

**Final Recovery Planning Outline with Listing Status Review Triggers
for the Illinois Endangered Eryngium Stem Borer (*Papaipema eryngii*)**

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November 2013 final draft reviewed and approved as agreement with feasibility as outlined, by Joe Kath and Jody Shimp (IDNR), Kelly Neal (INPC), and Anne Mankowski (ESPB) in November and December, 2013.

November 2013 final draft approved by the ESPB at the February 20, 2014 Special Meeting, pending approval by agency representatives who had approved the November 2013 final draft of additional text as included in the June 2014 final draft.

The June 2014 draft with additional text in Recovery Strategy 5a of *“Possible translocation sites will be assessed for potential impacts upon other listed species from Rattlesnake Master plantings.”* and in Recovery Strategy 6a of *“Possible translocation sites will be assessed for potential impacts upon other listed species from Eryngium Stem Borer releases.”* was circulated for a 12 business-day review. It was approved by Randy Heidorn (INPC) and Anne Mankowski (ESPB) and no replies with specific objection were received from Jody Shimp, Ann Holtrop, or Jim Herkert (IDNR), so as explained in the email sent with the distribution, the two sentences are also considered approved by those individuals in the June 2014 final outline.

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Introduction

This recovery outline with listing status review triggers is intended as a planning document to guide development of an *Illinois Eryngium Stem Borer (Papaipema erngii) Recovery Plan*. Information and prescriptions presented in this outline, including listing status review triggers and recovery strategies, are based on current knowledge about the subject species or surrogates and are expected to be updated and revised as new information is gained. In particular, the outline prescribes first steps including surveys to confirm current Illinois status and distribution, genetic analysis of Illinois populations, and development of species-specific habitat suitability assessment criteria; the results of each will greatly inform and may change elements of this outline as they are incorporated into the development of a recovery plan.

Common Name: Eryngium Stem Borer
Scientific Name: *Papaipema eryngii* Bird, 1917
Family: *Noctuidae*
Synonyms: Rattlesnake-Master Borer Moth

Status

Eryngium Stem Borer (*Papaipema eryngii*) is listed as endangered in Illinois (17 Ill. Adm. Code 1010). It was first listed in 1991 as an endangered species because it was a species with a very restricted geographic range of which Illinois is a part and it occupies restricted habitats or has low populations in the state (Mankowski 2012).

The species recently underwent review by the US Fish and Wildlife Service for possible listing as federally endangered or threatened. A twelve-month finding published August 14, 2013 announced the Service's determination that listing as endangered or threatened is warranted, but is precluded by higher priority actions and the species will be added to the USFWS candidate species list until a time when priorities allow the Service to develop a proposed rule for listing.

NatureServe gives the species a global rank of G1G2 (critically imperiled/imperiled), noting that the species probably qualifies for a G1 rank, but there is some level of protection at known extant sites and some are well-managed. The national rank is N1N2 (critically imperiled/imperiled). It is ranked as S1 (critically imperiled) in Illinois. Other state rankings include an SX rank (presumed extirpated) in Indiana and an S1 rank (critically imperiled) in Arkansas, Kentucky, North Carolina, and Oklahoma. It is not ranked in Iowa (NatureServe 2013; Figure 1).

Total Range

Eryngium Stem Borer is endemic to the continental United States and its range, estimated by NatureServe based on historic and recent specimens, includes Arkansas, Illinois, Indiana, Iowa, Kentucky, North Carolina, and Oklahoma. It is presumed to have occurred from Missouri and the states between the prairie region and North Carolina, although no records are known from those areas (NatureServe 2013; Figure 1).

Illinois Distribution

Historic and current records for Eryngium Stem Borer were queried from multiple sources and reviewed by the Illinois Endangered Species Protection Board as it evaluated the species' status and distribution when making the decision to add it to the Illinois List of Endangered and Threatened Species. Descriptions here are based on

information from the initial listing evaluation and information subsequently submitted to the Illinois Natural Heritage (Biotics 4) Database.

Historic records for *Eryngium* Stem Borer are noted as sparse (both in Illinois and range-wide) because identification of the species is made difficult due to cryptic larvae and pupae, and nocturnal adult activity. In Illinois, the species is historically recorded only from locations in Cook County, with multiple collections made from 1915 – 1938 across a localized area that retained larger prairie remnants containing rattlesnake master (*Eryngium yuccifolium*), its host plant (Nyboer et al. 2006; INHS 2009; INHD 2013). More recent historic Illinois Natural Heritage (Biotics 4) Database (Database) element occurrence records (EOs) (classified as greater than 10 years old) have expanded the known distribution of the species to areas downstate. Combining the known historic collection records and the Database historic EOs, there are historic occurrences from 4 counties (EOs have been established from all 4 counties) and two Natural Division Sections (EOs have been established in both of the Sections) (Nyboer et al. 2006; INHD 2013; Tables 1 and 2, Figure 2). Based on the reported dispersal distances of the species and its habitat requirements, it is presumed that it historically occurred in additional counties/Natural Division Sections.

