

Recovery Plan for Soapweed and Yucca Moth in Alberta 2006-2011



Alberta Species at Risk Recovery Plan No. 11



Recovery Plan for Soapweed and Yucca Moth in Alberta 2006-2011

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The logo for the province of Alberta, featuring the word "Alberta" in a stylized, bold, sans-serif font. The letter 'A' is significantly larger and more prominent than the other letters, which are in a smaller, uniform size.

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PREFACE

Albertans are fortunate to share their province with a diverse variety of wild species. Populations of most species of plants and animals are healthy and secure. However, a small number of species are either naturally rare or are now imperilled because of human activities. Recovery plans establish a basis for cooperation among government, industry, conservation groups, landowners and other stakeholders to ensure these species and populations are restored or maintained for future generations.

Alberta's commitment to the *Accord for the Protection of Species at Risk* and to the *National Framework for the Conservation of Species at Risk*, combined with requirements established under Alberta's *Wildlife Act* and the federal *Species at Risk Act*, has resulted in the development of a provincial recovery program. The overall goal of the recovery program is to restore species identified as *Threatened* or *Endangered* to viable, naturally self-sustaining populations within Alberta.

Alberta species at risk recovery plans are prepared under the supervision of the Fish and Wildlife Division, Alberta Sustainable Resource Development. These recovery plans are prepared by recovery teams composed of a variety of stakeholders including conservation organizations, industry, landowners, resource users, universities, government agencies and others. Membership is by invitation from the Director of Wildlife Management, and includes representation from the diversity of interests unique to each species and circumstance. Conservation and management of these species continues during preparation of the recovery plan.

These plans are provided by the recovery team as advice to the Minister responsible for fish and wildlife management (the Minister) and to all Albertans. Alberta's Endangered Species Conservation Committee reviews draft recovery plans, and provides recommendations to the Minister. In addition, an opportunity for review by the public is provided. Plans accepted and approved for implementation by the Minister are published as a government recovery plan. Approved plans are a summary of the Department's commitment to work with involved stakeholders to coordinate and implement conservation actions necessary to restore or maintain these species.

Recovery plans include three main sections: background information that highlights the species' biology, population trends, and threats; a recovery section that outlines goals, objectives, and strategies to address the threats; and an action plan that profiles priority actions required to maintain or restore the *Threatened* or *Endangered* species. These plans are "living" documents and are revised as conditions change or circumstances warrant. Each approved recovery plan undergoes an annual review, and progress of implementation is evaluated. Implementation of each recovery plan is subject to the availability of resources, from within and from outside government.

TABLE OF CONTENTS

PREFACE	iii
LIST OF FIGURES	v
EXECUTIVE SUMMARY	vii
1.0 INTRODUCTION	1
1.1 Provincial and Federal Status	1
1.2 Recovery Team	1
2.0 SPECIES BIOLOGY	2
2.1 Life History and Adaptations	2
2.2 Habitat Requirements	3
2.3 Population Size, Distribution and Trends in Alberta	3
3.0 THREATS	5
3.1 Ungulate Herbivory	5
3.2 Horticultural and Medicinal Uses	5
3.3 Habitat Loss, Fragmentation and Degradation	5
3.4 Pollen Limitation	6
3.5 Uncoupling of Interactions Between Soapweed and Yucca Moths	6
3.6 Insect Herbivory	6
3.7 Wind	7
4.0 CRITICAL HABITAT	7
4.1 Description of Critical Habitat for Soapweed and Yucca Moth	7
4.2 Identification and Rationale for the Amount and Arrangement	7
4.3 Range Coordinates	9
4.4 Destruction of Critical Habitat	9
4.5 Effective Protection of Critical Habitat	10
4.6 Schedule of Studies to Identify Critical Habitat Comprehensively	10
5.0 KNOWLEDGE GAPS AND INFORMATION NEEDS	10
6.0 RECENT RECOVERY AND CONSERVATION EFFORTS	11
7.0 RECOVERY STRATEGY	11
7.1 Biological and Technical Feasibility of Recovery	11
7.2 Guiding Principles	12
7.3 Recovery Goal	12
7.4 Recovery Objectives	12

