (1963) reported that these conifer swamps were converted to alder thickets throughout the Great Lakes region.

Boreal Forest "Islands"

There were small "islands" of boreal forest throughout the 524 hectares on the south unit of the Pokegama SNA. There was also a small forest stand dominated by *Populus tremuloides* (51 hectares) in the southeast corner, while a mature stand of boreal forest (39 hectares) hugs the rugged terrain of the east

branch of the Little Pokegama River in the northwest corner of the Pokegama SNA. The remaining islands of trees remnants of the boreal forest (88 hectares). These combined forests represent 34% of the land cover. Several walkthroughs were conducted through these forests to add to the species inventory for the Pokegama SNA.

The boreal forest remnants were dominated by *Picea glauca*, *Pinus strobus*, *Betula papyrifera*, *Populus balsamifera*, *Populus tremuloides*, and *Thuja occidentalis*. *Abies balsamea*, commonly found in most boreal forest communities, was infrequent at the Pokegama SNA. Common understory herbs include *Aralia nudicaulis*, *Clintonia borealis*, *Cornus canadensis*, *Eurybia macrophylla*, and *Maianthemum canadense*.

Of potential interest from the perspective of vegetation classification and restoration, Curtis (1959) discussed white pine having the highest importance value of any tree in the Lake Superior region, as recorded during the original land survey of the mid-1800's. The public land surveys of the Pokegama SNA area, recorded *Pinus strobus*, *Larix laricina*, *Thuja occidentalis*, *Picea glauca*, *Abies balsamea* as dominant trees, while *Alnus incana* and *Corylus spp.* occupied the forest understory (Stuntz, 1852-1854). Today on the Pokegama SNA, only large white pine trees >20 inch dbh exist with sporadic re-generation on the forested islands.

Northern Sedge Meadows

This open wetland community makes up 3% or 16 hectares of land cover, with 90% found in the northern unit. These northern wet meadows were dominated by sedges and grasses. There were three common subtypes:

- 1) Tussock meadows, dominated by *Carex stricta* and *Calamagrostis canadensis*.

- 2) The broad-leaved sedge meadows were dominated by the robust sedges *Carex lacustris* and *Carex utriculata*
- 3) Wire-leaved sedge meadows were dominated by such species as *Carex buxbaumii*, *Carex oligosperma*, and the broad-leaved sedge *Carex lacustris*.

Of the three, the broad-leaved sedges were the most dominant. Frequent herbaceous associates included:

Symphyotrichum lanceolatum, *Eutrochium maculatum*, *Mentha arvensis*, and *Solidago*

gigantea. The graminoids were represented by: *Glyceria striata*, *Juncus brevicaudatus*, *Leersia oryzoides*, *Poa palustris*, *Schoenoplectus tabernaemontani*, and *Scirpus cyperinus*. *Sphagnum* mosses were mostly absent, but when found, occurred in scattered, discontinuous patches.

Site Inventory

The species list found in Appendix A is a combined list from all vegetative sampling methods described above and represents a cross-section across all natural plant communities and disturbed areas found at Pokegama Carnegie Wetlands. The vascular plant list included 318 taxa, representing 161 genera and 56 families. There were 10 fern and fern allies, 8 gymnosperms and 300 angiosperms. Of the angiosperms, 94 were monocots and 206 were dicots. The predominant plant families observed were Asteraceae (46 taxa), Cyperaceae (39 taxa), Rosaceae (23 taxa), Poaceae (22 taxa), and Ranunculaceae (16 taxa).

Observations were recorded in four natural plant community types (alder thickets, two northern sedge meadow types, a mixture of boreal and northern dry-mesic forests remnants), and a ¼ hectare pond in the northern unit, and several disturbed areas. These disturbed areas include gas pipelines, a designated county snowmobile trail, ATV trails, and in the north unit an old railroad grade. There were 169 taxa in the northern dry mesic forest/boreal forest remnants, 68 taxa in the *Carex lacustris* sedge meadow, 33 taxa in the *Carex buxbaumii* sedge meadow, 133 taxa in the alder thickets, 60 taxa in the pond and its

surrounding shore, 40 taxa in dry disturbed areas and 41 taxa in wet disturbed areas including the rare *Eleocharis nitida* and *Sparganium glomerata*.