Currently, there are a total of 10 EOs (across 7 counties) in the Database for *Eryngium* Stem Borer. As described in the paragraph above for historic distribution, due to the survey/observation difficulties associated with the species and based on dispersal distances and habitat requirements, *Eryngium* Stem Borer may presently occur in more areas and across a larger area of the state. 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 9 EOs (across 6 counties and 3 additional Natural Division Sections) have been added for the species: 4 EOs (3 naturally occurring EOs and 1 EO established by stocking) were added in the 1990s; 4 naturally occurring EOs were added in the 2000s; and, 1 naturally occurring EO has been added since 2010. The 1 EO that was established by stocking in the 1990s has had repeated subsequent observations. 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 8 EOs across 6 counties; representing 3 of the 4 counties and both of the Natural Division Sections with known historic distribution. 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 (INHD 2013; Tables 1, 2, and 3; Figure 2).

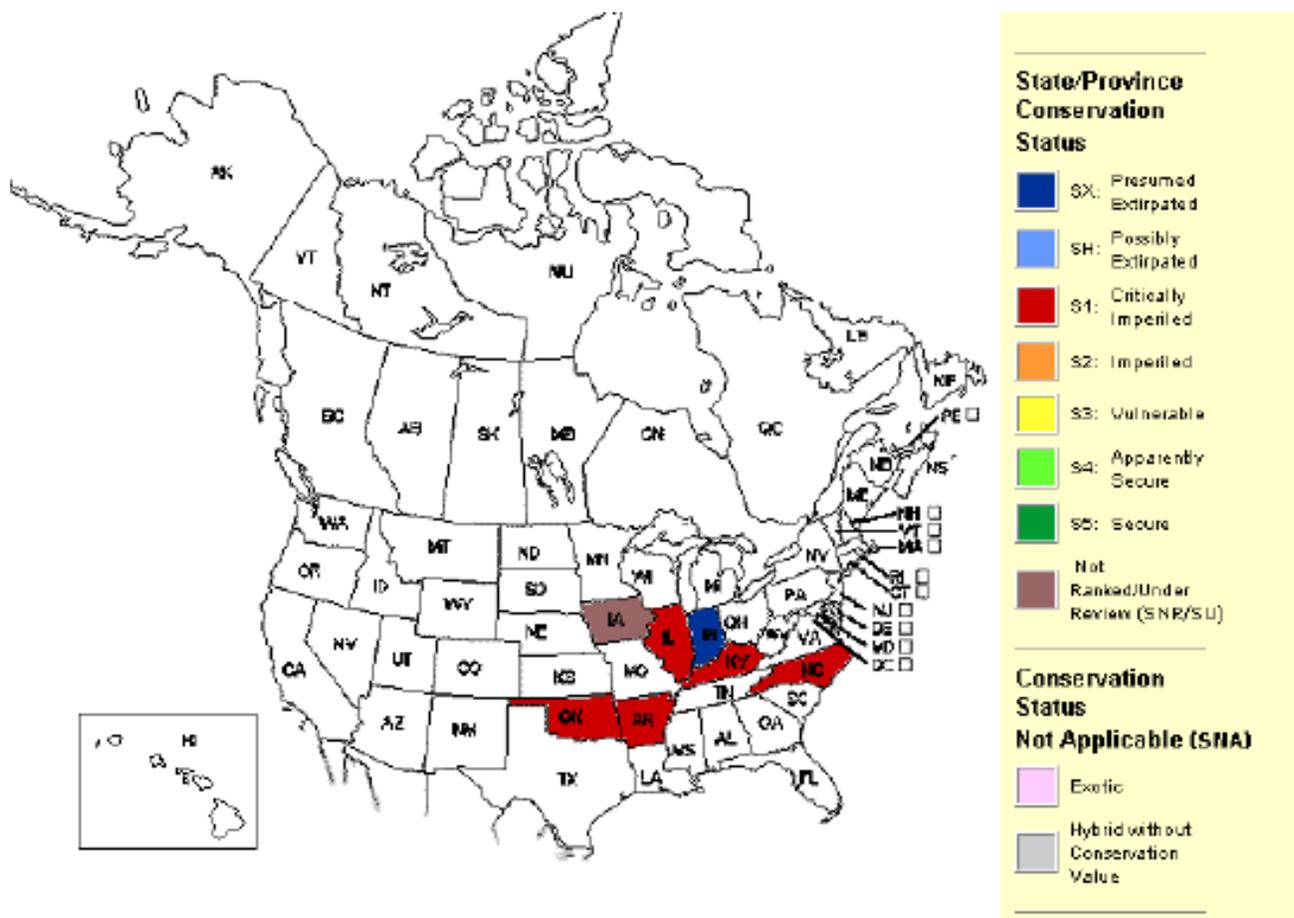


Figure 1. Distribution and NatureServe status of Eryngium Stem Borer, by state and province (NatureServe 2013).

