

**Final Recovery Planning Outline with Listing Status Review Triggers
for the Illinois Endangered Mud-plantain (*Heteranthera reniformis*)**

Bob Edgin, Illinois Nature Preserves Commission
Anne Mankowski, Illinois Endangered Species Protection Board
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Approved by the Illinois Endangered Species Protection Board at the February 20, 2014 Special Meeting.

Common Name: Mud-plantain
Scientific Name: *Heteranthera reniformis* Ruiz and Pav.
Family: Pontederiaceae
Synonyms: Kidneyleaf mud-plantain

Status

Mud-plantain (*Heteranthera reniformis*) is endangered in Illinois (17 Ill. Adm. Code 1050). It was first listed in 1980 as an endangered species due to restricted habitats or low populations in Illinois (Mankowski 2012).

The species is not listed as federally endangered or threatened.

NatureServe gives the species a global rank of G5 (secure) and it is ranked as N4N5 (apparently secure/secure) at a national scale. It is ranked as S1 (critically imperiled) in Illinois. Other state rankings include SH (possibly extirpated) in Connecticut; an S1 rank (critically imperiled) for the species in Iowa, Ohio, West Virginia, and South Carolina; an S2 rank (imperiled) in North Carolina; an S3 rank (vulnerable) in New York and Georgia; and, an S4 rank (apparently secure) in Delaware, Kentucky, New Jersey, and Virginia. It is not ranked in the remaining states with distribution (NatureServe 2013; Figure 1).

Total Range

Mud-plantain ranges from Paraguay and Argentina to the southern and eastern United States from Texas to New York (Figure 1).

Illinois Distribution

In Illinois, the species is historically known from the southern 1/3 of the state in counties bordering major rivers (Herkert and Ebinger 2002). There are historic museum and/or the Illinois Natural Heritage (Biotics 4) Database (Database) element occurrence records (EOs) from 6 counties (EOs have been established from 3 of the 6 counties) and 3 Natural Division Sections (EOs have been established in 3 of the 3 Sections) (Herkert and Ebinger 2002, INHD 2013; Tables 1 and 2, Figure 2).

Currently, there are a total of 4 EOs (across 3 counties) in the Database for Mud-plantain. At the time of initial listing, location information was brought forth to establish 2 EOs (across 2 counties and within a 2 Natural Division Sections) and since then 2 EOs (adding 1 county and 1 Natural Division Section) have been added for the species: 1 in 2001 and 1 in 2004. While new EOs have been added since listing, not every EO is surveyed each year or regularly (3 of 4 EOs have reports since 2002), so the number of EOs with observations in any given year or 5-year interval may not reflect the true status of the species (see Figure 3). There have been recent observations (since 2002) at only 1 EO in 1 county; representing 1 of the 6 counties and 1 of the 3 Natural Division Sections with known historic distribution. No EOs occur

on properties that are formally protected by dedication as an Illinois Nature Preserve or registration as an Illinois Land and Water Reserve (INHD 2013; Tables 1, 2, and 3; Figure 2).