7.5 Recovery Strategies _____	13
7.5.1 Population Conservation and Management _____	13
7.5.2 Habitat Conservation and Management _____	13
7.5.3 Information and Outreach _____	13
7.5.4 Research _____	13
7.5.5 Resource Acquisition _____	13
7.5.6 Legislation _____	13
7.5.7 Plan Management and Administration _____	13
8.0 ACTION PLAN _____	13
8.1 Population Conservation and Management _____	13
8.2 Habitat Conservation and Management _____	14
8.3 Information and Outreach _____	15
8.4 Research _____	15
8.5 Resource Acquisition _____	16
8.6 Legislation _____	16
8.7 Plan Management and Administration _____	16
9.0 TIMETABLE FOR IMPLEMENTATION AND SCHEDULE OF COSTS _____	17
10.0 SOCIO-ECONOMIC CONSIDERATIONS _____	18
11.0 PLAN REVIEW AND AMENDMENT _____	18
12.0 LITERATURE CITED _____	19

LIST OF FIGURES

Figure 1. The distribution of soapweed and yucca moths in Alberta. _____	4
Figure 3. Range of soapweed at the Onefour Site. _____	8
Figure 4. Range of soapweed at the Pinhorn Site. _____	9

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EXECUTIVE SUMMARY

Soapweed (*Yucca glauca* Nuttall), commonly known as yucca, is an arid-region perennial that grows as a single rosette or cluster of rosettes of long, narrow, spear-shaped leaves. A tall flowering stalk grows from the centre of each rosette and produces large, white flowers. The yucca moth (*Tegeticula yuccasella* Riley) is a small, white, nocturnal moth. Soapweed and yucca moths have an obligate mutualistic relationship such that neither species can survive and sexually reproduce without the other; although soapweed can reproduce asexually on its own. Moth larvae feed only on soapweed seeds and soapweed can only produce seeds if pollinated by yucca moths.

In February 2003, the Minister of Sustainable Resource Development approved the listing of soapweed and yucca moth as *Endangered* in Alberta. These designations were based on the Alberta population of soapweed occurring at only two sites and occurring over a small area. In addition, both sites are isolated from soapweed populations in the United States (United States). Yucca moths appear to be near extirpation in one of the two Alberta populations (Pinhorn population) and both populations are isolated from moth populations in the United States. A number of factors, including ungulate herbivory, collection of soapweed for horticultural or medicinal uses, habitat destruction or alteration, uncoupling of interactions among soapweed and yucca moths, pollen limitation, insect herbivory, and intense winds may threaten the persistence of these species in Alberta. The goals of the recovery plan are to: (1) maintain the existing habitat and distribution of soapweed and yucca moth in Alberta; (2) maintain naturally self-sustaining populations of soapweed and yucca moth at the Onefour site; (3) increase the reproductive capacity of soapweed and yucca moth populations at the Pinhorn site.

The specific strategies used to attain these goals are: (1) conservation and management of soapweed and yucca moths populations and management of native ungulate populations to reduce losses due to herbivory; (2) conservation and management of habitat in order to maintain the quality and quantity of habitat used by soapweed and yucca moth; (3) provision of information and educational materials to the public and stakeholders to promote the conservation requirements of soapweed and yucca moth; (4) research to elucidate aspects of the life history of soapweed and yucca moths to better understand how to conserve these species; (5) acquisition of resources needed to implement the recovery plan, and (6) development of provincial regulations to protect soapweed and yucca moths and their habitat.

It is expected that implementation of activities to conserve soapweed and yucca moth, combined with stakeholder cooperation and commitment, will allow for the long-term persistence of soapweed and yucca moths in Alberta.