Thirty-two taxa were found that are introduced non-native species to Wisconsin. Of the 93 taxa found in the alder thicket quadrat surveys, only three invasive taxa were found: *Phleum pratense*, *Poa annua*, and *Ranunculus acris*. Frequency, cover and importance values were low for each of these species. The remaining introduced non-native species were observed during meander surveys and were confined to the dry and wet disturbed areas (Table 7). Based on these vegetative surveys, we estimate non-native species occupy < 2% of total area of the SNA.

Rare, threatened and endangered plant populations were well represented throughout the north and south units of the Pokegama Carnegie Wetland. Populations of *Petasites frigidus* var. *sagittatus* (Figure 3) and *Salix planifolia* were extensive and found both in the alder thickets and sedge meadows while some *Juncus vaseyi* populations were found in the northern unit. *Caltha natans* was represented by only one specimen located in a drainage area found deep in the alder thickets. *Geum macrophyllum* var. *macrophyllum* was observed numerous times in the boreal forests remnants. Two large populations (> 1000 plants) and one isolated colony of *Mertensia paniculata* were located in or near the Pokegama SNA. *Eleocharis nitida* and *Sparganium glomeratum* had small populations and were found only in disturbed wet areas. *Potamogeton vaseyi* was found in the northern pond in early September. *Ranunculus gmelinii* was not observed during our survey work, but was recorded in 1997 by Epstein, et. al. A listing of these rare plants can be found in Table 8.

In addition to rare plants, we found eight taxa that were new county records for Douglas County, Wisconsin. *Canadanthus modestus*, great northern bog aster, is a new Wisconsin record and was found only in the northern unit in three small populations. Specimens were deposited both at the UW – Madison

(WIS) and Donald W. Davidson (SUWS) herbaria. A complete list of these taxa, their habitat and occurrences can be found in Table 9.

CONCLUSIONS

The WFQA sampling technique was developed by the Wisconsin Department of Natural Resources in 2003 as a level 3 wetland assessment method (Available online at: <http://dnr.wi.gov/wetlands/methods.html>). Field testing at the Pokegama SNA proved to illustrate the high value and biotic integrity of wetland types found in the northwest corner of Wisconsin when compared and contrasted with other Wisconsin wetlands.

In contrast, the WWPBI metric was a poorly chosen wetland assessment tool for assessing this scrub/shrub dominated wetland plant community, but provides more information on improving or modifying the assessment tool. With modifications, the WWPBI metric would better represent this wetland type by assigning more weight to the attributes present than to the ones absent.

The Pokegama SNA plant communities represent an outstanding natural resource for the region. Further human development activities in this area could have detrimental effects on the sensitive, unique characteristics of the area. The floristic quality assessment clearly indicated a wetland community of high value. Invasive species were infrequent, most commonly observed in disturbed areas. However, some of the rare, threatened and endangered species were also found in these same disturbed areas. Species diversity and conservatism may decrease if stem density in the alder thickets become so dense that their canopies shade out other plants, which may have a negative effect on the value of the community. The numerous small pools described by the WDNR in the 1997 description were not found during our two season survey. This may be an indication of hydrological shifts, natural variations of wet and dry cycles,

or a changing climate. All of these factors will have implications for future management decisions by the Wisconsin Department of Natural Resources.

