

Final Recovery Planning Outline with Listing Status Review Triggers for the Illinois Endangered Royal Catchfly (*Silene regia*)

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Approved by the Illinois Endangered Species Protection Board at the February 20, 2014 Special Meeting.

Common Name: Royal Catchfly
Scientific Name: *Silene regia* Sims.
Family: *Caryophyllaceae*
Synonyms: none

Status

Royal Catchfly (*Silene regia*) is listed as endangered in Illinois (17 Ill. Adm. Code 1050). It was first listed in 1980 as an endangered species because it was considered formerly widespread, but nearly extirpated from Illinois due to habitat destruction, collecting, or other development pressures (Mankowski 2012).

The species is not listed as federally endangered or threatened.

NatureServe gives the species a global and national rank of G3 (vulnerable). It is ranked as S1 (critically imperiled) in Illinois. Other state rankings include an SH rank (possibly extirpated) in Kansas and Tennessee; an S1 rank (critically imperiled) for the species in Georgia, Kentucky, Mississippi, and Oklahoma; an S2 rank (imperiled) in Alabama, Arkansas, Indiana, and Ohio; and, an S3 rank (vulnerable) in Missouri. NatureServe identifies the species as an exotic in Wisconsin (NatureServe 2013; Figure 1).

Total Range

Silene regia's distribution includes Kansas, Oklahoma, Arkansas, Missouri, Wisconsin, Illinois, Indiana, Ohio, Kentucky, Tennessee, Georgia, Alabama and Florida (NatureServe 2013; Figure 1).

Illinois Distribution

In Illinois, the species' historic distribution reflected the occurrence of dry-mesic barrens and prairies. Historic records range from counties in the northeastern, southeastern, and southwestern parts of the state (Herkert and Ebinger 2002). There are historic museum and/or the Illinois Natural Heritage (Biotics 4) Database (Database) element occurrence records (EOs) from 11 counties (EOs have been established from 5 of the 11 counties) and 10 Natural Division Sections (EOs have been established in 4 of the 10 Sections) (Herkert and Ebinger 2002, INHD 2013; Tables 1 and 2, Figure 2).

Currently, there are a total of 18 EOs (across 13 counties) in the Database for Royal Catchfly. At the time of initial listing, location information was brought forth to establish 1 EO (in 1 county and within a single Natural Division Section) and since then 17 EOs (across 12 counties and 8 additional Natural Division Sections) have been added for the species: 2 wild EOs added in the 1980s, 4 EOs (2 wild, 2 planted) added in the 1990s; 6 EOs (5 wild, 1 planted) added in the 2000s; and, 5 planted EOs added since 2010. A total of 9 EOs were established from plantings and/or have had population augmentations: 8 EOs were established from plantings - 2 have persisted for multiple years and have not additional population augmentation, 2 have had subsequent population augmentations in multiple years, and 4 were initially

planted in 2012; and, 1 EO was naturally occurring, had a single year of population augmentation and has since persisted for multiple years. While new EOs have been added every decade since listing, not every EO is surveyed each year or regularly, 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 15 EOs across 11 counties; representing 4 of the 11 counties and 6 of the 10 Natural Division Sections with known historic distribution. Six of the 15 EOs with recent observations were established from plantings and/or received population augmentations during the same time period. Five EOs occur on properties that are formally protected by dedication as an Illinois Nature Preserve or registration as an Illinois Land and Water Reserve. One EO was reported as “destroyed” in 1999/2000 (INHD 2013; Tables 1, 2, and 3; Figure 2).