1.0 INTRODUCTION

1.1 Provincial and Federal Status

In February 2003, the Minister of Sustainable Resource Development approved the listing of soapweed (*Yucca glauca* Nuttall) and yucca moth (*Tegeticula yuccasella* Riley) as *Endangered* under the *Wildlife Act* in Alberta on the recommendation of the Alberta Endangered Species Conservation Committee (ESCC). The designation for soapweed was based on a small distribution and decline of the Alberta population, combined with a limited occurrence of the species at only two sites. In addition, populations at both sites are isolated from soapweed populations in the United States. The yucca moth appears to be declining in one of the two Alberta populations (Pinhorn population) and both populations are isolated from moth populations in the United States (Hurlburt 2001). Recommendations from the ESCC, and approved by the Minister, specified that a recovery plan should be developed in order to set goals, objectives, strategies and management actions necessary to guide the management of these two species during the next five years. The ESCC also recommended that management of these species should focus on the identification and conservation of existing populations. The initial conservation action statement for soapweed/yucca moth further stated that pending development and implementation of the plan, government regulated activities and land use management systems should be strengthened. As soapweed and yucca moths have an obligate mutualistic relationship the development of a joint recovery plan for these two species is both practical and appropriate.

In May 2000 and 2002, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated soapweed and yucca moth as *Threatened* and *Endangered*, respectively, due to their restricted occurrence and distribution in Canada (COSEWIC 2000, 2002, 2005). Both species are protected under the federal *Species at Risk Act* (SARA). Until recently, native populations of soapweed and yucca moth were known only to occur in Alberta. However, one native population of soapweed, and also possibly of yucca moths, may occur at one site in Saskatchewan (D. Hurlburt, pers. comm.). However this is still under investigation and debate.

1.2 Recovery Team

At the direction of the Minister of Sustainable Resource Development, the Soapweed and Yucca Moth Recovery Team was initiated in October 2003 by the Director of Wildlife Management. The team's primary responsibility is to facilitate, monitor and evaluate the conservation and recovery of these species in Alberta. It provides expert advice to the Minister (or his delegate) on all matters relating to the management of soapweed and yucca moth in Alberta, through the development of a provincial recovery plan. The recovery team typically does not implement recovery actions directly, although team members and the organizations they represent generally participate in the planned recovery actions. The team will encourage and facilitate the involvement of all interested parties in the recovery of soapweed and yucca moth in Alberta, whenever possible, and will periodically report on the progress of the recovery program.

Membership of the recovery team attempts to include the best representation of parties likely to affect or to be affected by recovery actions and consists of the following member organizations: Alberta Sustainable Resource Development (Fish and Wildlife Division and Public Lands and Forests Division), Alberta Community Development (Parks and Protected Areas Division—

Alberta Natural Heritage Information Centre), Agriculture and Agri-Food Canada, University of Lethbridge, Alberta Native Plant Council, and the Pinhorn Grazing Association.

2.0 SPECIES BIOLOGY

2.1 Life History and Adaptations

Soapweed (commonly known as yucca) is an arid-region perennial that grows as a single rosette or cluster of rosettes of long, narrow, spear-shaped leaves 25 to 40 cm long (Kingsolver 1984). A rosette may reproduce asexually resulting in a clone plant growing near the original rosette. An inflorescence (flowering stalk) 30 to 85 cm tall grows from the centre of each rosette and produces 15 to 75 large, fleshy, downward-nodding flowers (Kingsolver 1984). Flowers are generally white or pinkish-white (Kingsolver 1984). Soapweed plants mature at 15 to 20 years of age and flower only every 2 or 3 years. Individual rosettes flower only once and die after flowering (Kingsolver 1984). The plant can reproduce sexually through the production of seeds or asexually through the production of rhizomes (Hurlburt 2001). Plants are tolerant of self-pollination but still require moths for this process to occur (Hurlburt 2004). Flowers that are pollinated become fruit and mature into woody pods during July and August. Seedpods open in September and release thin, flat, black seeds (Kingsolver 1984, Kershaw et al. 2001). Seeds are primarily gravity dispersed and fall near the parent plant, creating the clumped distribution of this species (D. Hurlburt, pers. comm.). Seeds have a low germination rate and are viable only for one year (Webber 1953, Milner 1977), resulting in a seedbank that cannot ensure the persistence of the species (Alberta Sustainable Resource Development 2002).