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LITERATURE CITED

- Bernthal, T. W. (2003). *Development of a floristic quality assessment methodology for Wisconsin* No. #CD975115-01-0). Madison, WI: Wisconsin Department of Natural Resources. <http://dnr.wi.gov/wetlands/methods.html> . Accessed November 20, 2010.
- Braun-Blanquet, J., G. D. Fuller, and H. S. Conard, (1932). *Plant sociology; the study of plant communities*; (1st ed.). New York: Hafner Publication Co.
- Curtis, J.T. (1959). *The vegetation of Wisconsin: An ordination of plant communities*. Madison, WI. University of Wisconsin Press.
- Eggers, S.D. and D. M. Reed. (1987) *Wetland plants and plant communities of Minnesota and Wisconsin*. St. Paul, MN: U.S. Army Corps of Engineers.
- Epstein, E., W. Smith, and E. Judziewicz. (1997). *Priority Wetland Sites of Wisconsin's Lake Superior Basin*. Madison, WI: Wisconsin Department of Natural Resources - Bureau of Endangered Resources.
- Flora of North America Editorial Committee, eds. (1993+). *Flora of North America North of Mexico*. 16+ vols. New York and Oxford.
- Goff, F.G., G. Dawson, J. Rochow. (1982). Site examination for threatened and endangered plant Species. *Environmental Management* 6(4):307-316.
- Hauxwell, J., T. W. Bernthal, R. A. Lillie, E. J. Judziewicz, and S. Kenney. (2004). *Field testing the Wisconsin depressional wetland macroinvertebrate and plant indices of biological integrity for application by trained volunteers* No. #CD97565801). Madison, WI: Wisconsin Department of Natural Resources.
- Heinselman, M.L. (1963). Forest sites, bog processes, and peatland types in the Glacial Lake Region, Minnesota. *Ecological Monographs* 33(4): 327-374.
- Judziewicz, E. J. (2002). *Floristic quality assessment of 17 wetland sites in Wisconsin*. Madison, WI: Wisconsin Department of Natural Resources.
- Karamanski, T.J. (1989). *Deep woods frontier: A history of logging in northern Michigan*. Detroit, MI. Wayne State University Press.
- Lillie, R. A. (2000). *Development of a biological index and classification system for Wisconsin wetlands using macroinvertebrates and plants* No. #CD985491-01-0). Madison, WI: Wisconsin Department of Natural Resources. <http://dnr.wi.gov/wetlands/methods.html> . Accessed 20 November 2010.
- Stuntz, G.W. (1852-1854). Survey and subdivision of township 48 north range 14 west of the 4th meridian Wisconsin in Wisconsin Public Land Survey Records: Original field notes and plat maps. (1833-1866). State of Wisconsin Board of Commissioner of public lands. <http://digicoll.library.wisc.edu/cgi-bin/SurveyNotes/SurveyNotes-idx?type=article&byte=5124882&twp=T048NR014W§=17> Accessed 18 November 2010.

Wetter, M. A., T. S. Cochrane, M. R. Black, H.H. Iltis, and P. E. Berry. (2001). Checklist of the Vascular Plants of Wisconsin. Wisconsin Department of Natural Resources, Technical Bulletin Number 192.

APPENDIX A

POKEGAMA CARNEGIE WETLANDS SPECIES INVENTORY

PTERIDOPHYTES

DENNSTAEDTIACEAE (Bracken Family)

Pteridium aquilinum (L.) Kuhn. var. *latiusculum* (Desv.) Underw. ex A. Heller, bracken fern

DRYOPTERIDACEAE (Wood Fern Family)

Athyrium filix-femina (L.) Roth ex. Mert. var. *angustum* (Willd.) G. Lawson, lady fern

Dryopteris carthusiana (Vill.) H.P. Fuchs., spinulose wood fern

D. cristata (L.) A. Gray, crested shield fern

Matteuccia struthiopteris (L.) Todora var. *pennsylvanica* (Willd.) C.V. Morton, ostrich fern

Onoclea sensibilis L., sensitive fern

EQUISETACEAE (Horsetail Family)

Equisetum arvense L., common horsetail

E. fluviatile L., water horsetail (1220)

E. sylvaticum L., wood horsetail

THELYPTERIDACEAE (Marsh Fern Family)

Thelypteris palustris Schott. var. *pubescens* (Lawson) Fernald, marsh fern

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)

Thuja occidentalis L., northern white-cedar

PINACEAE (Pine Family)

Abies balsamea (L.) Mill., balsam fir

Larix laricina (Du Roi) K.Koch, tamarack

Picea glauca (Moench) Voss, white spruce

P. mariana (Mill.) Britton, Sterns & Poggenb., black spruce

Pinus banksiana Lamb., jack pine

P. resinosa Aiton, red pine

P. strobus L., eastern white pine

DICOTYLEDONS

ACERACEAE (Maple Family)

Acer rubrum L. var. *rubrum*, red maple

A. spicatum Lam., mountain maple

APIACEAE (Carrot Family)

Cicuta bulbifera L., bulblet water hemlock (1157, 1185)