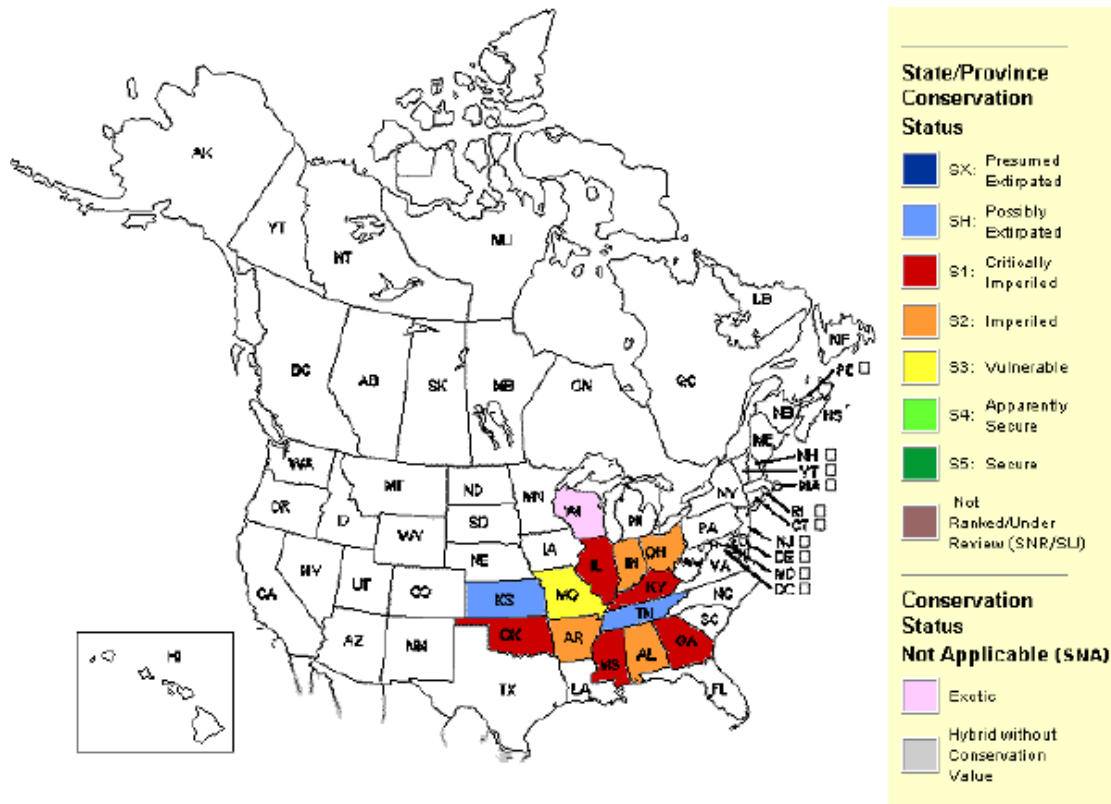


Figure 1. Distribution and NatureServe status of *Silene regia*, by state and province (NatureServe 2013).

Table 1. Illinois county distribution of *Silene regia*

	Historic (with no EO)	EO with historic obs	EO w/ recent (since 2002) obs
Clark	x	x	
Clay			x
Cook	x		x
Edwards			x
Effingham			x
Jasper			x
Kane			x
Lawrence		x	x
Macoupin		x	x
Madison		x	
Marion			x
Montgomery			x
St. Clair	x		
Vermilion		x	x
Wabash	x		
Will	x		

Winnebago	x		
White	x		

Table 2. Illinois Natural Division and Section distribution of *Silene regia*

DIVISION	SECTION	Historic (with no EO)	EOs with historic obs	EOs with recent (since 2002) obs
Wisconsin Driftless				
Rock River Hill Country	Freeport	x		
	Oregon			
Northeastern Morainal	Morainal	x		4
	Lake Michigan Dunes			
	Chicago Lake Plain			
	Winnebago Drift	x		
Grand Prairie	Grand Prairie	x		
	Springfield			
	Western			
	Green River Lowland			
	Kankakee Sand Area			
Upper Mississippi River and Illinois River Bottomlands	Illinois River			
	Mississippi River			
Western Forest-Prairie	Galesburg			
	Carlinville		1	1
Middle Mississippi Border	Glaciated			
	Driftless			
Southern Till Plain	Effingham Plain	x		3
	Mt. Vernon Hill Country	x		3
Wabash Border	Bottomlands	x	3	3
	Southern Uplands			
	Vermilion River		1	1
Ozark Division	Northern			
	Central			
	Southern			
Lower Mississippi River Bottomlands	Northern	x	1	
	Southern			
Shawnee Hills	Greater Shawnee Hills			
	Lesser Shawnee Hills			
Coastal Plain	Cretaceous Hills			
	Bottomlands			

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.