Yucca moths are small night-flying moths. Forewings are generally white with a wingspan of 18 to 28 mm (Pellmyr 1999). Hindwings are brownish-grey, gradually turning white toward the hind corner (Pellmyr 1999). Females have fully developed tentacles that they use to gather pollen and to pollinate soapweed flowers (Alberta Sustainable Resource Development 2002). Yucca moths do not appear to be strong flyers and probably cannot disperse over long distances (Hurlburt 2001).

Soapweed and yucca moths have an obligate mutualistic relationship such that neither species can survive on a long-term basis and/or reproduce sexually without the other. Moth larvae feed only on soapweed seeds and soapweed can only produce seeds if pollinated by yucca moths (Hurlburt 2001, 2002). Adult yucca moths emerge from the soil between mid-June and mid-July (Hurlburt 2004). After emergence, moths gather and mate in soapweed flowers that open at night (Riley 1892, Baker 1986, Addicott et al. 1990). Following mating, a female yucca moth collects pollen from one plant using her tentacles and typically flies to a flower of another plant. The female deposits her eggs next to the developing ovules (Aker and Udovic 1981, Addicott and Tyre 1995). She then actively transfers pollen using her tentacles. By pollinating the flower, the female ensures that seeds will develop and will provide food for her young (Kershaw et al. 2001). Adult moths do not feed and die 3 to 5 days after emerging from the soil (Kingsolver 1984). Moth eggs hatch 7 to 10 days after they are laid. Upon hatching, larvae feed on developing seeds. Developing larvae may consume significant numbers of seeds (D. Hurlburt, pers. comm.). Plants may develop strategies to reduce larval loads, however in Canada this is not the case as plants may even employ strategies to encourage high larvae production (Hurlburt 2004). After 50 to 60 days, larvae chew their way out of the yucca fruit leaving a

distinct hole in the pod and drop to the ground via a silken thread (Riley 1982). Larvae burrow into the soil, spin a cocoon of silk and sand particles, and enter diapause (Davis 1967, Fuller 1990, Hurlburt 2001). After a minimum diapause of one year (range 1-4 years), larvae pupate and emerge from the soil as adults, typically coinciding with flowering by soapweed (Fuller 1990). This prepupal diapause is quite rare in insects. Larvae have low survival rates; up to 50% of larvae from Alberta populations commonly fail to pupate and of those that pupate, up to 50% die in the cocoon (D. Hurlburt, unpubl. data).

2.2 Habitat Requirements

Soapweed is restricted to the Dry Mixed Grass Subregion (ANHIC 2002). Plants primarily occur on eroded south- or east-facing coulee slopes with sparse vegetation (Milner 1977). Soils tend to be alkaline and regosolic (undeveloped) without a shallow hardpan (Milner 1977). Details on vegetation commonly associated with soapweed can be found in Milner (1977), Wershler and Wallis (1986), and Hurlburt (2001). The habitat requirements of yucca moths are less well understood. Yucca moths use soapweed flowers for mating and oviposition, but the selection habits of moths for specific flowers to undertake these activities are not known. Yucca larvae require soapweed fruit for feeding. Once larvae emerge from fruit, they burrow into the soil around the plant and remain dormant for up to four years (Fuller 1990, Hurlburt 2004). Generally, the upper 20 cm of soil in a radius of approximately 25 cm from the edge of the outermost leaves of the plant may harbour dormant larvae (D. Hurlburt, pers. comm.). Larvae are not likely to exist where there is no remaining evidence of decayed plants (D. Hurlburt, pers. comm.).

2.3 Population Size, Distribution and Trends in Alberta

Soapweed and yucca moths occur naturally at two locations in southeastern Alberta. One location is near Onefour along the Lost River drainage within the boundaries of the Agriculture and Agri-Food Canada Onefour Research Station. The second is on the Pinhorn Grazing Reserve south of Manyberries (Figure 1). Both locations are on provincial land under lease to the federal government and to the Pinhorn Grazing Association, respectively. The Onefour site is within the boundaries of the Onefour Heritage Rangeland Natural Area designated by Alberta Community Development (Parks and Protected Areas Division). Several isolated plants, presumably originating as transplants, occur in numerous gardens across southern Alberta (Fairbarns 1985, Hurlburt 2001). Of particular interest are several plants in the town of Etzikom at the Etzikom Windmill Museum and in Police Point Park in Medicine Hat that have been observed to produce fruit, suggesting moths are also present (D. Johnson and J. Nicholson, pers. obs.). Additionally, approximately 50 non-reproducing plants occur in Fox Valley, Saskatchewan (Fairbarns 1985, Hurlburt 2001). Six clones also occur near Rockglen, Saskatchewan (D. Henderson, pers. obs., D. Hurlburt, pers. comm.). In 2003, one flowering stalk (inflorescence) was observed at this site indicating that flowering had occurred in the past. Enlarged pedicels observed on the stalk suggest that flowers may have been pollinated and thus, that yucca moths may have been present in the past.

