Preservation Foundation
of the Lake County Forest Preserves

DATE: May 16, 2019

TO: Nels Leutwiler, President
Preservation Foundation Board

FROM: Jim Anderson, Director of Natural Resources

RECOMMENDATION: Recommend approval of a $15,789 grant to provide partial support for a pilot project to improve the District's management of critically rare plant species.

FINANCIAL DATA: As of March 31, 2019, the Foundation had a total of $231,170 in unrestricted funds.

BACKGROUND: We can describe seven forms of intrinsic rarity of plant species based upon the intersection of the local abundance or population size of a species, the specificity of their habitat preference, and their geographic range (see Table 1).

Described by Deborah Rabinowitz in the mid-1980's (Rabinowitz 1981), these forms of rarity can provide fundamental insight into our understanding plant rarity in Lake County. For example, endemic species may be quite restricted in their habitat preference. However, they may also have quite large local population sizes (e.g. Cirsium pitcheri), or they may have very small local populations (e.g. Lespedeza leptostachya) as a result of very different life history dynamics. In contrast, some species may be quite widespread, but generally only have small populations, while others are widespread and have quite large populations – these species are likely to be common, unless there are other extrinsic factors at play such as habitat loss and resulting fragmentation or loss of pollinators (e.g. Platanthera leucophaea).

The District strives to maintain viable populations of all naturally occurring species native to our preserves. For many widespread and common species, standard management practices such as burning and invasive control will suffice. Other species, principally those with specialized biotic and abiotic requirements, will require specialized management practices, such as genetic augmentation of existing populations, hand pollination to ensure high quality seed set, and propagation to increase both the size and number of existing populations.

We have identified more than 100 species of special concern that are currently found in District sites. We are requesting funds to support specialized management of 5-10 of those most critically in need of these specialized interventions. Using these funds, we propose to work with staff and volunteers of the Chicago Botanic Garden's Plants of Concern program over a two-year period to conduct enhanced demographic monitoring, undertake hand pollinations, collect seed, and begin propagation efforts in order to restore these species on our preserves. Attached are profiles of five of these species.

REASON FOR RECOMMENDATION: On May 7, 2013 the Board adopted a Policy Regarding Use of Unrestricted Charitable Gifts. The policy instructs the Foundation to maintain a minimum level of operating reserves equal to 10 percent of the Foundation's annual fundraising and administrative expenses. Proposals must be submitted by a Forest Preserve department director or the executive director. A majority of Foundation board members must approve the proposal for funding to be released. Votes must be indicated in writing, either in person or via email.

TABLE 1

Geographic distribution:		Wide		Narrow or Restricted	
Habitat rarity:		Not Specific	Highly Specific	Not Specific	Highly Specific
Local Population Size	Somewhere large	Common	1	2	3
	Everywhere small	4	5	6	7

(Adapted from Rabinowitz, D., 1981. Seven forms of rarity. Biological aspects of rare plant conservation.)

Deliverables

- Enhanced Monitoring of select species/populations of rare plants
- Pollen collection and hand pollination (within & possibly between sites)
- Assessment of seed set
- Seed collection
- Seed dissemination at existing/adjacent location or in identified appropriate habitat
- Seed germination & plant propagation
- Propagule planting
- Follow-up monitoring on new plantings

Budget: Partial support for this project has been received by the Illinois Orchid Society, a new foundation donor with potential for renewed funding in future years.

Expense	Notes	Year 1	Year 2
Contractual: Chicago Botanic Garden Plants of Concern Program			
	Population monitoring	$ 1,000	$ 3,000
	Pollen collection/hand pollination	$ 1,000	
	Seed collection	$ 1,000	
	Plant propagation (e.g. Prairie Smoke, Goldenseal)		$ 2,500
	New propagule planting		$ 2,000
	Follow-up monitoring		$ 2,500
	Subtotal, Plants of Concern	*$ 3,000*	*$ 10,000*
Contractual: Specialty propagation of native orchids			
Minnesota Stare Arboretum (e.g. Purple Fringed Orchid, Showy Orchids)		$ 400	$ 800
Great Lakes Orchids (e.g. Lady Slipper Orchids)		$ 2,000	$ 2,000
	Subtotal, specialty propagation	*$ 2,400*	*$ 2,800*
	Total Expenses	**$ 18,200**	

Revenue	Notes	Amount
Illinois Orchid Society	Secured	$ 3,200
Preservation Foundation	Pending	$ 15,000
	Total Revenues	**$ 18,200**
	District Grant Administration	*$ 789*
	TOTAL REQUEST FOR UNRESTRICTED FUNDS	**$ 15,789**