Table 1. Illinois county distribution of Eryngium Stem Borer

	Historic (with no EO)	EO with historic obs	EO w/ recent (since 2002) obs
Cook	x	1	1
Effingham			1
Fayette			1
Grundy		1	1
Livingston		1	
Marion			3
Will		1	2

Table 2. Illinois Natural Division and Section distribution of Eryngium Stem Borer

DIVISION	SECTION	Historic (with no EO)	EOs with historic obs	EOs with recent (since 2002) obs
Wisconsin Driftless				
Rock River Hill Country	Freeport			
	Oregon			
Northeastern Morainal	Morainal			
	Lake Michigan Dunes			
	Chicago Lake Plain	x	1	1
	Winnebago Drift			
Grand Prairie	Grand Prairie		2	2
	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			3
	Mt. Vernon Hill Country			2
Wabash Border	Bottomlands			
	Southern Uplands			
	Vermilion River			
Ozark Division	Northern			
	Central			
	Southern			
Lower Mississippi River Bottomlands	Northern			
	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.

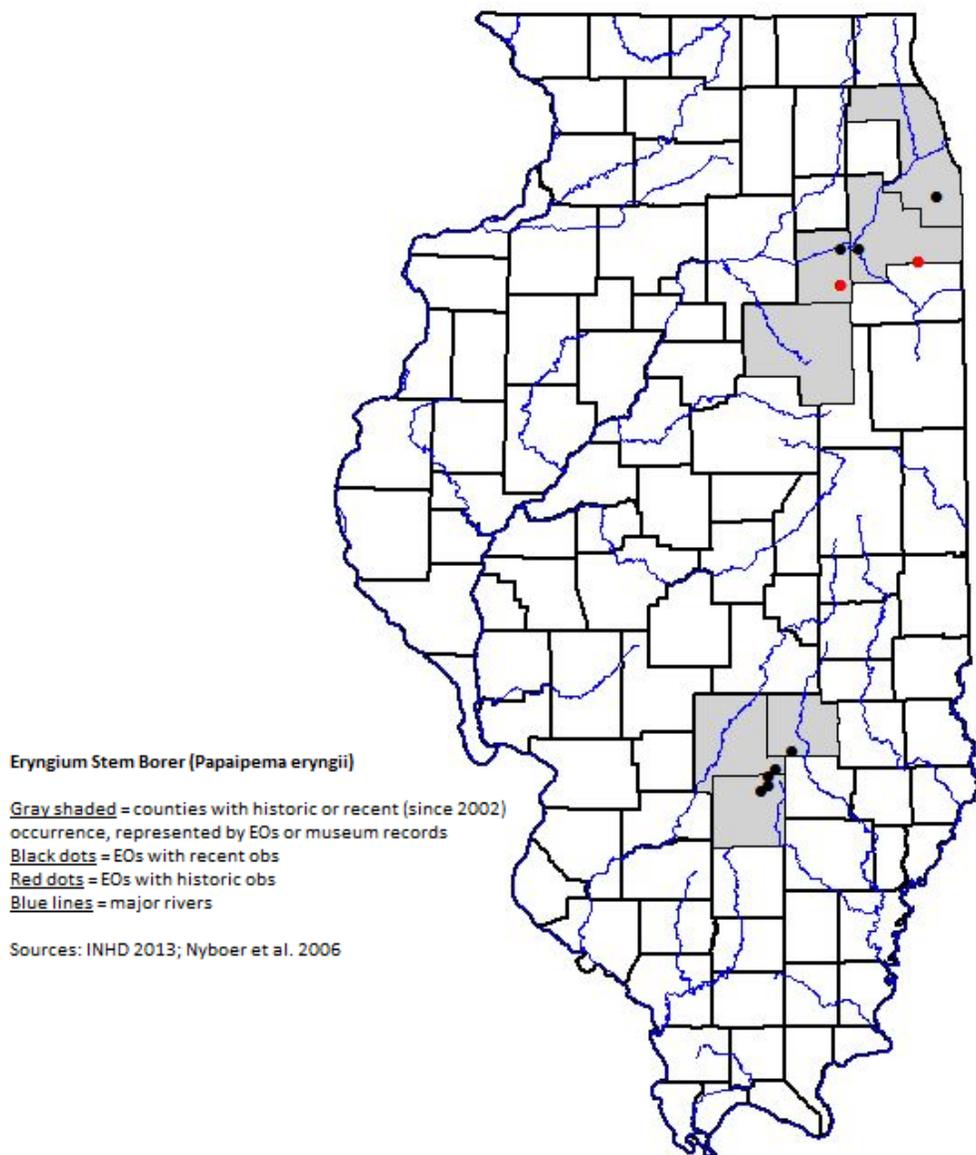


Figure 2. Historic and current distribution of Eryngium Stem Borer in Illinois.
 (Note: EOs are illustrated by point locations; the full extent of the occurrence may cover a smaller or larger area.)