Soapweed occurs along a 2 km stretch of slope at the Onefour location and along a 200 m stretch of slope at the Pinhorn site (Hurlburt 2001, Alberta Sustainable Resource Development 2002). A 1998 census of soapweed revealed a total of 29,577 plants (i.e., rosettes) (8903 clones) in Alberta (Csotonyi and Hurlburt 2000). Of these plants, 28,174 (8499 clones) occurred at the Onefour

site and 1383 (404 clones) occurred at the Pinhorn site (Csotonyi and Hurlburt 2000). The number of larvae entering diapause in 1998 at Onefour was 255 (including males) with 75-90 (29-35%) expected to survive to become adults (Csotonyi and Hurlburt 2000). New information suggests survival could sometimes be significantly lower (18%)(Hurlburt 2004). No moths were observed at the Pinhorn site in 1998 or in 2002. The Onefour population has produced fruit each year since 1998, indicating that this population is reproducing sexually (D. Hurlburt pers. comm.). Fruiting success of flowering plants at Onefour varied between 8-92 % from 1999-2002 (Hurlburt 2004). Fruit has not been produced at the Pinhorn site in recent years (at least since 1997 or earlier), suggesting that this population is only reproducing asexually (Hurlburt 2004).

Population trends of soapweed are difficult to determine. A total of 59,450 plants were counted in 1977 (Milner 1977). The large decrease between this count and the 1998 census (29,577 plants) appears to be due to differences in survey techniques rather than a decline in population size (Csotonyi and Hurlburt 2000).

The extent of occurrence of soapweed and yucca moths in Alberta is 400 km² and the area of occupancy is less than 2 km². The Onefour and Pinhorn populations of soapweed and yucca moths are isolated from one another by a distance of approximately 15 km. There is no evidence that moths migrate between populations, probably because yucca moths and seeds are not capable of long distance dispersal (Hurlburt 2001). The closest population in the United States is approximately 200 km from the Onefour population.

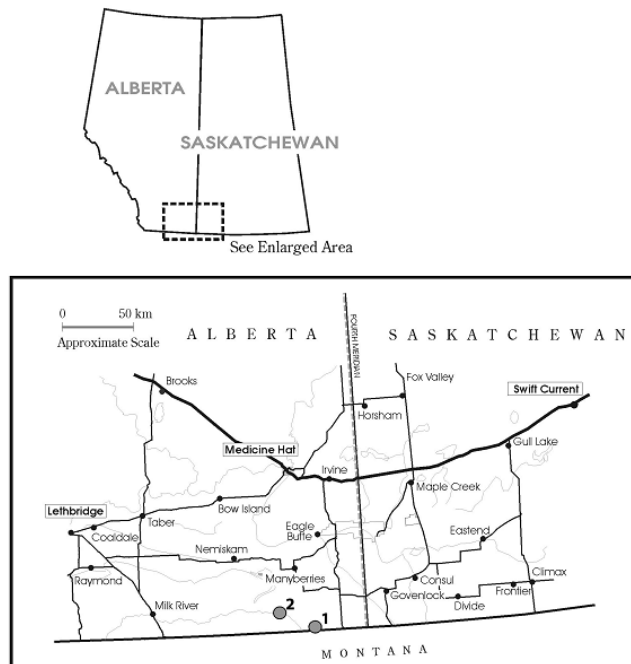


Figure 1. The distribution of soapweed and yucca moths in Alberta. Site 1 is the Onefour population and site 2 is the Pinhorn Population. Map modified from Hurlburt (2001).