PRESERVATION FOUNDATION BOARD:

Date: _____ ☐ Roll Call Vote: Ayes: _____ Nays: _____

☐ Voice Vote Majority Ayes; Nays: _____

ATTACHMENT

Case studies of 5 of the most threatened plants of the Lake County Forest Preserve District

Calystegia spithamaea, Low Bindweed (Convolvulaceae)

Figure 1: Photo of Calystegia spithamaea by Peter Dziuk, Minnesota Wildflowers

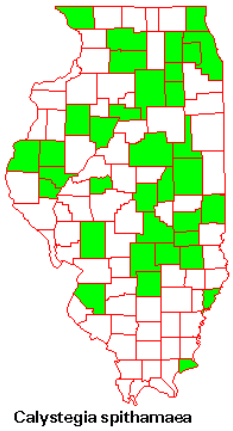


Figure 2. Calystegia spithamaea distribution in Illinois, ILPIN

Calystegia spithamaea, low bindweed, is a rhizomatous perennial of dry, open, sandy savanna. *C. spithamaea* grows upright, but low, and does not twine or twist around other vegetation, a characteristic that differentiates it from other Calystegia and Convolvulus species. **Pollination**: Low bindweed flowers from June 1 to June 28, and is insect pollinated, likely by bumblebees and long-tongued generalist bees. A study of the nesting ecology of two Megachile (leafcutting) bee species found pollen from *C. spithamaea* in a provisioned cell within a *Megachile inermis* nest (Strickler et al. 1996). Reproduction: Corrigan (2004) notes that sexual reproduction of *C. spithamaea* in New England populations remains undocumented; plant monitors do not report finding viable fruit or seedlings. We could not find documentation of the breeding system for *C. spithamaea* in the literature. Self-incompatibility could explain the low rate of sexual reproduction for this clonal species. While pollinators might be present, the lack of compatible mates could limit successful reproduction. **Germination**: Corrigan (2004) details personal communication with Carol Baskin who suggests that *C. spithamaea* has an impermeable seed coat that can imbibe water after dislodging a structure called the water plug. Baskin says that direct heat from fires or fluctuations between night and day temperatures can cause the water plug to move. **Management:** Low bindweed likely benefits from fire, a management tool that reduces competition with other vegetation and may stimulate flowering and seed germination. However, studying a Northwestern Wisconsin brush prairie savanna, Beck & Vogl (1972) found that the frequency of *C. spithamaea* decreased more than 25% in burned vs. control areas when burns occurred 11 out of 15 years, so a longer fire-return cycle may be more beneficial to maintain this species. If self-incompatibility is limiting population viability, introduction of new individuals into existing populations could effectively promote cross-fertilization between unrelated plants. Only a very small number of immigrant should be necessary to effectively promote genetic rescue of this this species in Lake County. Of critical importance is ensuring the provenance of those individuals to be introduced, as well as ongoing monitoring of the population to ensure long-term success.

Beck, A., & Vogl, R. 1972. The Effects of Spring Burning on Rodent Populations in a Brush Prairie Savanna. *Journal of Mammalogy, 53*(2), 336-346. doi:10.2307/1379170

Corrigan, Elizabeth. 2004. *Calystegia spithamaea* (L.) Pursh ssp. *Spithamaea* (Low Bindweed) Conservation and Research Plan for New England. New England Wild Flower Society, Framingham, Massachusetts, USA.

ILPIN. Distribution map of *C. spithamaea.* https://www.nrs.fs.fed.us/data/il/ilpin/local-resources/images/488.gif

Strickler, K., Scott, V., & Fischer, R. 1996. Comparative Nesting Ecology of Two Sympatric Leafcutting Bees That Differ in Body Size (Hymenoptera: Megachilidae). *Journal of the Kansas Entomological Society, 69*(1), 26-44. Retrieved from http://www.jstor.org/stable/25085646

Hydrastis Canadensis, Goldenseal (Ranunculaceae)

