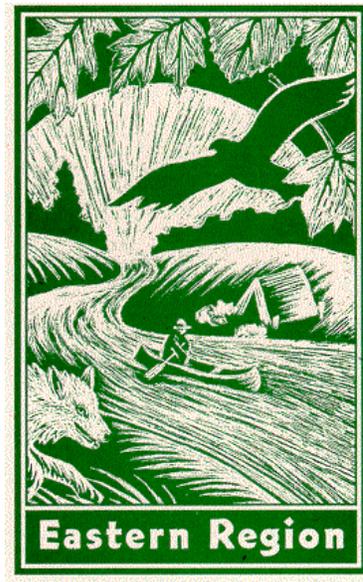


Conservation Assessment
For
Eryngium Root Borer (Papaipema eryngii)



USDA Forest Service, Eastern Region
2003

Prepared by:



This Conservation Assessment was prepared to compile the published and unpublished information and serves as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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NOMENCLATURE AND TAXONOMY

Scientific Name:	<i>Papaipema eryngii</i> Bird
Common Name:	<i>Eryngium</i> root borer moth
Family:	Noctuidae (Noctuid Family)
Synonyms:	
USFS Region 9 Status:	Sensitive
USFWS Status:	No status
Illinois Status:	Endangered

Global And State Rank: The Illinois Natural Heritage Program ranks this species as G2/S1. This ranking means *Papaipema eryngii* is critically imperiled globally and in Illinois (Illinois Natural Heritage Database 1999). *Papaipema eryngii* has been extirpated in much of its historic range and rare throughout its current range. Reasons for this decline are loss of prairie habitat. The populations vary from large (2 sites) to small. Most of the populations are isolated from other populations.

RANGE:

Primarily southern/midwestern, known in Illinois, Arkansas, Oklahoma, and Kentucky. Formally probably throughout the tallgrass prairie where its larval food plant rattlesnake master *Eryngium yuccifolium* was found. The Figure 1 indicates the range of the *Eryngium yuccifolium* in the United States. Potentially *Papaipema eryngii* could have been found historically throughout this range on its larval food plant, but may have been most common in the Midwest. In Illinois, this species can be found in three counties: Cook (reintroduced), Grundy, Will (Illinois Natural Heritage Database 1999), see Figure 2.

PHYSIOGRAPHIC DISTRIBUTION:

In Illinois *Papaipema eryngii* is currently known from the Central Till Plains Section of the Prairie Parkland Province and the Southwestern Great Lakes Morainal Section of the Eastern Broadleaf Forest Province (Keys et. al. 1995). *Papaipema eryngii* occurs in the Grand Prairie and Northeastern Morainal Natural Divisions of Illinois (Schwegman et. al. 1973).

HABITAT:

Mesic and wet-mesic prairie. In Illinois, *Papaipema eryngii* is associated with moderately disturbed to relatively undisturbed prairie.

SPECIES DESCRIPTION:

Members of the noctuid genus *Papaipema* have simple antennae and are characterized by a long thoracic tuft (except in *cerina*) that often slants forward and is truncate at the distal end (Panzer and Bess 1997). *Papaipema eryngii* is a large chocolate-colored moth with bold white orbicular and axillary markings.

Papaipema larvae, nearly all of which are purplish brown in color, have a pattern of longitudinal white stripes and can be placed into one of four groups based on stripe configurations within the thoracic region (Panzer and Bell 1997). *Papaipema eryngii* is a member of the group with zero stripes.

Papaipema eryngii is readily distinguished, as an adult, using both male genitalia or external maculation (see Forbes 1948). *Papaipema birdi* somewhat resembles *Papaipema eryngii*, but can be separated by the shape of the reniform spot (see Forbes 1948).

LIFE HISTORY:

Papaipema eryngii larvae rely on rattlesnake master as their requisite host plant. Rattlesnake master is sole host plant for this species, and a population of 100-1000 rattlesnake master plants needs to be present for *P. eryngii* to persist (Ron Panzer pers. com.). *Papaipema silphii* and rarely *Papaipema baptisiae* will also feed on rattlesnake master in June (Ron Panzer pers. com.).