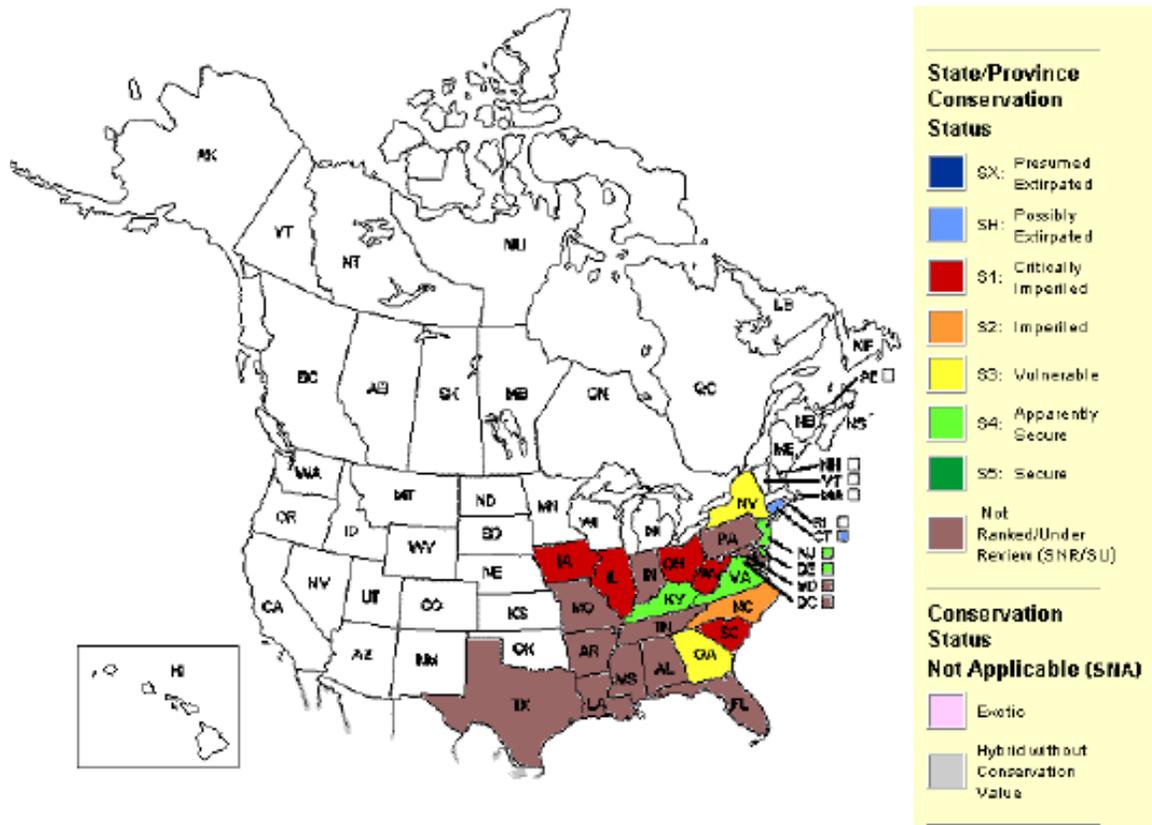


Figure 1. Distribution and NatureServe status of *Heteranthera reniformis*, by state and province (NatureServe 2013).

Table 1. Illinois county distribution of *Heteranthera reniformis*

	Historic (with no EO)	EO with historic obs	EO w/ recent (since 2002) obs
Alexander		X	X
Lawrence	X		
Pope		X	
St. Clair	X		
Union		X	
Wabash	X		

Table 2. Illinois Natural Division and Section distribution of *Heteranthera reniformis*

DIVISION	SECTION	Historic (with no EO)	EOs with historic obs	EOs with recent (w/in last 10 yrs) obs
Wisconsin Driftless				
Rock River Hill Country	Freeport			
	Oregon			
Northeastern Morainal	Morainal			
	Lake Michigan Dunes			
	Chicago Lake Plain			
	Winnebago Drift			
Grand Prairie	Grand Prairie			
	Springfield			

	Western			
	Green River Lowland			
	Kankakee Sand Area			
Upper Mississippi River and Illinois River Bottomlands	Illinois River			
	Mississippi River			
Western Forest-Prairie	Galesburg			
	Carlinville			
Middle Mississippi Border	Glaciated			
	Driftless			
Southern Till Plain	Effingham Plain			
	Mt. Vernon Hill Country			
Wabash Border	Bottomlands	?		
	Southern Uplands			
	Vermilion River			
Ozark Division	Northern			
	Central			
	Southern			
Lower Mississippi River Bottomlands	Northern			
	Southern	?	2	
Shawnee Hills	Greater Shawnee Hills			
	Lesser Shawnee Hills			
Coastal Plain	Cretaceous Hills			
	Bottomlands	?	1	1

Note: "Historic with no EO" location information is not precise and assignment to Natural Division Section is based on a combination of known county occurrence, habitat association, and other Natural Division Section occurrences.