Table 3. Select Illinois Natural Heritage (Biotics 4) Database information for Eryngium Stem Borer: 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
2012-06-11	10	8	5	14	7	6

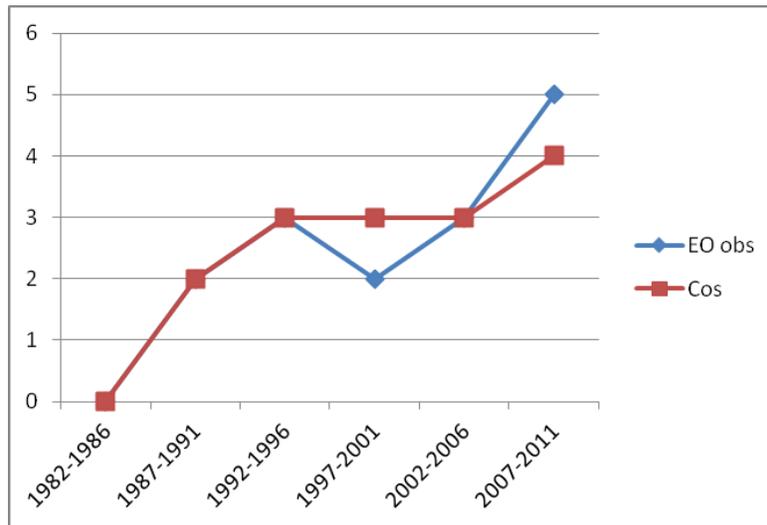


Figure 3. The number of Eryngium Stem Borer EOs in Illinois with observation during respective 5-year intervals.

Description, Biology, and Habitat

Description

The following description is excerpted from 50 CFR Part 17 (2013):

The adult rattlesnake-master borer moth measures 3.5–4.8 centimeters (cm) (1.4–1.9 inches) (Bird 1917, p. 125). It has a smooth head with simple antennae and a tufted body (Forbes 1954, p. 191, Bird 1917, p. 125). The forewing is rich purple brown to red brown becoming lighter and showing yellow powderings near the inner margin, a yellowish white dot at the base, and a powdery yellow patch at the apex (Bird 1917, p. 125). The middle of the forewing contains several distinct white and yellow spots (Bird 1917, p. 125). The hind wing is duller than the forewing and is described by Bird (1917, p. 125) as smoky fawn overlaid with dark purplish powderings becoming darker at the margin. Male rattlesnake-master borer moths have distinctively identifiable genitalia, which allow distinction from other Papaipema moths of similar appearance (Forbes 1954, p. 193; Bird 1917, p. 126). Rattlesnake-master borer moth larvae develop in five instars, all of which have a yellowish head and are deep purplish brown with longitudinal white lines that are broken over the first four abdominal segments (Hessel 1954, p. 62; Bird 1917, p. 127).

Species Biology

The following description is excerpted from 50 CFR Part 17 (2013):

Rattlesnake-master borer moths are univoltine (having a single flight per year) with adults emerging from mid-September to mid-October, and flying through mid- to late October or when the weather becomes too cold (Derkovitz 2013, pers. comm.; Hessel 1954, p. 59; Forbes 1954, p. 198; Bird 1917, p. 128). Their nocturnal habits make them hard to observe, thus adults feeding habits are unknown. Based on their short adult flight span, their underdeveloped mouth parts, and the large amount of stored fat, researchers postulate that they likely do not need much for nectar sources and likely use dew or oozing sap for imbibing moisture (Wiker 2013, pers. comm.). Adults will drink from sugar water when held in captivity (LaGessee 2013, pers. comm.). Based on their coloring, researchers believe the moths likely spend their days attached to plants or on the bottom of leaves, where their presence is camouflaged (Wiker 2013, pers. comm.).

In mid-October, females drop their eggs in the vicinity of the food plant, Eryngium yuccifolium (rattlesnakemaster), where the eggs overwinter in the duff; young larvae emerge between mid-May and early June (Derkovitz 2013, pers. comm.; LaGesse et al. 2009, p. 4; Bird 1917, p. 126). Rattlesnakemaster borer moths are monophagous (have only one food source), with larvae feeding exclusively on rattlesnakemaster (Panzer 2003, p. 18; Hessel 1954, p. 59; Forbes 1954, p. 198; Bird 1917, p. 124). When larvae first emerge, they feed on the leaves of the host plant and the second instars burrow into the stem (or root) and on into the root where they remain until they pupate in mid- to late August (Derkovitz, pers. comm. 2013; LaGesse et al. 2009, p. 4; Bird 1917, p. 127). During the time that the larvae are actively boring into the host plant, researchers have detected cannibalistic behavior with some caterpillars moving into already occupied bore holes, killing the occupant and pushing them back out (LaGesse et al. 2009, p. 4). Rattlesnake-master borer moths diapause in the chamber they create in the host plant and pupation appears to take place either inside the chamber or in the soil and lasts 2–3 weeks (Derkovitz 2013, pers. comm.; LaGesse et al. 2009, p. 4; Bird 1917, p. 127). The boring activities of the rattlesnakemaster borer moth generally result in the plant not producing a flower and can be fatal to the host plant (Wiker 2013, pers. comm.; LaGesse et al. 2009, p. 4).

