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## SURVEY OF THE ILLINOIS ENDANGERED KANKAKEE MALLOW, *ILIAMNA REMOTA* (GREENE), IN KANKAKEE COUNTY

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and John E. Ebinger<sup>4</sup>

**ABSTRACT:** *Iliamna remota* Greene (Malvaceae), endemic only to Langham Island in the Kankakee River, Kankakee County, Illinois, is a state endangered species. During the present study, the size of the population was determined, the habitat structure in and around the individual colonies analyzed, and management recommendation made to potentially increase the size of the population. During the summer of 2005, the *I. remota* population consisted of 1,074 stems in 12 colonies, located along the northwest side of the island. In late June, flowering appeared to be prolific, where means and standard deviations of floral buds and open flowers were  $1.6 \pm 1.2$  and  $2.1 \pm 1.7$  per stem, respectively. By late July, however, flowering was sporadic, but many flowering stems had set seed with the mean number of fruits being  $1.2 \pm 0.9$  per stem. Forty percent of sampled seeds germinated after being treated in hot water (80°C) for 10 seconds. Common species associated with *I. remota* colonies were the cool-season Eurasian grass, *Poa pratensis*, and the East Asian shrub *Lonicera maackii*, along with 22 native species and a few other exotics. Previous management included cutting and burning of the shrubby vegetation in and around the *I. remota* colonies. A return to these management practices is suggested.

### INTRODUCTION

*Iliamna remota* Greene (Malvaceae) is an endangered species that is endemic to Langham Island in the Kankakee River, Kankakee County, Illinois (Herkert and Ebinger, 2002). This island, owned by the Illinois Department of Natural Resources, was dedicated as the Kankakee River Nature Preserve in 1966 to preserve the only known native population of *I. remota* (McFall and Karnes, 1995). In 1980, the Illinois Endangered Species Protection Board declared *I. remota* as endangered in Illinois because of its limited range (Schwegman, 1984). Some taxonomical debates exist about this species classification. However, Edward Lee Greene classified *I. remota* as specifically distinct from *I. rivularis* in 1906, based upon morphological differences of the calyx-lobes and carpels (Rydberg, 1913; Strausbaugh and Core, 1932; Wiggins,

1936). More recently, a study resolving the phylogeny of *Iliamna* species found *I. remota* to be genetically distinct from *I. rivularis* at the internal transcribed spacer region in the nuclear ribosomal RNA subunits (Bodo Slotta, 2000). Another taxonomical debate exists over whether *I. remota* is the same species as its closely related eastern occurring species, *I. corei* (Sherff) Sherff (Sherff, 1949). Resolution with regards to *I. remota* and *I. corei* species classification was attempted using the internal transcribed spacer regions in the nuclear ribosomal RNA subunits of both species, without clear results (Bodo Slotta, 2000). The name *Iliamna remota* is recognized in this study from *I. rivularis* and *I. corei* in response to different morphological characters documented by Greene (Strausbaugh and Core, 1932) and Sherff (Sherff, 1949).

*Iliamna remota* is an herbaceous, perennial species that typically grows in sunny, open habitats near the shore along the northwestern portion of Langham Island (Glass et al., 2003; Schwegman, 1984). Plants are 1.0 to 2.5 m tall, with coarse hairs covering the stems and leaves. The palmately-lobed leaves are alternate along the stem, and the flowers occur in terminal racemes. Roots of *I. remota* are shallow and densely fibrous, and vegetative reproduction readily occurs from root crowns of older plants. Two to eight stems may arise from one root crown. Flowers range

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from white to lavender. Fruits are capsules that usually release seeds by the end of September. Previous reports indicate that seedling establishment occurs in March and flowering occurs from July through August (Glass et al., 2003; Schwegman, 1984).

*Iliamna remota* was first documented from Altorf (Langham) Island by E. J. Hill on June 29, 1872, which he noted was close to the small village of Altorf (Strausbaugh and Core, 1932; Sherff, 1946; Jones, 1952). Hill reported that most of the *I. remota* plants grew in habitats such as "gravelly" and "dry banks" (Schwegman, 1988). According to Schwegman (1984), an unpublished class report, written by B. Peyton of Westview High School in Kankakee, Illinois in 1973, measured and plotted all major colonies of *I. remota* on Langham Island. The population was more or less continuous for approximately 200 m along the northwest edge of the island, where plants were observed to occur from halfway up the slope from the shore of the island to 7 m inland. In 1981, about 109 flowering stems were counted in one colony. In 1983, the number of flowering stems declined to 49 in the same colony, and the population consisted of a total of 180 stems concentrated in five colonies (Schwegman, 1984).