Figure 3. Photo of Hydrastis canadensis by Carol Freeman, Plants of Concern

Hydrastis canadensis, goldenseal, is a clonal, perennial species of rich mesic woodlands that usually forms small, isolated, and dense clusters of ramets. The genetic diversity of these stands remains unknown; they may represent single or multiple genotypes. Prized for the herbal medicinal use of its rhizomes, illegal harvesting threatens this species. Sanders (2004) documents a mixed breeding system for *H. canadensis* in which both selfing and outcrossing occur at similar rates. **Pollination:** Goldenseal flowers during the early spring (April 26 – May 10). Sinclair et al. (2000) observed small bees (Genera Dialictus and Evylaeus) as well as some larger bees (Andrena, Bombus, and Augochlora species) visiting goldenseal. These researchers also observed dispersal of fruits by birds (especially red-winged blackbirds) and suggest that neither pollination nor dispersal limit population growth. **Germination:** Recruitment by seed appears to be uncommon in natural populations (Sanders and McGraw 2002). A study of the dormancy and germination of *H. canadensis* seeds found that seeds are dormant at the time of dispersal and require experiencing specific seasonal temperature shifts (summer to autumn to winter) in order to break dormancy. Fresh seeds sown immediately following dispersal showed higher germination in the spring compared to seeds that did not experience seasonal temperature changes (Albrecht & McCarthy 2011). *H. canadensis* can also be propagated vegetatively using segments of its underground rhizome. **Management:** Sanders (2004) reports that greater light availability may bolster flowering and fruit set of this species. Highest stand counts and survival occur under 47% to 63% shade (Davis and McCoy 2000). Maintaining a more open canopy may benefit the reproduction of the species.

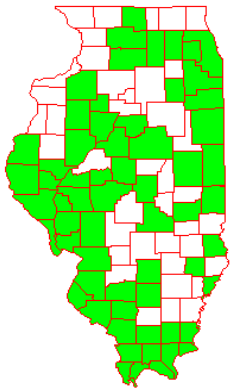


Figure 4. Hydrastis Canadensis distribution in Illinois, ILPIN.

Albrecht, M.A. & McCarthy, B.C. 2011. Variation in dormancy and germination in three co-occurring perennial forest herbs. Plant Ecology, 212: 1465. https://doi.org/10.1007/s11258-011-9921-3

Davis, J. M. and J. A. McCoy. 2000. Commercial Goldenseal Cultivation. Department of Horticultural Science, North Carolina State University, Raleigh, North Carolina. https://content.ces.ncsu.edu/commercial-goldenseal-cultivation

ILPIN. Distribution map of *Hydrastis canadensis*. https://www.nrs.fs.fed.us/data/il/ilpin/local-resources/images/1513.gif

Sanders, S. 2004. Does Breeding System Contribute to Rarity of Goldenseal (*Hydrastis canadensis*)? The American Midland Naturalist 152 (1), 37-42.

Sanders, S. & J. B. McGraw. 2002. Distribution, Abundance, and Population Dynamics of Goldenseal (*Hydrastis canadensis* L.) in an Indiana Nature Preserve, USA. Natural Areas Journal 22, 129–134.

Sharp, P. C. 2003. *Hydrastis canadensis* L. (Goldenseal) Conservation and Research Plan for New England. New England Wild Flower Society, Framingham, Massachusetts, USA.

Sinclair, A., Catling, P., & Dumouchel, L. 2000. Notes on the pollination and dispersal of Goldenseal, *Hydrastis canadensis* L., in southwestern Ontario. Canadian Field Naturalist. 114. 499-501.

Sinclair, A., Nantel P., & Catling, P. 2005. Dynamics of threatened goldenseal populations and implications for recovery. Biological Conservation 123(3): 355-360.

ATTACHMENT

Panax quinquefolius, Wild Ginseng (Araliaceae)

Figure 5. Photo of Panax quinquefolius by Peter Dziuk, Minnesota Wildflowers

Similar to goldenseal, *Panax quinquefolius*, wild ginseng, is a long-lived perennial species of rich mesic woodlands threatened by illegal harvesting of its roots for the medicinal herbal market. However, unlike low bindweed and goldenseal, ginseng is not clonal. Each plant is a single genet and produces a single stem. Ginseng is slow to grow and slow to reproduce according to Farrington's study; eight years of monitoring was insufficient in determining the duration for a seedling to become a mature reproductive plant (Farrington 2006), but Carpenter and Cottam (1982) studying ginseng in Wisconsin found that plants producing seed were 8 years old or older. Interestingly, plants can remain dormant for one or more seasons (Farrington 2006). Ginseng exhibits a mixed breeding system in which both selfing and outcrossing occur. **Pollination:** During its flowering period from mid-June to late July, ginseng is visited by generalist pollinators such as halictid bees (family Halictidae) and flies (families Syrphidae, Anthomyiidae, Calliphoridae) (Farrington 2006 & references within). **Germination:** Similar to *H. canadensis*, seed dormancy delays germination in *P. quinquefolius*. Seeds require warm followed by cold stratification to break dormancy (Hackney & McGraw 2001). Typically, seeds remain dormant for two winters before germination (Van der Vort 2003). **Management:** As for all native species, invasive species management is key to maintaining the habitat for this species. Protecting ginseng plants from poachers is critical to the long-term survival of this species. Given the long seed dormancy period, reintroduction by seed would be difficult to achieve. Seed collection and plant production, followed by outplanting in a suitable location would likely benefit the long-term viability of this species in Lake County. All known populations should be protected from deer, as they can negatively affect population stability of this species (McGraw & Furedi 2005).