Although there are no specific data on their home range, rattlesnake-master borer moths are not thought to disperse widely and have been described as “relatively sedentary” (LaGesse et al. 2009, p. 4; Panzer 2003, p. 18). Panzer (2003, p. 19) found that female rattlesnake-master borer moths dispersed up to 120 meters (m) (394 feet (ft)) from where they were released and some traversed a 25-m (82-ft) gap that was devoid of host plants. LaGesse et al. (2009, p. 4) indicate that rattlesnake-master borer moths will disperse up to 2 miles (3–6 kilometers (km)) if the number of host plants is limiting.

Habitat

The following description is excerpted from 50 CFR Part 17 (2013):

Rattlesnake-master borer moths are obligate residents of undisturbed prairie and woodland openings that contain their only food plant, rattlesnake-master (Schweitzer et al. 2011, p. 351; LaGesse et al. 2009, p. 4; Panzer 2002, p. 1298; Molano-Florez 2001, p. 1; Panzer et al. 1995, p. 115; Mohlenbrock 1986, p. 34; Hessel 1954, p. 59; Forbes 1954, p. 198; Bird 1917, p. 124). Although common in remnant prairies, rattlesnake-master occurs in low densities; it is a conservative species and has been found to have relative frequencies in restored and relict prairies of less than 1 percent (Danderson and Molano-Flores 2010, p. 235; Molano-Flores 2001, p. 1). The range of rattlesnake-master covers much of the eastern United States and spans from Minnesota south to Texas, east to Florida and back north to Connecticut (U.S. Department of Agriculture (USDA) Plants Web site 2013, <http://plants.usda.gov/java/>; Danderson and Molano-Flores 2010, p. 235). Although the plant has an expansive range, the loss of its tallgrass prairie habitat within that area is estimated to be between 82–99 percent (Samson and Knopf 1994, p. 418). Most high-quality prairies that remain are small and scattered across the landscape (Robertson et al. 1997, p. 63). In 1997, Robertson et al. (1997, p. 63) cited the Illinois Natural Areas Inventory, which found that of the 253 grade A and B (high-quality) prairies identified, 83 percent were smaller than 10 acres (4 hectares) and 30 percent were smaller than 1 acre (0.4 hectares). Most prairie destruction occurred between 1840 and 1900 (Robertson et al. 1997, p. 63).

Reasons for Status and Threats

Eryngium Stem Borer are dependent on large areas of prairie with an abundance of Rattlesnake Master (*Eryngium yuccifolium*), its singular host plant. While 5 of 10 EOs for the species occur on protected sites (INHD 2013), prairie habitat has been largely destroyed, fragmented, and otherwise disturbed in Illinois. It is estimated that

prior to European settlement, prairie covered about 60% of the state (Anderson 1970) and by the mid-1970s, undisturbed examples occupied less than 0.01% of the state (White 1978). Additionally, *Eryngium yuccifolium* (Rattlesnake Master) is a conservative prairie plant that often occurs only in low densities. Panzer (in USFS 2003) estimates that from 100-1,000 Rattlesnake Master plants need to be present for Eryngium Stem Borer to persist at a site, although that estimate does not specify how many individuals of Eryngium Stem Borer would be supported by 100-1,000 plants nor for how long; “persist” is not defined.

As a relatively sedentary species (even once capable of flight), Eryngium Stem Borer is especially vulnerable to impacts upon its habitat and host plant. This threat increases when habitat occurs in areas with competing management priorities, such as roadway or railroad rights-of-way. Several pre-flight stages of its life-cycle are locally restricted, with eggs overwintering in the duff layer and then larvae emerging in May-June and moving into roots and stems until they pupate in mid-late August (citations in 50 CFR Part 17 2013). Once capable of flight, dispersal distances may be only up to 120 m (394 feet) (citation in 50 CFR Part 17 2013). This very limited mobility and dependence on undisturbed duff and plant roots/stems for nearly a year, has significant implications for the design of management units and timing of management activities (especially prescribed burning) in areas that are being managed for Eryngium Stem Borer and its host plant, Rattlesnake Master. A burn unit rotation of one third of existing habitat/year to retain adequate refugia for recolonization is prescribed in the USFS Conservation Assessment (2003).

There is limited data documenting the number of Eryngium Stem Borer individuals at any of the EOs in Illinois, with 8 of 10 EOs having reports of “observed” to fewer than 100 individuals, one EO having reports of between 250 and 500 individuals, and one EO having reports of between 200 and nearly 4,000 individuals (INHD 2013). The genetic health or viability of separate populations or the state-wide population is unknown at this time.