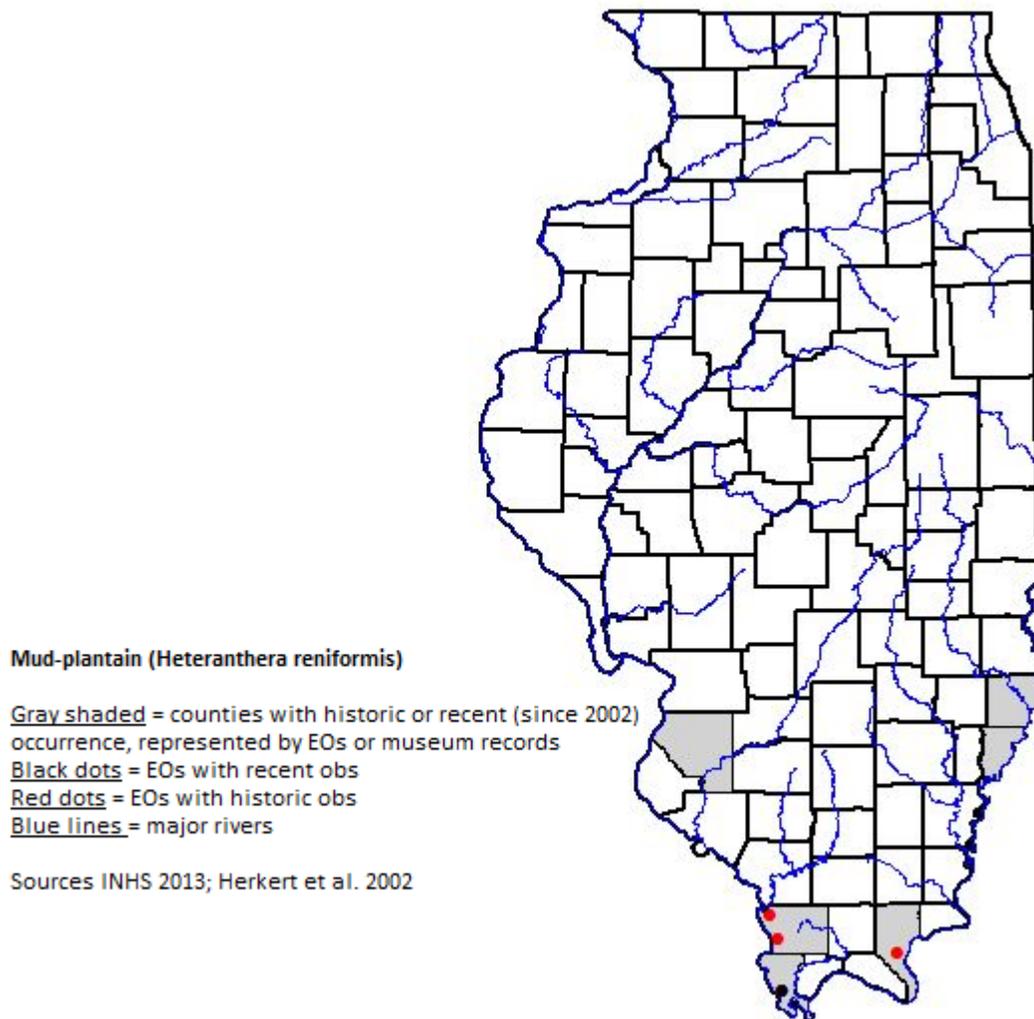


Figure 2. Historic and current distribution of *Heteranthera reniformis* in Illinois.

Table 3. Select Illinois Natural Heritage (Biotics 4) Database information for *Heteranthera reniformis*: Last observation date; total number of element occurrences (EOs); number of EOs observed since 2002; number of EOs protected as Illinois Nature Preserves or Illinois Land and Water Reserves; number of topographic quadrangles captured by total EOs; number of counties captured by total EOs; and, number of counties captured by EOs observed since 2002.