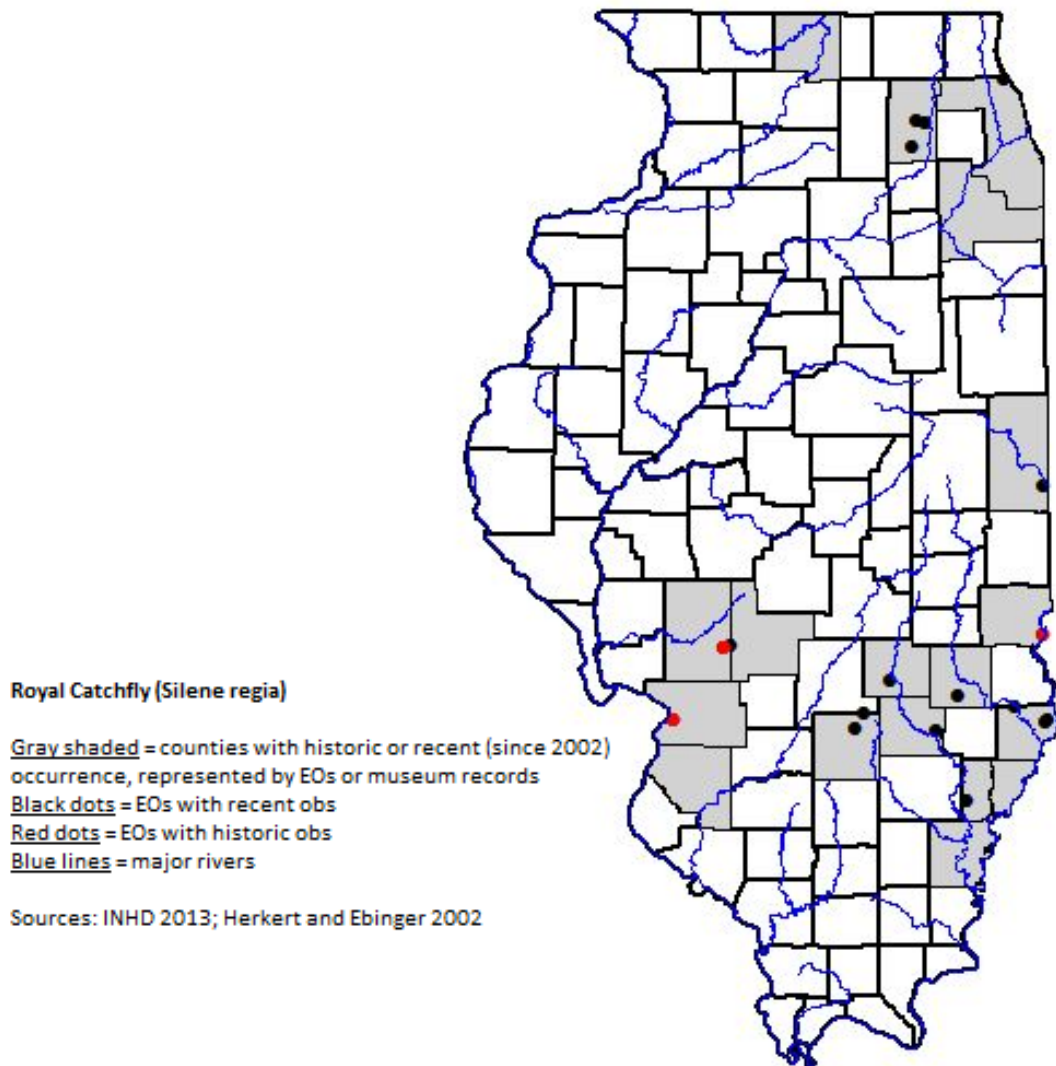


Figure 2. Historic and current distribution of *Silene regia* in Illinois.