The following account is from Ron Panzer (pers. com.). *Papaipema eryngii* is univoltine in Illinois, with adults on the wing for mid-September through early October. Mating and egg laying are strictly nocturnal. Females deposit 200 or more eggs within the duff on or near requisite host plants. Larvae emerge from overwintered eggs in late May and immediately begin to bore into their host plants (rattlesnake master). Larvae enter stems near the ground and slowly eat their way into the root of the plant. Feeding continues through early August, at which time mature larvae cease all activity and lay dormant for approximately one week. Larvae pupate in late August, either in the root or in the soil, and emerge as adults roughly 18-21 days later.

Papaipema eryngii is probably only a modest colonizer (Ron Panzer pers. com.).

NATURAL AND HUMAN LAND USE THREATS:

Since *Papaipema eryngii* is host specific to rattlesnake master it is dependant upon the survival of its host plant. Rattlesnake master, although a common prairie plant, rarely grows in disturbed conditions and is restricted to high quality relatively undisturbed prairies. Since high quality prairie remnants are rare, habitat for *Papaipema eryngii* is somewhat restricted. Rattlesnake master grows well in reconstructions and habitat may be augmented by planting prairie in former croplands.

Predation may have an impact on *Papaipema eryngii*, the following account is taken directly from Panzer and Bess (1997). *Papaipema* larvae are preyed upon by a variety of organisms. Losses to endoparasitic wasps can be extensive, with entire populations wiped out within specific host plant patches (Wyatt 1942). Adult moths are cryptically colored, move about very little, are present late in the year when most predator species are no longer present, and likely experience only slight levels of predation. It is quite likely that egg and larval mortality accounts for the bulk of the losses to predation for this species. Sources of larval mortality are numerous, and can include larger predators such as skunks, mice, and muskrats (Bird 1934).

Papaipema eryngii overwinters in the duff and is very sensitive to fire (Panzer 1998). This could especially be a problem if most or all the rattlesnake master habitat within a natural area is burned. However, Panzer and Bess (1997) believe that long-term fire suppression and the resultant loss of prairie habitat that can occur may represent the greatest threat to the species.

Although the impact of grazing on *Papaipema* species is unknown, Panzer and Bess (1997) mentioned it as a possible threat if grazing is heavy during October through May. *Papaipema* species have survived past grazing on some sites such as Goose Lake Prairie State Park in Illinois. Grazing maybe acceptable as long as the host plant (rattlesnake master) survives.

There is speculation that trampling could be a problem (Ron Panzer pers. com.). Females mate in late fall (Sept.) And deposit their eggs around the host plant. Studies have shown that insect eggs buried one centimeter deep are not subject to trampling issues. However, since these eggs simply fall to the ground right around the host plant, they are susceptible. They may also be particularly vulnerable to trampling in the spring, for larvae emerge from overwintered eggs in late May.

After June 15, the insects have moved to the ground, so mowing may have no direct impacts to the population at this time (Ron Panzer pers. com.). However, in the spring, mowing may destroy larvae before they have enough time to enter the roots of the host plants. Indeed, mowing at this time maybe worse than grazing or trampling.

VIABILITY:

The overall goal is to maintain a viable population of *Papaipema eryngii* throughout appropriate habitat. Soule (1980) suggested that minimum viable populations are the smallest size that can persist over a period of years (usually 100 is used) with a low extinction probability (less than 5%) and with enough genetic diversity to adapt to changing conditions in the environment. Good population information doesn't exist for the few sites currently known to have *Papaipema eryngii*. Until population data is available it's impossible to determine a minimum population size. In the mean time the following specific goals would increase the likelihood of maintaining a viable population:

1. Maintain and increase the existing population of *Papaipema eryngii* by improving the current habitat.

2. Increase the population size of the host plants through prairie reconstruction.
3. Reintroduce populations into patches of rattlesnake master as restoration and reconstruction proceeds. Rattlesnake master is a common prairie forb and should be planted in prairie restoration and reconstruction. This will provide habitat for *Papaipema eryngii*. Disjunct populations of rattlesnake master may need *Papaipema eryngii* reintroduction efforts.