Schwegman (1984) prepared a recovery plan to ensure that the *Iliamna remota* population would not become extinct at its only native location. The recovery plan recommendations included: mechanical and chemical eradication of invasive, woody shrubs, namely *Lonicera maackii*, to reduce shading; controlled burns to maintain the open environment optimal for *I. remota* growth and development, and a yearly survey of plants including direct counts of flowering and vegetative stems and seedlings. Since 1984, the portion of the island where *I. remota* occurred was managed according to the recovery plan and the population was monitored for the next 19 years. During this time, *Lonicera maackii* was chemically treated with foliar sprays of Roundup® (2-[phosphonomethylamino] acetic acid), while dense stands were mechanically removed and stems were treated with Garlon 4 herbicide (3,5,6-trichloro-2-pyridinooxyacetic acid; Glass et al., 2003). In April 2001, many shrubs and small trees were mechanically removed and stacked into brush piles in eighteen areas within the *I. remota* population (Figure 1). Seedlings were counted at every brush pile position two months after the piles were burned. Table 1 illustrates where brush pile positions occurred (using a Trimble GeoExplorer III unit) and correlating seedling number. Seedling number reached 3,500 in one area after brush was burned, indicating the effectiveness of burning on seedling development. Data from this 19-year study showed that there was an overall increase in population size from 180 stems in 1983 to 1,646 stems in 2002, with the largest number of

stems (5,364) occurring in 2001, when the brush piles were burned (Glass et al., 2003).

The recent lack of management poses a potential threat to the *Iliamna remota* population. The last controlled burn was conducted in 2003, and the interior of the island did not burn well due to high moisture levels (Kirk, pers. comm.). Since 2003, burns and invasive species control have not been conducted on the island. The objectives of this study were to estimate the current population size and status of *I. remota* on Langham Island, and to obtain data useful for the continued management of this species.

#### DESCRIPTION OF STUDY AREA

Kankakee River Nature Preserve is located in the Kankakee River about 10 km northwestern of downtown Kankakee, Kankakee County, Illinois (N1/2 S9 T31N R11E). The preserve consists of approximately 56 ha in three separate tracts, Langham Island, and forested shorelines on both sides of the river at the western most edge of Kankakee River State Park (McFall and Karnes, 1995). The island is about 700 m long by 195 m wide, and about 10.1 ha in size (Schwegman, 1991). The interior of the island is very flat with little variation in elevation, while steep slopes 2–4 m high separate the upland from the narrow shoreline.

The earliest known report on the vegetation of Langham Island was in 1834 when a government surveyor described the south shore as being "high level rich prairie" with scattered trees of bur oak (*Quercus macrocarpa*), white oak (*Q. alba*) and hickories (*Carya* spp.). By 1912, the elevated, flat portion of the island was cleared and used for row crops. At that time, *Iliamna remota* plants were noted to be "numerous" on the island and located from the edges of the crop field down the slopes of the island leading to the river. In 1945, cultivation ceased and the *I. remota* population consisted of "hundreds of plants," with most plants inhabiting the island's "marginal rocky, grassy slope[s]" (Sherff, 1946). Soon exotic grasses, such as *Poa pratensis* and *P. compressa*, dominated where the cultivated field had been (Glass et al., 2003; Schwegman, 1984, 1991). Other herbaceous species observed in the old field were *Melilotus albus* and *Solidago canadensis*. Woody species such as *Quercus macrocarpa*, *Fraxinus quadrangulata*, and *Toxicodendron radicans* were observed along the south slope of the island (Schwegman, 1988, 1991).