Table 3. Select Illinois Natural Heritage (Biotics 4) Database information for *Silene regia*: 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 (# EOs observed w < 3 yrs post population manipulation during the same period)	# of EOs protected as NP/LWR	# topo quads	# Counties	# Counties since 2002
10/15/2012	18	15 (6)	5	15	13	11

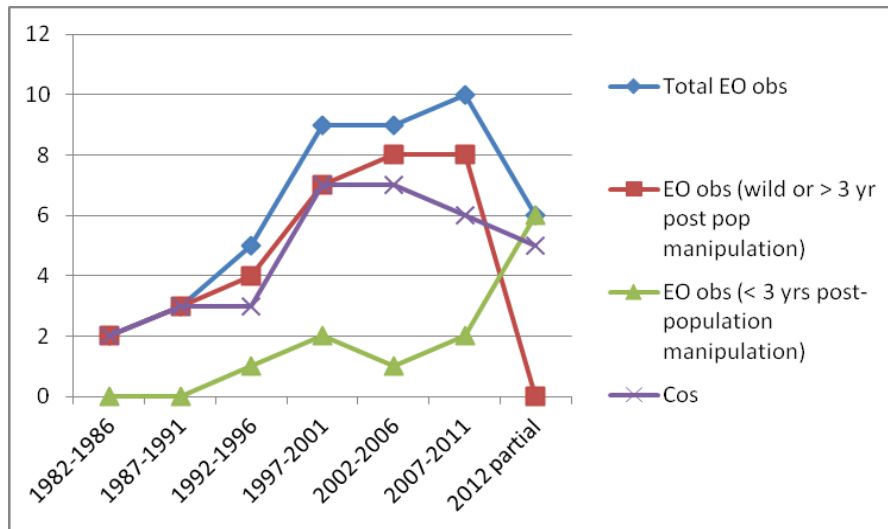


Figure 3. The number of *Silene regia* EOs in Illinois with observation during respective 5-year intervals and for 2012 (partial).

Description, Biology, and Habitat

Description

Silene regia is a long-lived perennial herb in the Caryophyllaceae. The stout, fleshy taproot gives rise to 12 or more erect, simple stems that are 0.5-1.5 m tall. The stems are closely pubescent with 10-20 pairs of opposite, sessile, cauline leaves. The leaves are three-veined, lanceolate to ovate, rounded at the base, acute at the tip, 4-12 cm long, 1.5-7.0 cm wide, and slightly reduced in size on the upper portion of the stem. Lower leaves often wither following anthesis. The inflorescence is a terminal, slightly elongated, compound, bracteate, several-flowered panicle, 15-30 cm tall with strongly ascending branches and pedicels. Pedicels are stipitate-glandular and pubescent. The calyx is prominently 10-nerved, tubular in flowering becoming fusiform in fruit, 1.8-2.5 cm long and glandular-pubescent. The corolla is crimson, scarlet, or rarely pink, 5-merous, unlobed or emarginate, with lobes 10-20 mm long, 3-6 mm wide and prominent auricles. Flowers of *S. regia* are protandrous. The 10 stamens are pale and exserted. It has three exserted styles. Initially during anthesis, five of ten stamens elongate and dehisce their anthers, followed by elongation of the remaining five stamens. Shortly thereafter, elongation of the styles and expansion of the three stigmas occur (Heaslip 1951). The fruit is an ovoid to ellipsoid capsule nearly as long as the calyx, rounded at the base, tapering to the distal end, dehiscent by 6-8 ascending teeth and has a 3-5 mm carpophore. The gravity dispersed seeds are tan to dark reddish brown, reniform to globose in shape, and 1.5-2.0 mm long with smooth, glossy, flat or concave sides (Fernald 1950, Gleason and Cronquist 1991, Dolan 1994, Ladd 1995, Flocca et al. 2004).