C. maculata L., common water-hemlock

Heracleum lanatum Michx., American cow-parsnip

Osmorhiza claytonii (Michx.) C.B. Clarke, hairy sweet cicely

O. longistylis (Torr.) DC., smooth sweet cicely

Sanicula marilandica L., black snakeroot

Sium suave Walter, water parsnip

Zizia aurea (L.) W.D.J.Koch, golden alexanders

APOCYNACEAE (Dogbane Family)

Apocynum androsaemifolium L., spreading dogbane

AQUIFOLIACEAE (Holly Family)

Ilex mucronata (L.) M. Powell, V. Savolainen & S. Andrews, catberry

I. verticillata (L.) A. Gray, common winterberry

ARALIACEAE (Ginseng Family)

Aralia nudicaulis L., wild sarsaparilla

A. racemosa L., American spikenard

ARISTOLOCHIACEAE (Birthwort Family)

Asarum canadense L., wild-ginger

ASTERACEAE (Aster Family)

Achillea millefolium L., yarrow

Anaphalis margaritacea (L.) Benth. & Hook.f., pearly everlasting

Antennaria neglecta Greene, field pussy-toes

A. parlinii Fernald, plantain pussy-toes

Bidens cernua L., nodding beggar-ticks

B. connata Muhl. ex Willd, purple-stem beggar-ticks (1163)

B. trichosperma (Michx.) Britton, swamp beggar-ticks

B. vulgata Greene, tall beggar-ticks

Canadanthus modestus (Lindl.) G.L. Nesom., great northern bog aster (1167)

**Cirsium arvense* (L.) Scop., canada thistle

C. muticum Michx., swamp thistle

**C. vulgare* (Savi) Ten., bull thistle

Doellingeria umbellata (Mill.) Nees, flat-top aster

Erigeron philadelphicus L., common fleabane

E. strigosus Muhl. ex Willd, daisy fleabane

Eupatorium perfoliatum L., boneset

Eurybia macrophylla (L.) Cass., big-leaved aster

Euthamia graminifolia (L.) Nutt., grass-leaved goldenrod

Eutrochium maculatum (L.) Lamont, spotted joe-pye-weed

Helianthus giganteus L., giant sunflower

H. grosseserratus M. Martens, saw-tooth sunflower

Heliopsis helianthoides (L.) Sweet, ox-eye (1164)

**Hieracium aurantiacum* L., devil's-paintbrush

**H. caespitosum* Dumort., field hawkweed

H. umbellatum L., Canada hawkweed

Lactuca biennis (Moench) Fernald, tall blue lettuce

**Leucanthemum vulgare* Lam., ox-eye daisy

Packera paupercula (Michx.) A. Löve & D. Löve, northern ragwort

Petasites frigidus var. *palmaris* (Aiton) Cronquist, arctic sweet-colt's-foot

P. frigidus var. *sagittatus* (Banks ex Pursh) Chern., arrowhead sweet-colt's-foot (1199)

P. frigidus X *vitifolius* (Greene) Chern., sweet-colt's-foot (1247)

Prenanthes alba L., white-lettuce

Rudbeckia hirta L. var. *pulcherrima* Farw., black-eyed susan

Solidago canadensis L., Canada goldenrod

S. gigantea Aiton, giant goldenrod
S. speciosa Nutt., showy goldenrod (1227)
S. uliginosa Nutt., northern bog goldenrod (1171)
 **Sonchus oleraceus* L. field sow-thistle
Symphyotrichum boreale (Torr. & A. Gray) A. Löve & D. Löve, northern bog aster
S. ciliolatum (Lind.), A. Löve & D. Löve, northern heart-leaved aster (1225)
S. lanceolatum (Willd.) G. L. Nesom, white panicked aster
S. lanceolatum (Willd.) G. L. Nesom var. *interior* (Wieg.) G. L. Nesom, white panicked aster
S. lateriflorum (L.) A. Löve & D. Löve, calico aster
S. puniceum (L.) A. Löve & D. Löve, purple-stemmed aster
 **Tanacetum vulgare* L., common tansy
 **Taraxacum officinale* F. H. Wiggers, common dandelion

BALSAMINACEAE (Touch-me-not, Jewelweed Family)

Impatiens capensis Meerb., orange jewelweed

BETULACEAE (Birch Family)