Both Sogan and Rockton Loam soils occur on the island (Paschke, 1979). The Sogan Loam occurs along the steep slopes (18–30%) around the edge of the island where *Iliamna remota* is common. This well-drained, loamy soil commonly contains gravel deposits that increase drainage. The soils of the nearly flat uplands are Rockton Loam. This soil is typically 22.5 cm thick

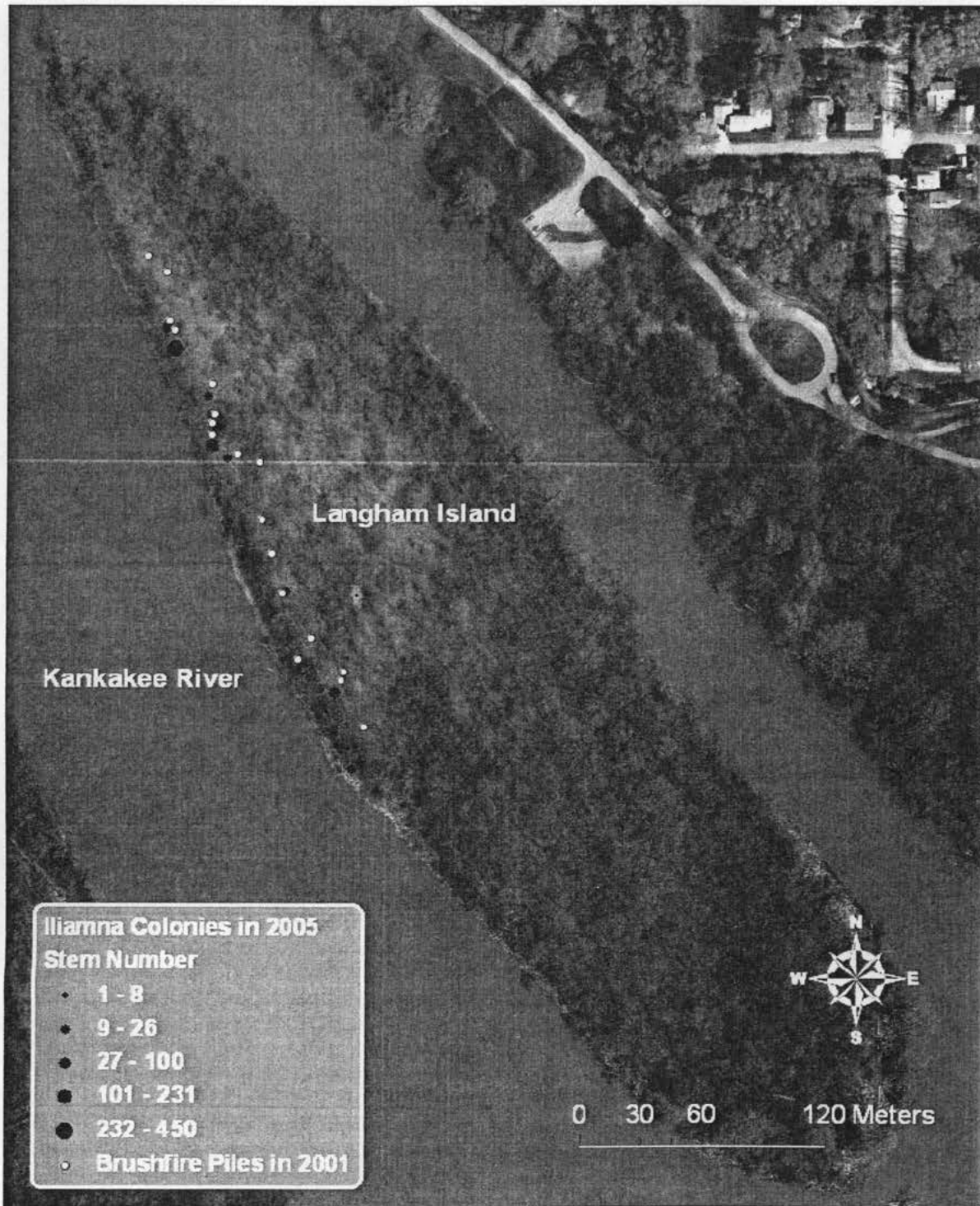


Figure 1: Colony positions and stem numbers of *I. remota* in 2005 and brushfire pile positions in 2001. Stem numbers classified on a Jenks scale. Colony and brushfire pile positions based on the Illinois State Plane East Zone (FIPS 1201) coordinate system and map (NAD 1983) courtesy of Kankakee County GIS specialist, Roger Diercks.