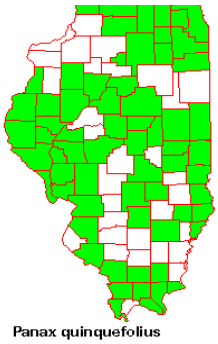


Figure 6. Panax quinquefolius distribution in Illinois, ILPIN.

Carpenter, S. G. & Cottam, G. 1982. Growth and reproduction of American ginseng (*Panax quinquefolius*) in Wisconsin, U.S.A. Canadian Journal of Botany, 60(12): 2692-2696. https://doi.org/10.1139/b82-328

Farrington, S. J. 2006. An ecological study of American ginseng (*Panax quinquefolius* L.) in the Missouri Ozark Highlands: Effects of herbivory and harvest, ecological characterization and wild simulated cultivation. MS thesis University of Missouri, Columbia.

Hackney, E. E. and McGraw, J. B. (2001), Experimental Demonstration of an Allee Effect in American Ginseng. Conservation Biology, 15: 129-136. doi:10.1111/j.1523-1739.2001.98546.x

ILPIN. Distribution map of *P. quinquefolius*. https://www.fs.fed.us/ne/delaware/ilpin/2060.gif

McGraw, J.B. and Furedi, M.A., 2005. Deer browsing and population viability of a forest understory plant. *Science*, *307*(5711), pp.920-922.

Van der Voort, M., Bailey, B., Samuel, D., & McGraw, J. (2003). Recovery of Populations of Goldenseal (*Hydrastis canadensis* L.) and American Ginseng (*Panax quinquefolius* L.) Following Harvest. *The American Midland Naturalist, 149*(2), 282-292.

Platanthera psychodes, Lesser Purple Fringed Orchid, (Orchidaceae)

Platanthera psychodes is one of 13 species of the genus *Platanthera* documented to occur in Illinois. Generally considered "secure" across its global distribution, the species is imperiled in Illinois and Kentucky. Considered a facultative wetland species, *P. psychodes* is found in swampy forests, marshes, moist meadows, and along riverbanks and roadsides. Northern Illinois represents the southern edge of the species range, with a few disjunct occurrences in Iowa and Missouri. As populations in Illinois represent the southern, and potentially lagging, edge of the range, they may be more vulnerable to extirpation as a result of changing climate. Flowering time in this species appears to be much earlier than it was historically (Pearse et al. 2017). **Pollination**: Generally flowering over a 2-3 week period late June through mid-July, this orchid is pollinated by several species of moths and butterflies. Known pollinators include *Autographa ampla*, *Epargyreus clarus*, *Hemaris diffinis*, *Hemaris thysbe*, *Papilio glaucus*, *Papilio polyxenes*, *Papilio troilus* and *Polites mystic*. Pollinaria attach to the proboscis for transfer to subsequent flowers visited. Visitors possessing pollinaria that were captured and identified include the clouded sulphur butterfly *Colias philodice*, the orange sulphur *Colias eurytheme*, the eastern tiger swallowtail *Papilio glaucus*, the black swallowtail *Papilio polyxenes*, the silver spotted skipper *Epargyreus clarus*, the drone fly *Eristalis tenax*, and an as yet unidentified species of *Bombus*. Examinations of plants after uncontrolled visits by *C. eurytheme* revealed that pollinaria had been removed and fresh pollen had been deposited upon stigmas. In addition, examination of pollinaria on the proboscises of *Papilio polyxenes* and *Papilio glaucus* revealed that the pollen masses that comprise the pollinia had been ruptured, suggesting that they had come into contact with stigmatic surfaces (Evans, 2006). **Germination:** Like many, if not most, north temperate terrestrial orchids, germination and establishment requirements for *Platanthera psychodes* remain unexamined. A potential fungal symbiont has recently been extracted from the roots of *P. psychodes* (Larry Zettler, pers. Com.), and should be tested to determine if it stimulates germination of fresh or stored seed. **Management:** Given the importance of the populations of this species in northern Illinois, every attempt should be undertaken to maintain its presence in these locations via improved management, population augmentation, and reintroduction to suitable habitat.