Alnus incana (L.) Moench ssp. *rugosa* (Du Roi) R. T. Clausen, speckled alder
Betula papyrifera Marshall, white birch
B. pumila L., bog birch (1174)
Corylus americana Walter, American hazelnut
C. cornuta Marshall ssp. *cornuta*, beaked hazelnut

BORAGINACEAE (Borage Family)

Cynoglossum boreale Fernald., northern wild comfrey
Mertensia paniculata (Aiton) G. Don var. *paniculata*, northern blue bells

BRASSICACEAE (Mustard Family)

**Barbarea vulgaris* R. Br., yellow-rocket

CAMPANULACEAE (Bellflower, Bluebell Family)

Campanula aparinoides Pursh, marsh bellflower

CAPRIFOLIACEAE (Honeysuckle Family)

Diervilla lonicera Mill., northern bush-honeysuckle
Lonicera canadensis W. Bartram ex Marshall, American fly honeysuckle
L. dioica L., red honeysuckle
L. hirsuta Eaton, hairy honeysuckle (1187)
 **L. morrowii* A. Gray, Asian fly honeysuckle
 **L. tatarica* L., tartarian honeysuckle
Viburnum lentago L., nannyberry
V. opulus L. ssp. *trilobum* (Marshall) R. T. Clausen, American cranberry-bush
V. rafinesquianum Schult., arrow-wood

CARYOPHYLLACEAE (Pink Family)

Stellaria longifolia Muhl. ex Willd., long-leaved stitchwort (1280)

CONVOLVULACEAE (Morning-glory Family)

Calystegia sepium (L.) R. Br., hedge bindweed

CORNACEAE (Dogwood Family)

- Cornus canadensis* L., bunchberry
C. rugosa Lam., round-leaved dogwood
C. stolonifera Michx., red osier dogwood

ERICACEAE (Heath Family)

- Chamaedaphne calyculata* (L.) Moench, leather-leaf
Pyrola americana Sw., round-leaved shin-leaf
P. chlorantha Sw. green-flowered shinleaf
P. elliptica Nutt., elliptic shin-leaf
Rhododendron groenlandicum (Oeder) Kron & Judd, labrador-tea
Vaccinium angustifolium Aiton, early low blueberry
V. myrtilloides Michx., velvet-leaf blueberry

FABACEAE (Pea Family)

- Amphicarpaea bracteata* (L.) Fernald, hog-peanut
Lathyrus ochroleucus Hook., cream pea-vine
L. venosus Muhl. ex Willd., forest pea
**Lotus corniculatus* L., bird's-foot trefoil
**Melilotus officinalis* (L.) Lam., yellow sweet-clover
**Trifolium hybridum* L., alsike clover
**T. pratense* L., red clover
**T. repens* L., white clover
Vicia americana Muhl. ex Willd. ssp. *americana*, American vetch

GENTIANACEAE (Gentian Family)

- Gentiana andrewsii* Griseb. var. *andrewsii*, bottle gentian (1153)

GERANIACEAE (Geranium Family)

- Geranium bicknellii* Britton var. *bicknellii*, Bicknell's crane's-bill

GROSSULARIACEAE (Gooseberry Family)

- Ribes americanum* Mill., American black currant (1158)
R. cynosbati L., eastern prickly gooseberry (1155)
R. hirtellum Michx., hairy-stem gooseberry (1234)
R. triste Pall., swamp red currant

LAMIACEAE (Mint Family)

- Agastache foeniculum* (Pursh) Kuntze, fragrant giant hyssop (1197)
Lycopus americanus Muhl. ex W.P.C.Barton, American water-horehound
L. uniflorus Michx., northern bugleweed
Mentha arvensis L. var. *canadensis* (L.) Kuntze, field mint (1182)
Prunella vulgaris L. ssp. *lanceolata* (W. P. C. Barton) Hultén, heal-all
Scutellaria galericulata L., common skullcap
S. lateriflora L., blue skullcap
Stachys palustris L., marsh hedge-nettle

LYTHRACEAE (Loosestrife Family)

- **Lythrum salicaria* L., purple loosestrife

MYRSINACEAE (Myrsine Family)

- Lysimachia ciliata* L., fringed loosestrife
L. terrestris (L.) Britton, Sterns, & Poggenb., swamp-candles
L. thysiflora L. swamp loosestrife
Trientalis borealis Raf. ssp. *borealis*, American starflower