Table 1: *Iliamna remota* brushfire pile positions and correlating seedling number determined from a previous study headed by W. Glass (Glass et al., 2003).

2001			
Colony #	Latitude	Longitude	Seedling number
1	41°11'21.371"N	87°57'58.436"W	51
2	41°11'21.861"N	87°57'58.547"W	11
3	41°11'22.719"N	87°57'59.275"W	20
4	41°11'22.890"N	87°57'59.387"W	15
5	41°11'23.661"N	87°57'59.446"W	15
6	41°11'23.939"N	87°57'59.839"W	20
7	41°11'21.243"N	87°57'58.495"W	160
8	41°11'21.040"N	87°57'58.495"W	20
9	41°11'20.721"N	87°57'57.980"W	91
10	41°11'20.598"N	87°57'57.518"W	58
11	41°11'19.660"N	87°57'57.460"W	245
12	41°11'19.124"N	87°57'57.264"W	128
13	41°11'18.469"N	87°57'57.061"W	187
14	41°11'17.748"N	87°57'56.448"W	10
15	41°11'17.210"N	87°57'55.749"W	222
16	41°11'17.059"N	87°57'55.806"W	3500
17	41°11'16.327"N	87°57'55.342"W	70
18	41°11'16.420"N	87°57'56.715"W	2
			Total: 4825

over the dolomite bedrock, and has a moderate water-holding capacity. *Iliamna remota* also occurs in this uplands soil, which has a 0–2% slope (Schwegman, 1984).

#### MATERIALS AND METHODS

The *Iliamna remota* population on Langham Island was surveyed during early summer of 2005 and the

number of stems determined for the colonies encountered (Table 2). A GPS unit (Trimble Pro XRS) was used to mark the position of each colony. The population extent was defined as the northernmost and southernmost *I. remota* positions. Twelve colonies of *I. remota* were located along the northwest edge of the island and colony positions were overlaid onto a high-resolution aerial photograph of Langham

Table 2: *Iliamna remota* colony positions and stem numbers found during this survey. Coordinates based on the Illinois State Plane East Zone (FIPS 1201).

2005			
Colony #	X coordinates	Y coordinates	Stem number
1	1085596.24188	1646751.65769	8
2	1085511.18926	1646810.69330	13
3	1085481.68734	1646935.01594	75
4	1085405.33189	1647100.66349	12
5	1085309.74929	1647318.07209	12
6	1085283.67252	1647338.38232	231
7	1085292.66288	1647371.17920	78
8	1085283.99328	1647388.56829	68
9	1085278.51029	1647420.42367	26
10	1085224.79993	1647497.58760	450
11	1085212.73024	1647530.60695	100
12	1085114.54694	1647796.01309	1
			Total: 1074

Island (Figure 1). In Figure 1, the colony position points were formatted to increase in size to illustrate the stem numbers for each colony. Also, the position of the brush piles burned in 2001 is shown on this map (Glass et al., 2003). Position coordinates were based on the Illinois State Plane East Zone (FIPS 1201) global positioning coordinate system. In late July of 2005, the plant species encountered in and at the edge of colonies 2 through 11 was recorded. Nomenclature follows Mohlenbrock (2002).

Means and standard deviations of flower buds and open flowers were determined from ten colonies that were observed in June. Mean and standard deviation of fruits per stem were calculated based on a random choice of three stems from six colonies observed in July. Fruits were randomly collected in six colonies for germination experiments, and stored at room temperature (approx. 22°C) until tested for viability. Twenty-five seeds from four stems from one of the colonies were treated with a 10 second hot water dip (80°C) to break dormancy (Hilscher and Preece, 1994) and planted in cell packs containing Jiffy® soilless potting mix to test for viability based on the number of seeds germinated.

## RESULTS

The *Iliamna remota* population extended as almost a straight line 350 m long on the slope and adjacent upland on the northwest side of Langham Island (Figure 1). The population was nearly continuous within this area with concentrated areas recorded as colonies in order to estimate population size. The larger colonies were estimated to be 5 × 7 m and up to 9 × 10 m, with most of the colonies much smaller. The number of stems ranged from 1 to 450 per colony, while the total number of individual stems encountered was 1,074. The position coordinates with the stem numbers for each colony are shown in Table 2.