Last Observation	Total # EOs	# EOs observed since Jan 2002	# of EOs protected as NP/LWR	# topo quads	# Counties	# Counties since 2002
10/29/2004	4	1	0	4	3	1

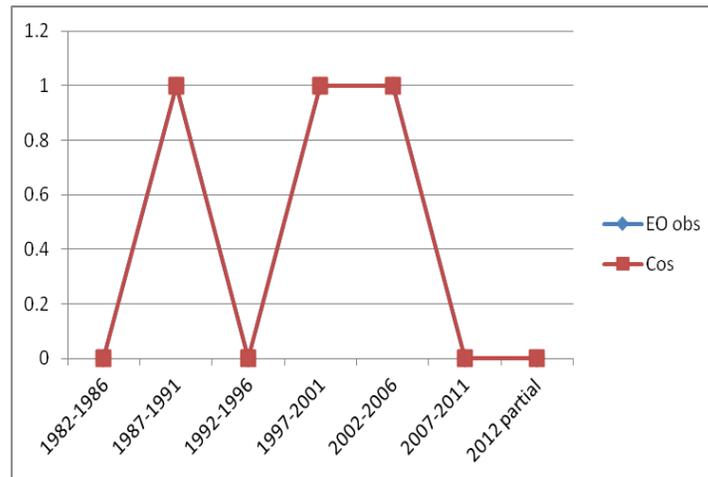


Figure 3. The number of *Heteranthera reniformis* EOs in Illinois with observation during respective 5-year intervals and for 2012 (partial).

Description, Biology, and Habitat

Description

Heteranthera reniformis is an annual or facultative perennial in frost- and freeze-free areas (Herkert and Ebinger 2002, eFloras 2008, NatureServe 2013). It is a shoreline to aquatic herb growing from an underwater cluster of basal leaves and from creeping rhizomes (Herkert and Ebinger 2002; Mohlenbrock 2002; NatureServe 2013). Vegetative stems can be either submersed with elongate sheathed internodes or immersed and procumbent and up to one meter in length (Hill 2006). The flowering stem is glabrous, 1-9 cm long, upper internode 0.5-4 cm. Leaves are initially sessile, usually submersed, from a basal rosette, thin, whitened on abaxial surface, linear to oblanceolate, 2.4–3.7 cm × 3–8 mm and acuminate at the apex. Petiolate leaves develop later and float on the surface or are immersed, kidney-shaped, obtuse at apex, 1-4 cm long, 1-5 cm wide, length equal to or less than the width. The petiole is glabrous 2-13cm long. Stipules are 1-5 cm long, sheathing and conspicuous. The spathe is folded, 8-55 mm long, 2-5 mm wide. The inflorescence is a spike with 2-8 flowers, elongate, and shorter than the spathe. The peduncle is glabrous, 5-42 mm long (Gleason and Cronquist 1963). The flower is a densely glandular pubescent, white, slender tube, 5-10 mm long with five spreading lobes. Lower lobes are narrowly elliptic, acuminate at the apex, 3.0-6.5 mm long. The upper dissimilar central lobe has a yellow/green region at base, sometimes with a brown spot. Stamens are of two sizes; lateral stamens 0.9-2.2 mm long, filaments linear, white, pubescent with white hairs toward apex, anthers rounded, yellow, 0.2-0.8 mm long. The central stamen is yellow or blue, 2.2-4.7 mm long, filament linear, white, sparsely pubescent with hairs, anther is yellow or blue, 0.8-1.8 mm long. Style is white and pubescent with hairs. Fruit is elongate, thin-walled capsule, 0.5-0.8 cm long (50-100). The seeds are 0.5-0.9 mm long, 0.3-0.5 mm wide and have 8-14 longitudinal wings. In Illinois, this species flowers late July and August (Mohlenbrock 2002).

Species Biology

The flowers are very ephemeral in nature; all flowers on an inflorescence will open in the morning and close by the afternoon of the same day. Flowers on submerged inflorescences will not open (Hill 2006, Yatskievych 1994). Seedbanks may exist in the soil for many years; as a result, populations show up unexpectedly when conditions improve. Conditions optimum for seed germination may include daily fluctuations in temperature. These fluctuations naturally raise and lower soluble oxygen levels and may act as a trigger for germination. Historically, *Heteranthera reniformis* may have benefited from the hydrologic changes created by beavers.