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 currently proposed measures were developed relative to (1) the status and distribution of the species at the time of original listing, (2) the definitions of “endangered” and “threatened”, (3) protection status of sites, and (4) until a time when we have species-specific information for what constitutes a viable population, we will use the “viable metapopulation size” of 3,000 individuals identified by the U.S. Fish and Wildlife in the recovery plan for the Karner Blue Butterfly (2003). These measures are expected to be revised and a measure for species-specific habitat criteria may be added as information is gained from investigations prescribed in this outline.

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 – The Natural Heritage (Biotics 4) Database has element occurrence reports for the species that fall below the 5- and 10-year levels identified in the “Threatened” Listing Status Review Trigger.

Threatened – The Natural Heritage (Biotics 4) Database has element occurrence reports for the species of at least: (1) 1 EO having observation of at least 3,000 Eryngium Stem Borer (based on the number of Rattlesnake Master plants with sign of larval infestation and occasional sample of larva for captive rearing to confirm Eryngium Stem Borer identification) and evidence of persistence over the last 5 years; (2) 6 additional EOs with observations and evidence of persistence over the last 10 years, 3 in the northern ½ of the state (across at least 2 counties and one Natural Division Section) and 3 in the southern ½ of the state (across at least 2 counties and one Natural Division Section); and, (3) at least 5 EOs statewide 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 – The Natural Heritage (Biotics 4) Database has element occurrence reports for the species of at least: (1) 4 EOs having observation of at least 3,000 Eryngium Stem Borer (based on the number of Rattlesnake Master plants with sign of larval infestation and occasional sample of larva for captive rearing to confirm Eryngium Stem Borer identification) and evidence of persistence over the last 5 years, 2 in the northern ½ of the state (across at least 2 counties and one Natural Division Section) and 2 in the southern ½ of the state (across at least 2 counties and one Natural Division Section); (2) 12 additional EOs with observations and evidence of persistence over the last 10 years, 6 in the northern ½ of the state (across at least 3 counties and two Natural Division Sections) and 6 in the southern ½ of the state (across at least 3 counties and two Natural Division Sections); and, (3) at least 8 EOs statewide 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 surveys and monitoring, management, and protection for known populations, genetic analysis of extant Illinois populations, and based upon the results of the genetic analysis, may include a prescription for testing a translocation program for the species to establish new populations.

Currently known extant populations in northern Illinois are disjunct from those in south-central Illinois by over 150 miles. While it is presumed that the species historically occupied the area in between, it is unknown how much if any, movement of individuals took place between local and/or distant subpopulations. This recovery outline prescribes conducting genetic analysis of the northern and south-central Illinois populations to determine genetic viability/health within, and compatibility between, respective populations. It is expected that recovery of the species will require translocations involving some combination of reintroduction of individuals to historically occupied areas, introduction of individuals to suitable habitat within the known range, and possibly augmentation of individuals to existing populations. The overall design and specific prescription for these activities should be informed by the results of the genetic analysis.

Any translocation activities prescribed will be designed and conducted compliant with the “IESPB Endangered and Threatened Animal Translocation Policy” (1989) and 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: Concurrently conduct genetic analysis of Illinois populations, confirm current status and distribution, and develop species-specific habitat suitability assessment criteria

- a. Conduct genetic analysis of the northern and south-central Illinois populations to determine genetic viability/health within, and compatibility between, respective populations.
- b. Over the course of one field season, conduct surveys of all EOs and all known historic locales (museum/collection records for which no EOs have been established) to confirm current status and distribution. Surveys should cover information necessary to complete an Element Occurrence Reporting form and include the following specific information: the total number of individuals Eryngium Stem Borer observed at a location (based on the number of Rattlesnake Master plants with sign of larval infestation and a small sample of larva for captive rearing to confirm Eryngium Stem Borer identification); an estimate of the number of Rattlesnake Master plants present; an estimate of the area surveyed and what % of proximate suitable habitat the survey area represents (include a map and/or GPS polygon file); and, search effort (person hours).
- c. Develop species-specific habitat suitability assessment criteria for use in guiding management and evaluating sites for suitability and minimum habitat area, host plant stocking/density, and other features necessary to support minimum viable populations of Eryngium Stem Borer.

Recovery Strategy 2: Develop an “Illinois Eryngium Stem Borer (*Papaipema eryngii*) Recovery Plan”

Using information including, but not limited to that contained in this current recovery outline and the results of Recovery Strategy 1, develop a full *Illinois Eryngium Stem Borer (Papaipema eryngii) Recovery Plan*. Development of the plan will follow the protocol described in “The Illinois Department of Natural Resources’ Recovery Planning in the Office of Resource Conservation” (current version).