In late June 2005, abundant open flowers and flower buds were observed in all colonies. The mean numbers and standard deviations of flower buds and open flowers were 1.6 ± 1.2 and 2.1 ± 1.7 per stems, respectively. By late July, flowering was sporadic throughout the population, and many flowers had set seed with mean numbers of fruits being 1.2 ± 0.9 per stem. The number of seeds per fruit ranged from 21 to 55 with an average of 44.2. After seeds were treated with hot water, germination occurred in seven days. True leaves were first observed on seedlings after 15 days. Ten of the 25 seeds (40%) germinated after 34 days.

Twenty-eight vascular plant species were observed growing in and at the edge of the *Iliamna remota* colonies. Of these, 78% were native species, and 25% were woody species (Table 3). The common native

herbaceous species were *Carex* spp., *Elymus villosus*, *Oxalis stricta*, and *Solidago canadensis*, occurring in at least 60% of the colonies. Among the herbaceous non-native species, only *Poa pratensis* was common, being associated with all colonies, while the introduced woody shrub, *Lonicera maackii*, was common throughout the island and found in 90% of the colonies. Two native woody species, *Cercis canadensis* and *Toxicodendron radicans*, were common, being found in 80% of the colonies (Table 3). Overall, 15 species occurred in three or fewer colonies, and eight species were found in eight or more colonies.

## DISCUSSION

During past and present surveys, the *Iliamna remota* plants were mostly restricted to open areas along the northwest portion of Langham Island, especially on the slopes (Sherff, 1946; Schwegman, 1984). When the population was severely limited (less than 100 plants), the range was reduced to the midwest portion of the island (Schwegman, 1984). After a controlled burn in 1986, the population re-established its original range as described by Sherff (1946) (Schwegman and Glass, 1986).

The species' range may be limited to the middle to northwestern portion of the island on the southwest-facing slope due to the more open habitat (Glass et al., 2003). Presently, the population appeared to contain concentrated colonies with isolated individuals scattered in between. The population appears to be more like the population observed in 1973, where stems were more or less continuous within the population (Schwegman, 1984). The population still appears to occur mostly on and near the peripheral slopes of the island. More plants were observed in full sun, whereas plants in shaded or partially shaded areas were shorter and tended to lack flowers and fruits.

The total length of the population (350 m) found in this study was close to the population length (366 m) observed in 1984. The number of stems (1,074) found in this survey exceeded that of the total number of stems (180) found in 1984. However, the stem number determined in this study was a low estimate because the estimated number of plants was derived from the more "concentrated" *Iliamna remota* colonies, whereas there were some isolated individuals scattered in between colonies, thus the population was more or less continuous, as noted in 1973. Therefore, the number of total stems found in this study is conservative.

The results of a controlled burn conducted on March 25, 1986, showed that burning was effective in seedling establishment and development. At that time, the controlled burn was conducted on nine of the ten known colonies of *Iliamna remota*. One colony remained unburned at the request of the Endangered

Table 3: Vascular plant species found within and at the edge of colonies of *Iliamna remota*.

	Colonies											% of colonies where species occurs
	2	3	4	5	6	7	8	9	10	11		
<i>Herbaceous species</i>												
Native												
<i>Ageratina altissima</i> (L.) R. M. King & H. Robins.				X	X	X						30
<i>Asclepias syriaca</i> L.									X			10
<i>Carex</i> L. spp.			X	X	X	X	X	X	X	X	X	80
<i>Elymus villosus</i> Muhl.		X	X	X	X	X	X	X	X	X	X	90
<i>Elymus virginicus</i> L.										X		10
<i>Erigeron annuus</i> (L.) Pers.							X				X	20
<i>Geum canadense</i> Jacq.				X	X	X						30
<i>Hypericum sphaerocarpum</i> Michx.	X			X								20
<i>Muhlenbergia frondosa</i> (Poir.) Fern.	X		X			X						30
<i>Oxalis stricta</i> L.			X	X	X	X	X	X	X	X	X	80
<i>Penstemon digitalis</i> Nutt.				X		X						20
<i>Phalaris arundinacea</i> L.		X	X			X					X	40
<i>Solidago canadensis</i> L.			X	X	X	X	X	X	X	X	X	80
<i>Teucrium canadense</i> L.		X								X	X	30
<i>Verbesina helianthoides</i> Michx.				X	X	X					X	40
<i>Viola pratensis</i> Greene			X									10
Non-native												
<i>Achillea millefolium</i> L.	X											10
<i>Asparagus officinalis</i> L.								X				10
<i>Melilotus albus</i> Medic.							X	X		X		30
<i>Poa pratensis</i> L.	X	X	X	X	X	X	X	X	X	X	X	100
<i>Torilis japonica</i> (Houtt.) DC.						X						10
<i>Woody species</i>												
Native												
<i>Cercis canadensis</i> L.			X	X	X	X	X	X	X	X	X	80
<i>Parthenocissus quinquefolia</i> (L.) Planch.							X				X	20
<i>Ptelea trifoliata</i> L.	X				X	X					X	40
<i>Rubus occidentalis</i> L.			X			X	X	X	X	X	X	50
<i>Smilax tammoides</i> L.		X		X	X	X	X	X	X	X	X	70
<i>Toxicodendron radicans</i> (L.) Kuntze.			X	X	X	X	X	X	X	X	X	80
Non-native												
<i>Lonicera maackii</i> (Rupr.) Maxim.	X	X	X		X	X	X	X	X	X	X	90