Habitat

Heteranthera reniformis is an obligate wetland species that prefers open sunny areas with nutrient-rich soil and water no more than 15 cm deep. Because it is a poor competitor with many sedges, rushes and other wetland species, *H. reniformis* is easily crowded out of wetlands. It is, however, able to take advantage of positive growing situations immediately, such as newly flooded areas (from excessive rain, beaver dams, or human activity) and areas where

competition is removed (as in the case of herbicide use). Habitats include streams, ponds, freshwater tidal mudflats, slow-moving or stagnant water, margins of lakes, creeks, rivers, canals, sloughs, swamps, bogs, marshes, sink holes, bayous, tidal shores, level floodplains that flood and dry regularly, roadside ditches, rice fields and powerline rights-of-way. It requires strong sunlight for its best development, but it can be found among open areas of shrubs and small trees (Hill 2006). It can tolerate acidic and alkaline habitats, but requires high nutrient sites, and can be found in disturbed wetland sites associated with livestock or agriculture. Plants establish from seeds which can be viable for up to 15 years. Plants grow slowly until temperatures become warm in mid-summer. Early leaves form a rosette, which may be submersed. In Illinois, flowering occurs in July and August (Mohlenbrock 2002). The flowers are only open for one day. Emergent flowers are insect pollinated while submersed flowers are cleistogamous. Seed production is best when the plants have emergent leaves and are growing in full sun and water that is 5 -10 cm deep. Seeds germinate when soil begins to warm in late spring and can germinate underwater in shallow areas.

Reasons for Status and Threats

Mud-plantain is at its Midwestern U.S. northern range limit in southern Illinois where it occurs in restricted habitat of wetlands and floodplains of major rivers. It has specific habitat needs, preferring open sunny areas in nutrient rich soils in water no more than 15 cm deep, and is easily crowded-out by competing species. Threats include conversion of habitat, alteration of hydrology (including draining or inundation), woody encroachment and herbaceous competition, and alteration of canopy that may cause excessive shading. It should be communicated to local land managers that local hydrology should not be altered or subjected to extreme fluctuation and that saturated soils should also not be drained in areas where *H. reniformis* occurs.

Low population numbers is also a threat to *Heteranthera reniformis* in Illinois. The species is currently known from only four EOs, with one reported as possibly extirpated, one not having observations since 1977, and most recent observations at the remaining two sites reported 25 individuals at one site and 1,000s at the other site.

Recovery Objectives and Criteria

The Illinois Endangered Species Protection Board is required by law to review, and revise as necessary, the Illinois List of Endangered and Threatened Species at least every five years. We propose that measures of population size and distribution, as documented in the Illinois Department of Natural Resources (Biotics 4) Database, be used to trigger a detailed review of the species' status by the Illinois Endangered Species Protection Board. The measures were developed relative to the status and distribution of the species at the time of original listing and the definitions of "endangered" and "threatened". Achieving the levels of population size and distribution proposed in this outline shall not prompt an "automatic" change in the status of the species in Illinois, and the Endangered Species Protection Board may review the status or status review criteria of the species at any time. Other factors, including known threats, productivity, and extent and condition of protected habitat, should be considered with population size and distribution data to judge whether a change in status is warranted.

Definitions of "endangered" and "threatened" under the Illinois Endangered Species Protection Act.

Endangered in Illinois – in danger of extinction in the wild in Illinois due to one or more causes including but not limited to, the destruction, diminution or disturbance of habitat, overexploitation, predation, pollution, disease, or other natural or manmade factors affecting its prospects of survival.

Threatened in Illinois – likely to become endangered in the wild in Illinois within the foreseeable future.

Listing Status Review Triggers

Endangered – Over the last 5-years, the Natural Heritage (Biotics 4) Database has element occurrence reports for the species that fall below the levels identified in the “Threatened” Listing Status Review Trigger.

Threatened – Over the last 5 years, the Natural Heritage (Biotics 4) Database has element occurrence reports for the species of at least 6 EOs with observations that demonstrate natural recruitment across 3 counties and within 2 Natural Division Sections known for historic distribution and at least 3 of the 6 EOs should have observations in more than one year during the last 10 years. At least 3 EOs must be protected. For EOs that have undergone population manipulation, they must have been liberated from population interventions for at least 3 years and meet the above criteria.