Species Biology

Silene regia blooms in July and August in Illinois (Mohlenbrock 2002). Most plants in a population bloom in any given year with upwards of 75% of plants blooming in most years (Menges and Dolan 1998). *S. regia* does not reproduce vegetatively. All reproduction is by seed and seed production tends to be greater in larger populations than smaller populations (Menges 1991). *S. regia* is self-compatible between flowers on individual plants and within individual flowers, but individual flowers rarely self because of dichogamy and production of more than a few fruits apparently requires cross-pollination (Heaslip 1951, Menges 1988, Menges 1995). Capsules produce an average 20-40 seeds (Menges 1988).

The ruby-throated hummingbird (*Archilochus colubris*) is thought to be a primary pollinator and exclusion of the ruby-throated hummingbird, but not insects, from flowers sharply reduced seed production (Menges 1995, Gerlica and Parsons 2006). Swallowtail butterflies (*Papilio* sp.) are also frequent visitors of *S. regia* in Missouri (Menges 1995). The

ruby-throated hummingbird and most *Papilio* species are inhabitants of forests and forest edges rather than prairies suggesting that *S. regia* historically may have had a stronger affinity to savannas and other open woodland communities than prairies (Kleen et al. 2004, Bouseman and Sternberg 2001).

Population size is linked directly to seed germination percentage in *S. regia* (Nature Serve 2013). Larger populations have higher percentages of seed germination than smaller populations. Reduced germination success in small populations (under 150 plants) may be the result of two factors, 1) inbreeding depression resulting in inefficient seed germination and 2) reduced pollinator activity and changes in pollen sources. Germination success is not apparently related to isolation.

Establishment may require bare, exposed soil and fire was likely the primary disturbance factor that historically prepared suitable germination and growth sites (NatureServe 2013). Seed germination is typically low (under 5%) but can be increased with minor soil disturbance and prescribed fire regimes (Menges 1988). Menges (1988) found that plant growth rates were highest in areas subjected to controlled burning and in some populations where litter was shallowest and cover was least. Detailed field work conducted by Menges (1988) found that frequently burned sites possessed numerous seedlings. Similar results had been observed in frequently burned plots at Chauncey Marsh Natural Area in Lawrence County (Edgin personal observations).

The recovery potential of *S. regia* appears to be good, as the species transplants easily and is known to produce well via seed (Emmitt and Cusick 1984, Edgin 2012). Thus, restocking *S. regia* within depleted populations or in restorable sites is an option that should be explored. Seeds of *S. regia* germinate readily with moist stratification at 40° F. Steyermark (1977) and Edgin in 2001 at Chauncey Marsh Natural Area grew *S. regia* from seed and transplanted individuals that have subsequently seeded new plants.

Prior to implementation of the Recovery plan for *Silene regia* Sims (royal catchfly) in the Prairie Ridge Conservation Opportunity Area (Edgin 2007), transplant trials were conducted using seeds collected from naturally occurring populations in Lawrence County, Illinois. Seedlings were subjected to one of four treatments - control, weekly or biweekly liquid fertilizer applications and a slow release fertilizer. The slow release fertilizer used was a 14-14-14 formulation of Osmocote, a resin coated granular fertilizer that soil moisture causes to swell within one week of application. The granules plump into capsules of liquefied plant food that continuously release nutrients for approximately four months. Osmocote was mixed with the planting medium at the rate of 5 grams per 4 inch pot as recommended on the label. All treatments were started simultaneously and grown in the greenhouse for eight to ten weeks before being transplanted. The transplants were planted in late April or early May and in October in consecutive years. No fertilizers were applied nor were transplants tended after planting. Spring transplants had 64.6% survival after 2 years compared to only 40.3% for fall transplants. Transplants treated with the slow release fertilizer were much more robust, grew more and taller stems and produced more flowering stems than the control, weekly, or bi-weekly fertilizer treatments. In a few instances, transplants grown with a slow release fertilizer flowered in August after being planted in May.

A major management concern should be to keep occupied habitats free of woody vegetation. *Silene regia* plants appear smaller and produce fewer flowers in the shade. Plants at sites that are shaded or overgrown with vines produce few flowering stems (Menges 1985).