Species Protection Board. The number of mature plants per colony increased from 27 in 1985 to 38 in 1986, whereas the number in the unburned colony decreased from 51 in 1985 to 33, suggesting that *I. remota* benefits from controlled burning (Schwegman and Glass, 1986). Although stem number dramatically increased after canopy removal and controlled burns during 19 years of study, the greatest number of seedlings emerged after the brush piles were burned. This suggests that burning brush is an effective technique to promote seedling development, probably

because the hot fire kills nearly all living vegetation in the area of the brush pile.

In late June of 2005, flower buds and open flowers were observed in abundance. Mean number of flower buds and open flowers calculated in this study, however, were low with overall number less than 2 flowers or flower buds per plant. The low numbers resulted since many stems were vegetative. According to Schwegman (1984), flowering in this species typically occurred throughout July and most of August. We observed almost no flowers in a second

visit to the site in late July. Flowers may have opened and fallen earlier due to the dry summer in 2005.

Seed germination rates of 40% were obtained after hot water treatment, indicating that fresh *Iliamna remota* seeds have a lower germination rate than older seeds (Schwegman, 1984). *Iliamna remota* seeds have been documented to survive in soil for at least 10 years, suggesting a significant seed bank for this species (Schwegman, 1990). Additional comparative studies, including seeds of differing age, would render more accurate information regarding seed longevity and germination percentages, which ultimately may be useful for conservation efforts for *I. remota*.

The associated woody vegetation appeared to overwhelm the *Iliamna remota* plants. Extensive woody encroachment resulted in excessive shading and decreased flower and fruit production. *Lonicera maackii* appears to be the most aggressive species, and is responsible for much of the shading. According to Schwegman (1984), *L. maackii* was introduced on the island in 1960, and he observed its rapid spread in 1983, where it was the most frequently occurring tall shrub on the island. This exotic, invasive species was found to be common throughout the island in 1991. A previous study has shown the adverse effect of this species on herbaceous species diversity (McDonnell et al., 2005). This study showed the effectiveness of concentrated glyphosate treatment on mechanically removed *L. maackii* shrubs, which may be a useful management tool for controlling *L. maackii* on Langham Island.

It is possible that *Poa pratensis* may adversely affect the germination and seedling establishment of *Iliamna remota*. This cool-season, Eurasian species forms a tight sod that may limit the resources available to *I. remota*. Further studies to determine the effects of this species on the growth and development of *I. remota* would be very useful. Presently, the use of early spring fire as a management tool would probably reduce the abundance of this exotic species on the island.

Overall, the *Iliamna remota* population appears to be surviving on Langham Island, and previous management practices have been effective in increasing stem numbers. Presently, the *I. remota* population has declined from the last survey in 2002. An increase in shading by the exotic shrub *Lonicera maackii*, and the tight sod of the exotic *Poa pratensis* appear to be responsible for this decline. The increase in abundance of these exotic species is the result of the lack of management. Therefore, the management plan outlined by Schwegman (1984) should be continued to ensure the survival of *Iliamna remota* on Langham Island.

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