Secure – Remove from the IL List – Over the last 5 years, the Natural Heritage (Biotics 4) Database has element occurrence reports for the species of at least 12 EOs with observations that demonstrate natural recruitment across 6 counties and within 3 Natural Division Sections known for historic distribution and at least 6 of the 12 EOs should have observations in more than one year during the last 10 years. At least 7 EOs must be protected. For EOs that have undergone population manipulation, they must have been liberated from population interventions for at least 3 years and meet the above criteria.

Recommended Recovery Strategies

Recovery Strategy 1: Assess current status and distribution

- a. Conduct surveys at 1/5 of known EOs annually to confirm presence/absence and population numbers of all EOs, within each 5-year cycle. Surveys should cover information necessary to complete an Element Occurrence Reporting form and include the following specific information: the total number of individuals at a location (indicate count or estimate); the number or percent of individuals from younger age classes that demonstrate natural recruitment (indicate count or estimate); the area surveyed and what % of proximate suitable habitat the survey area represents (include a map); and, search effort (person hours).
- b. Conduct surveys at three historic locales with no EOs to confirm presence/absence and population numbers (if present), within a 5-year period.
- c. Survey for additional suitable habitat and new occurrences in counties/Natural Division Sections known for historic and current populations where EOs have been established.
- d. Report results annually to the Illinois Natural Heritage (Biotics 4) Database.
- e. At the end of the initial 5-year period, assess whether additional surveys are warranted for areas identified in (b) and (c) or if these locales should be considered low priority areas in allocating future resources.

Recovery Strategy 2: Promote management and protection of known populations.

- a. Work with landowners to gain commitment for developing management plans to promote compatible land uses and minimize threats for properties with extant populations.
- b. Work with landowners to promote enrollment of properties with extant populations into land protection programs such as dedication as an Illinois Nature Preserve, registration as an Illinois Land and Water Reserve, or a similar conservation easement program.

Recovery Strategy 3: Assess need and potential for augmenting existing populations and/or establishing reintroduced/introduced populations within appropriate habitat.

- a. Review status and distribution against Listing Status Review Triggers to determine if augmenting existing populations and/or reestablishing/establishing new populations is necessary.

- b. Determine whether local ecotype stock is available for collection of seed and either direct dispersal to receiving sites or for propagation and later planting of propagules to receiving sites. If local ecotype stock is not available, conduct genetic analysis of proposed translocation stock to determine genetic health and compatibility. If propagation of stock is prescribed, methods with demonstrated success should be used – at this time, methods should follow those used for propagation and planting of *Silene regia* by Edgin (Edgin 2012).
- c. Perform an assessment of potential translocation areas based on results from Recovery Strategy 1 and relative to Recovery Strategy 3a and assess for potential impacts to other listed species in the proposed receiving sites.
- d. Relative to determinations about origin of proposed translocation stock from 3b, and consistent with the INPC/IESPB/IDNR Plant Translocation and Restoration Policy, conduct translocations at sites that have formal protection agreements in place.
- e. Translocated occurrences will be monitored annually for at least the first 3 years. Results of the first 3 years monitoring will be reviewed to determine survivorship at the receiving site and success of translocation methods and whether translocation efforts should be continued, ceased, or otherwise adjusted.
- f. Report results annually to the Illinois Natural Heritage (Biotics 4) Database.

Recovery Outline Review & Revision

This outline will be reviewed annually by the authors and staff involved with implementation. The need for revisions may be identified at any time. All substantive revisions to this outline, including but not limited to recovery objectives and recovery strategies, should be considered a new recovery plan and follow the protocol described in “The Illinois Department of Natural Resources’ Recovery Planning in the Office of Resource Conservation” (current version). As such, recovery planning may be initiated by any staff and follows an established process to ensure proper review and potential conflicts are identified. Updated information – such as new data on distribution and abundance, research results relevant to recovery considerations, changes in taxonomy or nomenclature, and corrections to factual errors in this document – may be posted as addendums to the recovery outline without changing the original document.