OLEACEAE (Olive Family)

- Fraxinus americana* L., white ash
F. nigra Marshall, black ash
F. pennsylvanica Marshall, green ash

ONAGRACEAE (Evening-primrose Family)

- Epilobium angustifolium* L. ssp. *circumvagum* Mosquin, fireweed
E. ciliatum Raf. ssp. *ciliatum*, American willow herb
E. coloratum Biehler, cinnamon willow-herb
E. leptophyllum Raf., American marsh willow-herb (1162)
Oenothera perennis L., small evening-primrose

OXALIDACEAE (Wood-sorrel Family)

- Oxalis dillenii* Jacq., southern yellow wood-sorrel
O. stricta L., tall wood-sorrel

PAPAVERACEAE (Poppy Family)

- Sanguinaria canadensis* L., bloodroot

POLYGONACEAE (Smartweed Family)

- Persicaria amphibia* (L.) Gray, water smartweed
P. sagittata (L.) H. Gross, arrow-leaved tear-thumb
**Rumex crispus* L., curly dock
R. britannica L., great water dock (1152)

RANUNCULACEAE (Buttercup Family)

- Actaea rubra* (Aiton) Willd., red baneberry
Anemone canadensis L., Canada anemone
A. cylindrica A. Gray, thimbleweed (1249)
A. quinquefolia L. var. *quinquefolia*, wood anemone
A. virginiana L., tall anemone
Aquilegia canadensis L., Canadian columbine
Caltha natans Pall., floating marsh-marigold
C. palustris L., marsh-marigold
Clematis virginiana L., virgin's-bower
Ranunculus abortivus L., little-leaf buttercup
**R. acris* L., common buttercup
R. hispidus Michx., bristly buttercup
R. pensylvanicus L.f., Pennsylvania buttercup (1232)
R. recurvatus Poir. var. *recurvatus*, hooked buttercup
Thalictrum dasycarpum Fisch. & Avé-Lall., tall meadow-rue
T. dioicum L., early meadow-rue

ROSACEAE (Buttercup Family)

Agrimonia gryposepala Wallr., common agrimony
Amelanchier interior Nielsen, inland juneberry (1169)
A. laevis Wiegand, Allegheny serviceberry
A. sanguinea (Pursh) DC. var. *sanguinea*, New England serviceberry
Comarum palustre L., marsh cinquefoil
Crataegus crus-galli L., cockspur hawthorn
Fragaria vesca L. ssp. *americana* (Porter) Staudt, woodland strawberry
F. virginiana Duchesne, wild strawberry
Geum aleppicum Jacq., yellow avens
G. macrophyllum Willd. var. *macrophyllum*, big leaved avens
Potentilla norvegica L., strawberry-weed (1233)
 **P. recta* L. sulphur cinquefoil
P. simplex Michx. common cinquefoil
Prunus americana Marshall, American plum
P. pensylvanica L. f., pin cherry
P. virginiana L. var. *virginiana*, chokecherry
Rosa acicularis Lindl. ssp. *sayi* (Schwein.) W. H. Lewis, bristly rose
R. blanda Aiton, smooth rose
Rubus allegheniensis Porter ex L. H. Bailey, common blackberry
R. idaeus L. var. *strigosus* (Michx.) Maxim., red raspberry
R. parviflorus Nutt., thimbleberry
R. pubescens Raf., dwarf red raspberry
Spiraea alba Du Roi var. *alba*, white meadowsweet

RUBIACEAE (Bedstraw, Madder Family)

Galium asprellum Michx., rough bedstraw
G. boreale L., northern bedstraw
G. tinctorium L., southern three-lobed bedstraw
G. trifidum L. ssp. *trifidum*, northern three-lobed bedstraw (1166)
G. triflorum Michx., fragrant bedstraw

SALICACEAE (Willow Family)

Populus balsamifera L. ssp. *balsamifera*, balsam poplar
P. grandidentata Michx., big-tooth aspen
P. tremuloides Michx., quaking aspen
Salix bebbiana Sarg., beaked willow
S. discolor Muhl., pussy willow
S. humilis Marshall, upland willow
S. interior Row., sandbar willow
S. nigra Marshall, black willow
S. petiolaris Sm., meadow willow
S. planifolia Pursh, basket willow (1184, 1276)
S. pyrifolia Andersson, balsam willow (1170, 1175, 1181)
 **S. x rubens* Schrank (pro sp.), hybrid crack willow (1150, 1154)