Figure7. Photo of Platanthera psychodes by Pati Vitt

Distribution of Platanthera psychodes in Illinois. USDA Plants

Evans, J. R. (2006). Identification and Comparison of the Pollinators for the Purple-fringed Orchids Platanthera psycodes and P. grandiflora.

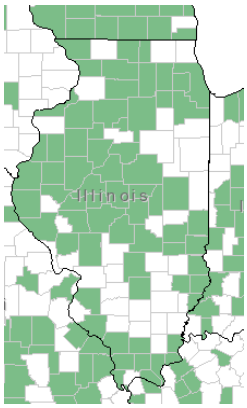
Pearse, W. D., Davis, C. C., Inouye, D. W., Primack, R. B., & Davies, T. J. (2017). A statistical estimator for determining the limits of contemporary and historic phenology. *Nature ecology & evolution*, *1*(12), 1876.

ATTACHMENT

Galearis spectabilis, Showy Orchis, (Orchidaceae)

Figure7. Photo of Galearis spectbilis, by A.L. Gibson.

Galearis spectabilis is considered globally secure, although it is rare in several New England states and considered vulnerable in other areas. The species flowers from mid-May to June, and while it may be locally abundant in some locations, more commonly it grows as isolated plants or in small colonies. Several orchid species, including *G. spectabilis*, appear to thrive in close proximity to trails (Catling and Kostuik, 2011). Specifically, the number of showy orchis shoots declined as one moved away from the trail into the woods (Bratton, 1985). It is reasonable to assume that proximity to trails increases light availability, although plants are rarely seen in full sun, or provides other mechanisms such as reduced competition due to trampling (Catling and Kostuik, 2011). This is an important consideration as there are reports that the species does not tolerate competition. Reproductive activity was negatively correlated with deer abundance in the Blue Ridge Mountains of Virginia (Fletcher et al 2001), which may be similarly affecting populations in Lake County. **Pollination:** This orchid is pollinated by many kinds of bumble bee queens including *Bombus fervidus*, *B. griseocollis*, *B. impatiens*, *B. nevadensis*, *B. pensylvanicus* and *B. vagans*. The lip petal has a hole at its base leading to a hollow spur with a droplet of nectar. Pollinia attach to the bees while inserting their tongues into the nectar spur. In Canada, an important pollinator is *Osmia proxima*, a smaller orchard bee. Although this species provides pollinators a nectar reward, low rates of visitation and very low rates of fruit set have been observed (Dieringer, 1982**). Germination:** Like other terrestrial orchids, the tiny seeds may be difficult to germinate, and are known to have prolonged seed dormancy, as they can apparently form a soil seed bank (Whigham et al, 2006). Symbiotic germination for showy orchis may be appropriate for reintroduction of *G. spectabilis* as they appear to form associations with fungi in the genus *Ceratobasidium*. **Management:** The primary threats to showy orchis are direct destruction of habitat, trampling; and displacement by invasive plant species. Hand pollination should be undertaken to increase fruit set, possibly by pollen transfer between populations. Resultant seeds can be sent to labs with experience in orchid seed germination. They may also be scattered near maternal or other existing plants to augment the population, as existing plants indicate the presence of the fungal symbiont. Protection of the orchid's rich forest habitat is critical for the survival of this species. It is likely vulnerable to canopy removal and to significant changes in hydrology. It is also possibly at risk of exploitation due to its attractiveness.



Distribution of Galearis spectabilis in Illinois. USDA Plants

Bratton, S.P., 1985. Effects of disturbance by visitors on two woodland orchid species in Great Smoky Mountains National Park, USA. *Biological Conservation*, *31*(3), pp.211-227.

Catling, P.M. and Kostiuk, B., 2011. Some Wild Canadian Orchids Benefit from Woodland Hiking Trails-and the Implications. *The Canadian Field-Naturalist*, *125*(2), pp.105-115.

Dieringer, G., 1982. The pollination ecology of Orchis spectabilis L.(Orchidaceae). *Ohio Journal of Science*, *82*(5), pp.218-225.

Fletcher, J.D., McShea, W.J., Shipley, L.A. and Shumway, D., 2001. Use of common forest forbs to measure browsing pressure by white-tailed deer (Odocoileus virginianus Zimmerman) in Virginia, USA. *Natural Areas Journal*, *21*(2), pp.172-176.

Rasmussen, H. N., & Whigham, D. F. (1993). Seed ecology of dust seeds in situ: a new study technique and its application in terrestrial orchids. *American Journal of Botany*, *80*(12), 1374-1378.