Estimated Timing of Strategies

Implementation is expected to take 10 or more years: Strategies will be somewhat implemented in phases and results from the first 5-year interval will greatly inform the overall estimate. Many activities such as landowner contacts, site-specific habitat management plan development, contract administration, etc., will be ongoing throughout the year. A basic schedule of some key implementation activities is presented below.

January	Conduct annual review of recovery outline strategies to confirm priority activities for calendar year. Recovery activities of INPC and IDNR staff are included in respective annual plan of work processes.
February	
March	Confirm information and resources are in place to conduct annual field work.
April	Primary window for spring plantings for translocations (April-May). Primary window for surveys of element occurrence and potential habitat (flowering is in July-August).
May	
June	
July	
August	If fall plantings are prescribed for translocations, September is the target window.
September	
October	Ensure element occurrence survey reports have been submitted to the Biotics 4 Database. Compile information on annual surveys, translocation activities, and habitat protection.
November	
December	Complete and post biennial progress reports on <i>Clematis viorna</i> recovery.

Estimated Costs of Strategies

Estimated total cost for establishing 300 plants on 7 protected sites (what is currently estimated as necessary to achieve the population threshold for the Listing Status Review Trigger for “Secure – Remove from the IL List”) is between \$5,000 and \$7,500 plus labor for transplanting. The estimate for staff time for monitoring, habitat searches, and reporting is approximately 0.75 day/occurrence.

References:

520 ILCS 10/ Illinois Endangered Species Protection Act (1972 et seq.).

Edgin, R. 2012. Recovery of *Silene regia* Sims (Royal Catchfly) in the Prairie Ridge Conservation Opportunity Area – Report 2010-2012. Unpublished report. Illinois Nature Preserves Commission. Springfield, Illinois. 26 pp.

Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 16+ vols. New York and Oxford. (Accessed online 06/30/2013).

Gleason, H. A., and A. Cronquist. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. Van Nostrand Reinhold Co., New York. 810 pp.

Herkert, J.R, and J.E. Ebinger, editors. 2002. Endangered and Threatened Species of Illinois: Status and Distribution, Volume 1 – Plants. Illinois Endangered Species Protection Board, Springfield, Illinois. 161 pp.

Hill, S. R. 2006. Conservation Assessment for the kidneyleaf mud-plantain (*Heteranthera reniformis* Ruiz & Pavon). Illinois Natural History Survey Center for Wildlife and Plant Ecology Technical Report, Champaign, Illinois.

ILL. ADM. CODE. Conservation § 1050: Illinois List of Endangered and Threatened Flora (1980 et seq.).

Illinois Natural Heritage Biotics 4 Database (INHD). 2013. Illinois Natural Heritage Biotics 4 Database, Illinois Department of Natural Resources, Springfield, Illinois. (Accessed January, 2013).

Illinois Nature Preserves Commission (INPC), Illinois Endangered Species Protection Board (IESPB), and Illinois Department of Natural Resources (IDNR). 1992. Illinois Plant Translocation and Restoration Policy. INPC, IESPB, IDNR, Springfield, Illinois. 8 pp.

Mankowski, A. 2012. The Illinois Endangered Species Protection Act at Forty: a Review of the Act’s Provisions and the Illinois List of Endangered and Threatened Species. Illinois Endangered Species Protection Board, Springfield, Illinois. 152 pp. Published online at <http://www.dnr.illinois.gov/ESPB/Pages/default.aspx>.

Mohlenbrock, R.H. 2002. Vascular Flora of Illinois. Southern Illinois University Press, Carbondale. 490 pp.

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life (web application). Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed June 8, 2013).

Schwegman, J.E. 1973. Comprehensive Plan for the Illinois Nature Preserves System, Part 2. The Natural Divisions of Illinois. Illinois Nature Preserves Commission, Rockford. 32pp.

Steiermark, J.A. 1963. Flora of Missouri. Iowa State University Press. Ames, Iowa. 1728 pp.