SANTALACEAE

Comandra umbellata (L.) Nutt ssp. *umbellata*, bastard-toadflax

SAXIFRAGACEAE (Saxifrage Family)

Micranthes pensylvanica (L.) Haw., eastern swamp saxifrage

SCROPHULARIACEAE (Figwort, Snapdragon Family)

Castilleja coccinea (L.) Spreng., Indian paintbrush (1161, 1165)

Chelone glabra L., turtlehead (1156)

Gratiola neglecta Torr., clammy hedge-hyssop (1228)

Mimulus ringens L. var. *ringens*, monkey-flower

Scrophularia lanceolata Pursh, American figwort

URTICACEAE (Nettle Family)

Urtica dioica L., stinging nettle

VALERIANACEAE (Valerian Family)

**Valeriana officinalis* L., garden valerian

VIOLACEAE (Violet Family)

Viola canadensis L., Canadian white violet

V. cucullata Aiton, blue marsh violet

V. labradorica Schrank, dog violet

V. novae-angliae House, New England blue violet

V. pubescens Aiton, downy yellow violet

V. sororia Willd., door-yard violet

MONOCOTYLEDONS

ALISMATACEAE (Water-plantain Family)

Alisma triviale Pursh, northern water plantain

CYPERACEAE (Sedge Family)

Carex arctata Boott, drooping woodland sedge

C. atherodes Spreng., hairy-leaved lake sedge (1204)

C. aurea Nutt., golden sedge (1274, 1250)

C. brunnescens (Pers.) Poir. ssp. *sphaerostachya* (Tuck.) Kalela, green bog sedge (1276)

C. buxbaumii Wahlenb., Buxbaum's sedge

C. canescens L., gray bog sedge

C. castanea Wahlenb., chestnut sedge (1420)

C. crawfordii Fernald, Crawford's sedge (1248, 1262)

C. disperma Dewey, soft-leaf sedge

C. gracillima Schwein., graceful sedge

C. intumescens Rudge, greater bladder sedge

C. lacustris Willd., common lake sedge (1216)

C. lasiocarpa Ehrh. ssp. *americana* (Fernald) D. Löve & Bernard, woolly-fruit sedge (1217)

C. lupulina Willd., hop sedge (1258)

C. oligosperma Michx., few-seeded sedge

C. projecta Mack., loose-headed oval sedge

C. radiata (Wahlenb.) Small, eastern star sedge (1210)

C. retrorsa Schwein., knot-sheath sedge (1275)

C. scoparia Schkuhr ex Willd., var. *scoparia*, broom sedge (1218, 1238, 1273, 1277)

C. stipata Muhl. ex Willd., var. *stipata*, fox sedge (1271)

C. stricta Lam., tussock sedge

C. tenera Dewey, quill sedge (1251, 1272)

C. trisperma Dewey, three-seeded bog sedge (1211)

C. utriculata Boott, yellow lake sedge (1215)
C. vesicaria L., blister sedge (1278)
C. vulpinoidea Michx., brown fox sedge (1237)
Eleocharis erythropoda Steud., bald spike rush (1243, 1256)
E. intermedia (Muhl.) Schult. matted spike rush (1263, 1264, 1265)
E. nitida Fernald., neat spike rush (1193, 1221, 1224, 1256)
E. obtusa (Willd.) Schult., blunt spike rush (1204, 1259)
E. ovata (Roth) Roem. & Schult., oval spike rush (1284)
E. palustris (L.) Roem. & Schult., marsh spike rush (1257, 1267)
Eriophorum angustifolium Honck., tall cotton-grass
Schoenoplectus acutus (Muhl. ex Bigelow) A. Löve & D. Löve var. *acutus*, hard stem bulrush
S. tabernaemontani (C. C. Gmel) Palla, soft-stem bulrush
Scirpus atrocinctus Fernald., black-girdled wool-grass
S. atrovirens Willd., black bulrush
S. cyperinus (L.) Kunth., wool-grass
S. microcarpus J. Presl & C. Presl, panicked bulrush