Depredation of *S. regia* seeds capsules by insect larvae can dramatically lower reproductive output. Insect damage resulted in no seed output for 40% of seed capsules in an Illinois population in 2003 (Edgin 2003 personal observation). Evidence of depredation was a slightly oblong, 1-2 mm wide hole in the lower one third of the seed capsule. Seed depredation may have been caused by a beetle of the family Bruchidae (Dr. Michael Goodrich - personal communication with Bob Edgin). Insect larvae approximately 2 cm long and light brown in color with greenish chevrons on the dorsal surface were also observed on foliage of some plants. These larvae may be the bronzed cutworm (*Nephalodes emmedonia*) or similar species (Dr. Michael Goodrich - personal communication with Bob Edgin).

Habitat

Silene regia occurs in dry, mesic, wet-mesic, and wet prairies, meadows, barrens, dry savannas, open woodlands, glades, and other areas with thin rocky soil (Broadhead 1878, Deam 1940, Jones 1944, Fernald 1950, Jones 1963, Gleason and Cronquist 1991, Dolan 1995, Herkert and Ebinger 2002, Gerlica and Parsons 2006). It is often associated with calcareous soils (Herkert and Ebinger 2002, Gerlica and Parsons 2006). An Ohio population occurs on deep, poorly to very poorly drained silty clay loam that formed on glacial till (Klips 2003). The naturally occurring populations in Lawrence County, Illinois occur on Carmi sandy loam, a droughty, medium acid, terrace soil that developed under grass vegetation usually with gravel 65 to 75 cm below the surface (Fehrenbacher and Odell 1956).

Reasons for Status and Threats

Silene regia is associated with dry-mesic barrens and prairies, including gravel hill prairies, habitats that have become very rare in Illinois, and the species' status and distribution were greatly reduced across the state. Habitat destruction/conversion is the biggest threat to the species. Additional threats include woody encroachment, fire suppression, and depredation/browsing.

Low population numbers may also be a threat to *Silene regia* in Illinois. There are 18 EOs for this species, however 1 EO has been reported as extirpated and 2 EOs have not had observations since at least 2001. Of the remaining 15 EOs, most recent observation reports are as follows: 1 plant/clump at 3 EOs; and, 5 plants/clumps, 11 flowering clumps, 20 flowering plants, 26 plants across 2 nested sites, 30 flowering stems, 38 plants in 10 locations, 85 stems with 79% flowering, 110 plants in 6 locations, 207 plants in 11 locations, 227 plants in 6 locations, 245 seedlings planted, and 1,056 plants across 3 locations, respectively, at the remaining 12 EOs.

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, documentation of minimum population size (> 150 plants) associated with reduced seed germination, 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 10 EOs with observations of > 150 plants each and demonstrating natural recruitment, across 5 counties and within 5 Natural Division Sections known for historic distribution and at least 5 of the 10 EOs should have observations in more than one year during the last 10 years. At least 5 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 20 EOs with observations of > 150 plants each and demonstrating natural recruitment, across 10 counties and within 10 Natural Division Sections known for historic distribution and at least 10 of the 20 EOs should have observations in more than one year during the last 10 years. At least 10 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

Recommended recovery strategies include a combination of monitoring, management, and protection for known populations and a prescription for testing a translocation program for the species to establish new populations. Translocations will be compliant with the INPC/IESPB/IDNR Plant Translocation and Restoration Policy (current version) and will be conducted according to site-specific prescriptions that will include a schedule of review to evaluate the success or failure of individual translocations, the need for prescription adjustments, and whether they should be continued. Translocations will need to be successful and liberated from population manipulation as described above in the Listing Status Review Triggers before they will be considered “wild” occurrences in the statewide population.

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 two 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 may 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 July-August). If fall plantings are prescribed for translocations, September is the target window.
May	
June	
July	
August	

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>Silene regia americana</i> recovery.

Estimated Costs of Strategies

Estimated total cost for establishing 300 plants on 10 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 \$6,000 plus labor for transplanting. The estimate for staff time for monitoring, habitat searches, and reporting is approximately 0.75 day/occurrence.

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