Recovery Strategy 3: Monitor current status and distribution

- a. Develop a field guide pamphlet for staff use in identifying 1) Rattlesnake Master plants, 2) signs of larval impact to Rattlesnake Master plants, and 3) Eryngium Stem Borer adult moths, and to 4) provide direction for collecting larvae to deliver to an Illinois Eryngium Stem Borer (*Papaipema eryngii*) Recovery Planning Team identified individual who is authorized to rear the larva and verify identification.
- b. 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 individual Eryngium Stem Borer observed at a location (based on the number of Rattlesnake Master plants with sign of larval infestation and a small sample of larvae for captive rearing to confirm Eryngium Stem Borer identification); an estimate of the number of Rattlesnake Master plants present; an estimate of the area surveyed and what % of proximate suitable habitat the survey area represents (include a map and/or GPS polygon file); and, search effort (person hours).
- c. Conduct surveys at two historic locales with no EOs to confirm presence/absence and population numbers (if present), within a 5-year period.
- d. Based on the results of Recovery Strategy 1b and 1c, develop a survey design to search for new occurrences of Eryngium Stem Borer and additional suitable habitat in counties/Natural Division Sections known for historic and current populations where EOs have been established, as well as areas proximate to and in between the northern and south-central Illinois populations.

- e. Report results annually to the Illinois Natural Heritage (Biotics 4) Database.
- f. 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 4: Promote management and protection of habitat with 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 facilitate and implement activities prescribed in management plans.
- c. 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 5: Promote establishment, management and protection of new habitat for expanding known populations or establishing new populations

- a. Work with landowners to establish new areas of suitable habitat by either introducing or augmenting existing populations of Rattlesnake Master in existing large tracts of prairie or by planting prairie “restorations/reconstructions” that include Rattlesnake Master. Translocations of Rattlesnake Master should be conducted consistent with the “INPC/IESPB/IDNR Plant Translocation and Restoration Policy” (1992). Possible translocation sites will be assessed for potential impacts upon other listed species from Rattlesnake Master plantings.
 - 1. Priority should be given to expanding or establishing suitable habitat adjacent or in close proximity to existing occupied habitats.
 - 2. Priority should be given to sites where landowner commitment has been gained for developing and instituting management plans to promote compatible land uses and minimize threats for the property.
 - 3. Priority should be given to sites where landowner commitment has been gained for enrolling the property 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.
- b. Work with landowners to promote management and protection of properties with established new habitat per Recovery Strategy 4.

Recovery Strategy 6: 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. Possible translocation sites will be assessed for potential impacts upon other listed species from Eryngium Stem Borer releases.
- b. Develop species-specific biological protocol for Eryngium Stem Borer translocation timing and methods.
- c. Perform an assessment of potential translocation areas based on results from Recovery Strategies 1c and 3b, 3c, and 3d and relative to Recovery Strategies 4 and 5.
- d. Based on results of Recovery Strategies 6a, 6b, and 6c develop site-specific prescriptions compliant with the “IESPB Endangered and Threatened Animal Translocation Policy” (1989) 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. Proposed translocations should be approved by the Illinois Eryngium Stem Borer (*Papaipema eryngii*)

- Recovery Planning Team prior to issuance of an IDNR Endangered and Threatened Species Possession Permit authorizing the activity.
- e. Conduct translocations at sites that have formal protection agreements in place or commitments for such.
 - f. 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, persistence of the donor site, and success of translocation methods and whether translocation efforts should be continued, ceased, or otherwise adjusted.
 - g. Report results annually to the Illinois Natural Heritage (Biotics 4) Database.

Recovery Strategy 7: Build Public Awareness of Eryngium Stem Borer & Support for Eryngium Stem Borer Conservation.

- a. Develop an informational brochure about Eryngium Stem Borer and Eryngium Stem Borer conservation in Illinois for distribution to the public. Post an electronic version on the Illinois Endangered Species Protection Board’s website.
- b. Publish biennial reports on Eryngium Stem Borer recovery progress on the Illinois Endangered Species Protection Board’s websites.
- c. Publish an article on Eryngium Stem Borer and Eryngium Stem Borer conservation in Illinois through a popular outlet, such as Illinois Audubon Magazine.

Recovery Outline and Plan Review & Revision

This outline and the prescribed recovery plan will be reviewed annually in the course of an annual planning meeting 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.

Year 1	
January	Establish recovery planning team and begin work on Recovery Strategy 1.
February	Strategy 1a. Develop scope and initiate contract for genetic analysis research.