3.0 THREATS

The greatest threat to soapweed and yucca moths is the loss of their partner species. Several natural and human-caused factors may limit the distribution and population size of soapweed and yucca moths in Alberta and may lead to a decrease in one or both of these species. Several of the natural limiting factors, such as insect herbivory or wind, are unlikely to be mitigated or managed by actions outlined in this recovery plan.

3.1 Ungulate Herbivory

Pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) are common herbivores of soapweed, removing individual flowers or entire inflorescences (Hurlburt 2001). Grazing of flowers and inflorescences reduces sexual reproduction in soapweed and yucca moths. Fewer flowers are available for moths to pollinate and to lay eggs in, and larvae compete for and consume most seeds. In addition, night-flying yucca moths rest within yucca flowers during the day, leading to inadvertent consumption of moths by grazing herbivores (Csotonyi and Hurlburt 2000). Soapweed plants can be heavily grazed by deer and antelope (range 1-100% of flowers across years, COSEWIC 2002), particularly during periods of drought when lower quality forage resources are available (Csotonyi and Hurlburt 2000, Hurlburt 2001, COSEWIC 2002).

In the southern United States, domestic livestock species are common herbivores of soapweed (Webber 1953, Hurlburt 2001). There is some evidence of livestock grazing on soapweed at the Onefour site, particularly when cattle are present during the flowering season. However, this appears to be restricted to soapweed plants occurring on upland habitat where cattle can access them easily. Soapweed plants on slopes are less likely to be grazed by livestock (COSEWIC 2002). Although cattle are present at the Pinhorn site, there is no evidence of cattle browsing on soapweed possibly because native ungulates graze plants early during flowering.

3.2 Horticultural and Medicinal Uses

Previous collection of soapweed is known because of its occurrence in household gardens across southeastern Alberta. However, all plants may not originate from wild stock as soapweed is available at garden centres for purchase. Soapweed is also a common component in a variety of herbal remedies and drugs used to treat a number of ailments including arthritis, gout, cystitis, and skin inflammations (Hurlburt 2001). Soapweed roots contain high concentrations of saponins (a chemical used in soaps, hence “soapweed”) that are precursors to the steroid cortisone and have anti-inflammatory properties. Removal of plants or seeds for horticultural or medicinal use could threaten the viability of the Alberta population, through a loss of plants and potentially viable seeds (Hurlburt 2001). Furthermore, removal of plants could result in the death of any yucca moths or larvae residing within soapweed flowers or fruit, and disturbance to the soil around the plant during removal could threaten the survival of dormant yucca moth larvae.

3.3 Habitat Loss, Fragmentation and Degradation

Both the Onefour and Pinhorn sites are on public land and unlikely to be at risk of conversion (e.g., cultivation). However, other activities such as oil and gas activity could result in the loss or

degradation of habitat supporting soapweed and yucca moths. At the Onefour site all dispositions (e.g., oil and gas) must receive consent from the Minister of Community Development, given this site's occurrence within the proposed boundaries of the Onefour Heritage Rangelands Natural Area (Section 13 of the *Wilderness Areas, Ecological Reserves, Natural Areas and Heritage Rangelands Act*).

There is also considerable public interest in these species. Both sites are accessible by road and are often visited daily during the summer (Hurlburt 2001, COSEWIC 2002). Plants and moths may be threatened by off-road traffic through direct trampling of plants (Hurlburt 2001). At both locations, there have been several observations of vehicles parked near or among soapweed plants and occasionally of vehicles driving over plants (D. Johnson and D. Hurlburt, pers. obs.). Off-road vehicles also may damage the soil crust leading to an increase in erosion (Wershler and Wallis 1986) or may harm dormant larvae in the soils around plants.