MANAGEMENT

1. Maintain and increase the existing population of *Papaipema eryngii* by improving the current habitat through the following management practices:
 - a) Prescribed burning, a necessary management tool for prairies, should be initiated in the current habitat to control woody plant encroachment and to stimulate prairie plants. Since *Papaipema eryngii* overwinters in the duff, they are sensitive to fire. Only one third of the existing habitat should be burned at any particular time. Unburnt areas are necessary to serve as refugia for recolonization by *Papaipema eryngii* into burned areas.
 - b) Mowing is another method that could be used to control woody vegetation. Little is known about the impacts of mowing on *Papaipema* species and until the impacts are known this management tool should only be used conservatively.
 - c) Exotic species encroachment into the current habitat should be controlled using integrated pest management methods (including herbicides if appropriate) as outlined by an integrated pest management plan such as Carroll and White (1997). Care should be taken to minimize impact to *Papaipema eryngii* host plants, rattlesnake master.
 - d) Woody plants too large to be controlled by prescribed fire or mowing should be removed from prairie restorations. Either the woody plants can be girdled and left in place to slowly decompose or cut off and removed during the dormant season. All cut surfaces should be treated with a herbicide to prevent resprouting. Care should be taken to minimize impact to *Papaipema eryngii* host plants, rattlesnake master.
 - e) Recreational activities that would disturb the newly restored populations should be avoided in the short term. Recreational activities that allow the introduction of exotic species should be avoided.
 - f) Development of trails within areas where the host plant, rattlesnake master, is being restored should be minimized to prevent any harm to the population until the population of rattlesnake master is quite large, in the thousands.

2. Increase the population size of the host plants through prairie reconstruction in disturbed areas such as old fields and crop fields.

a) Rattlesnake master is a common prairie forb and should be a major component of any wet-mesic to dry-mesic prairie reconstruction seed mix. Rattlesnake master establishes itself through seeds quite easily in early successional prairie plantings. Rattlesnake master is a prairie forb that is also quite common in late successional prairie.

b) Once rattlesnake master is established in prairie reconstructions, management as for existing prairies should be initiated as outlined above.

3. Reintroduce populations of *Papaipema eryngii* into patches of rattlesnake master as restoration and reconstruction proceeds. Rattlesnake master is a common prairie forb and should be a common prairie forb planted as prairie restoration and reconstruction proceeds. This will provide host plants for *Papaipema eryngii*. Both *Papaipema eryngii* and rattlesnake master should be managed for by the following practices:

a) Since rattlesnake master is a common prairie forb as restoration proceeds thousands to hundred of thousands of host rattlesnake master plants will probably be available for *Papaipema eryngii*. *Papaipema eryngii* should colonize newly established rattlesnake master plants from existing populations if the distance between them isn't too great.

b) Reintroduction of *Papaipema eryngii* to more distant populations of rattlesnake master may be necessary. Any reintroductions should be done with adults.

4. General management considerations should consider the following:

a) Once good populations of *Papaipema eryngii* have been established and there are thousands of rattlesnake master plants, little specific management will be necessary other than normal prairie management. Periodic prescribed burning will be necessary to control woody plant encroachment and to stimulate the prairie. Burning should be done on a rotation and in units to provide unburned areas for recolonization into burned areas by *Papaipema eryngii*. No more than 1/3 of the *Papaipema eryngii* habitat should be burned in any one year. Exotic species should be controlled in any prairie reconstruction or restoration. No specific recreational activities need be prohibited other than those general ones necessary to protect the prairie habitat.

b) Collecting of *Papaipema eryngii* should be prohibited except for scientific purposes and only with a permit.

MONITORING:

A monitoring protocol should be set up to locate subpopulations of *Papaipema eryngii* and to monitor the health of select subpopulations. This is best done searching for the larval entry

holes and associated frass on the host plants between mid-June and early July. Detecting the presence of the species is straightforward, but measuring populations is more difficult and good techniques haven't been developed.

RESEARCH NEEDS:

- 1) The colonization through space and time of *Papaipema eryngii* to new areas should be researched to determine recolonization potential.
- 2) Research is needed on population genetics, including studies of such topics as gene flow and diversity. Population genetics of this species are unknown.
- 3) Research is needed on the effects of grazing and mowing on this species.
- 4) Research is needed on the differential effects of spring vs fall burns.
- 5) Sampling techniques need to be developed so that populations of this species can be measured more easily.

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FIGURES

Figure 1. United States Distribution of *Eryngium yuccifolium*

Figure 2. Illinois Distribution of *Papaipema eryngii* By County