March	Strategy 1 b. Confirm whether staff will conduct surveys of all EOs and historic locales for which no EOs have been established or develop scope and initiate contract to perform the work.
April	Strategy 1c. Confirm whether staff will conduct research to develop species-specific habitat suitability assessment criteria or develop scope and initiate contract to perform the work. Confirm information and resources are in place to conduct annual field work.
May	Continue implementation of Recovery Strategies 1a, 1b, and 1c.
June	Primary window for surveys of element occurrence and potential habitat (May-September). If larvae from extant populations are needed for genetic analysis, the target window for collection would be shortly after emergence in mid-May – June.
July	
August	
September	
October	
November	Ensure element occurrence survey reports have been submitted to the Biotics 4 Database. Plan for the (January) annual planning meeting of the recovery planning team and staff involved with implementation.
December	

Year 2

January	Convene recovery planning team to review results of Recovery Strategies 1a, 1b, and 1c and begin implementation of Recovery Strategy 2 to develop an <i>Illinois Eryngium Stem Borer (Papaipema eryngii) Recovery Plan</i> . If contract employment is necessary, begin administration to execute contract.
February	
March	Confirm information and resources are in place to conduct annual field work. Primary window for frost seeding of Rattlesnake Master is January – early March.
April	Continue development of recovery plan with respective draft versions of the plan routed through ORC review process and all reviews and responses to comments completed by end of September.
May	
June	If translocations of Eryngium Stem Borer are prescribed in the recovery plan, implement Recovery Strategy 6b to develop species-specific biological protocol for Eryngium Stem Borer translocation timing and methods. If contract employment is necessary, begin administration to execute contract.
July	
August	
September	Primary window for spring plantings of Rattlesnake Master is April-May and for fall plantings, is September/October.

	Primary window for surveys of element occurrence and potential habitat (May-September).
October	Final draft recovery plan is signed by ORC Director by mid-October and request is made to present the plan as an agenda item at the ESPB November mtg for ESPB approval and signature by ESPB Chair.
November	
	Ensure element occurrence survey reports have been submitted to the Biotics 4 Database. Compile information on annual surveys, translocation activities, and habitat protection.
December	Plan for the (January) annual planning meeting of the recovery planning team and staff involved with implementation.

Beginning Year 3

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. Primary window for frost seeding of Rattlesnake Master is January – early March.
April	Primary window for spring plantings of Rattlesnake Master is April-May and for fall plantings, is September/October.
May	
June	Primary window for surveys of element occurrence and potential habitat (May-September).
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 Eryngium Stem Borer recovery. Develop informational brochure on Eryngium Stem Borer and Eryngium Stem Borer conservation in Illinois and post to ESPB website. Publish an article on Eryngium Stem Borer and Eryngium Stem Borer conservation in Illinois through a popular outlet, such as Illinois Audubon Magazine.

Estimated Costs of Strategies

Year 1

Implementation of Recovery Strategy 1a - estimated cost for genetic analysis contract is \$5,000 - \$6,500.

Implementation of Recovery Strategy 1b – estimated cost for staff to conduct surveys of all EOs and historic locales with no established EOs is 20 staff person days and \$1,250-\$1,500 in travel costs/person. If the work is contracted, estimated cost is \$5,000 - \$7,000.

Implementation of Recovery Strategy 1c – estimated cost for staff to conduct research to develop species-specific habitat suitability assessment criteria is 3 staff person days. If the work is contracted, estimated cost is \$800.

Year 2

Implementation of Recovery Strategy 2 – estimated cost for staff to develop an “Illinois Eryngium Stem Borer (*Papaipema eryngii*) Recovery Plan” is 15-20 staff person days over the course of one year. If the work is contracted, estimated cost is \$3,000 - \$4,000.

Implementation of Recovery Strategy 6b – estimated cost for staff to Develop species-specific biological protocol for *P. eryngii* translocation timing and methods is 3 staff person days. If the work is contracted, estimated cost is \$800.

Implementation of Recovery Strategy 5a – estimated cost for contracting rearing and planting and/or translocating propagated plants is about \$400 - \$600 contractual and 2-3 staff person days/100 plants. Estimated cost for purchasing seed and planting is approximately \$250 - \$300 contractual and 1 staff person day/acre (at 3 lbs/acre).

Implementation of Recovery Strategy 4 – estimated cost for staff to facilitate or conduct management plan activities is about 5-7 staff person days/site. If the work is contract, estimated cost is \$2,500 - 5,000.

Implementation of Recovery Strategy 3 – estimated cost for staff to monitoring EOs and conduct habitat searches and report results is approximately 1.5 staff person days/occurrence.

Per Year beginning Year 3

Implementation of Recovery Strategy 5a – estimated cost for contracting rearing and planting and/or translocating propagated plants is about \$400 - \$600 contractual and 2-3 staff person days/100 plants. Estimated cost for purchasing seed and planting is approximately \$250 - \$300 contractual and 1 staff person day/acre (at 3 lbs/acre).

Implementation of Recovery Strategy 4 – estimated cost for staff to facilitate or conduct management plan activities is about 5-7 staff person days/site. If the work is contract, estimated cost is \$2,500 - 5,000.

If prescribed, implementation of Recovery Strategy 6e – estimated cost for rearing and releasing Eryngium Stem Borer is \$3,940 - \$4,925 contractual and 8 staff person days/100 individuals. Estimated cost for translocating larvae per protocol developed under Recovery Strategy 6b is \$985 and 4 staff person days/100 individuals.

Implementation of Recovery Strategy 3 – estimated cost for staff to monitoring EOs and conduct habitat searches and report results is approximately 1.5 staff person days/occurrence.

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