IRIDACEAE (Iris Family)

Iris versicolor L., northern blue flag
Sisyrinchium montanum Greene, mountain blue-eyed-grass (1219)

JUNCACEAE (Rush Family)

**Juncus articulatus* L., jointed rush (1282)
J. brevicaudatus (Engelm.) Fernald, narrow-panicle rush (1254, 1281)
J. effusus L., common rush
J. nodosus L., joint rush (1151, 1201, 1203, 1244)
J. pelocarpus E. Mey., brown-fruited rush (1205)
J. tenuis Willd., path rush (1268, 1270)
J. vaseyi Engelm., Vasey's rush (1206, 1242, 1245)
Luzula acuminata Raf. var. *acuminata*, hairy wood rush
L. multiflora (Ehrh.) Lej. ssp. *multiflora*, common wood rush

LILIACEAE (Lily Family)

Clintonia borealis (Aiton) Raf., yellow blue-bead-lily
Lilium michiganense Farw., Michigan lily
Maianthemum canadense Desf., wild lily-of-the-valley
M. racemosum (L.) Link ssp. *racemosum*, false Solomon seal
M. trifolium (L.) Sloboda, false mayflower
Polygonatum pubescens (Willd.) Pursh, hairy Solomon seal
Streptopus lanceolatus (Aiton) Rev., rosy twisted-stalk
Trillium cernuum (L.) var. *cernuum* nodding trillium
Uvularia grandiflora Sm., large-flowered bellwort
U. sessilifolia L., sessile bellwort

NAJADACEAE (Naiad, Water-nymph Family)

Najas flexilis (Willd.) Rostk. & W.L.E. Schmidt, northern water-nymph (1288)

ORCHIDACEAE (Orchid Family)

Corallorhiza maculata (Raf.) Raf., spotted coralroot
Malaxis unifolia Michx., green adder's-mouth

POACEAE (Grass Family)

- **Agrostis gigantea* Roth, redtop
- A. hyemalis* (Walter) Britton, Sterns & Poggenb., tickle grass
- **Alopecurus pratensis* L., meadow foxtail
- **Beckmannia syzigachne*, (Steud.) Fernald, American slough grass
- Calamagrostis canadensis* (Michx.) P. Beauv., blue-joint grass
- Elymus hystrix* L. var. *hystrix*, bottlebrush grass (1261)
- E. virginicus* L. var. *virginicus*, Virginia wild-rye
- **Elytrigia repens* (L.) Desv. ex B.D.Jacks, quackgrass (1209)
- **E. smithii* (Rydb.) Nevski, western wheat grass (1290)
- Glyceria canadensis* (Michx.) Trin., rattlesnake manna grass
- G. grandis* S. Watson, American manna grass
- G. striata* (Lam.) Hitchc., fowl manna grass
- Leersia oryzoides* (L.) Sw., rice cut grass
- Oryzopsis asperifolia* Michx., rough-leaved rice grass
- O. pungens* (Torr. ex Spreng.) Hitchc., mountain rice grass
- **Phalaris arundinacea* L., reed canary grass
- **Phleum pratense* L. ssp. *pratense*, timothy
- **Poa annua* L., annual bluegrass
- P. palustris* L., marsh bluegrass
- **P. pratensis* L., Kentucky bluegrass
- Puccinellia pallida* (Torr.) R.T.Clausen, pale false manna grass
- Schizachne purpurascens* (Torr.) Swallen, false melic grass

POTAMOGETONACEAE (Pondweed Family)

- Potamogeton amplifolius* Tuck. large-leaved pondweed (1286)
- P. vaseyi* J.W.Robbins, Vasey's pondweed (1289)
- P. zosteriformis* Fernald, flat-stemmed pondweed (1287)
- Stuckenia pectinata* (L.) Borner, sago pondweed

SPARGANIACEAE (Bur-reed Family)

- Sparganium fluctuans* (Engelm. ex Morong) B.L.Rob., floating bur reed
- S. glomeratum* (Beurl. ex Laest.) Neuman, northern bur reed (1202)

TYPHACEAE (Cat-tail Family)

- Typha latifolia* L., broad-leaved cat-tail

***Denotes non-native, introduced, exotic plant species found at Pokegama SNA**
Numbers in parentheses are collection numbers