3.4 Pollen Limitation

Alberta populations of soapweed show little or no fruit production in some years (< 1% of flowers bear fruit), low pollination, and low emergence of moth larvae from fruit (Hurlburt 2001). These characteristics are atypical of the species compared to populations in the southern United States. One explanation for these differences is that Alberta populations are pollen limited. Pollen limitation may be due to low temperatures that restrict moth activity (Dodd and Linhart 1994) or to low abundance of moths. Pollen limitation may also occur if flowering by soapweed is unpredictable, does not occur annually, or does not coincide with moth emergence. Pollen limited plants either produce no fruit and seeds or may produce a higher percentage of asymmetrical fruit. At Onefour, 1-2% of fruit tend to be misshapen and have small numbers of viable seeds, providing evidence of pollen limitation (Hurlburt 2001, 2004). Low numbers of moths and no recent fruit production at the Pinhorn may suggest that this population is also pollen limited.

3.5 Uncoupling of Interactions Between Soapweed and Yucca Moths

Mutualism between soapweed and yucca moths requires that moths must be present when soapweed is flowering. Flowering of Alberta populations of soapweed is highly asynchronous resulting in a large number of plants flowering earlier or later than average. For soapweed, this results in flowers receiving fewer visits by pollinators, having lower rates of pollen deposition and having smaller potential for outcrossing. For yucca moth, this results in low recruitment due to decreased numbers of flowers in which to lay eggs and carry out its reproductive cycle (Hurlburt 2001).

3.6 Insect Herbivory

Another moth, (*Tegeticula corruptrix*), lays its eggs in soapweed fruit but does not pollinate the plant. These non-pollinating moths may impact soapweed and yucca moths by depositing enough eggs that many seeds are consumed by the larvae. In Alberta, *T. corruptrix* larvae can consume up to 40% of seeds (Hurlburt 2001). Another moth, *Prodoxus quinquepunctellus* ('five spotted bogus yucca moth'), lays its eggs in the flowering stalks of soapweed but does not appear to impact the plant (D. Hurlburt, pers. comm.).

Ants are common on soapweed plants and negatively impact plants by foraging on the buds, causing premature shedding of those buds. In Alberta, some plants lose up to 90% of their buds through ant damage, resulting in fewer flowers for moths to pollinate and lay eggs in (COSEWIC 2002). Ants also may kill yucca moths that reside in flowers. Some species of grasshoppers also forage on soapweed and often consume the reproductive parts of the flower. Hurlburt (2001) reported that grasshoppers damaged 50% of the flowers on the upland prairie flats at the Onefour site in 1999.

3.7 Wind

Periods of intense wind can result in the loss of flowers and fruit, greatly reducing the reproductive success of soapweed and yucca moths. As an example, at the Pinhorn site in 1999, over 50% of the flowers were lost due to high winds. Windstorms also may limit the ability of moths to fly among plants to lay eggs and to pollinate other soapweed plants (Hurlburt 2001).

4.0 CRITICAL HABITAT

Critical habitat is a legal designation under the SARA. Recovery Teams define critical habitat in the recovery plan. The emphasis is on defining habitat that is “necessary for survival or recovery of a listed wildlife species” (Species at Risk Act 2002 s 2). In defining critical habitat, recovery teams must also specify activities that may result in destruction of critical habitat. These parameters afford protections for critical habitat as destruction of critical habitat is illegal on lands where the SARA applies.

4.1 Description of Critical Habitat for Soapweed and Yucca Moth

Soapweed is restricted to the Dry Mixed Grass Subregion (ANHIC 2002). This is a region characterized by extremes with a low annual precipitation, usually between 260 mm - 280 mm (Hurlburt 2001). Warm summer temperatures (average 16° C) and a high average wind speed translate into a high rate of evaporation throughout the summer months (Hurlburt 2001). The regional frost-free season (100-120 days) and growing season (180-200 days) are long for the Canadian interior plains (Fairbarns 1984). There are approximately 2200 daylight hours with bright sunshine, making this one of the sunniest regions in Canada (Hurlburt 2001).

As expected, soapweed at Onefour and Pinhorn primarily occurs on eroded south or east facing coulee slopes with sparse vegetation (Milner 1977), although plants have been observed on the upland prairie flats. Coulee slope aspects range from 34° (northeast) - 220° (south-southwest) (Hurlburt 2001). Soapweed favours soil that is alkaline and regosolic (undeveloped) without shallow hardpan (Milner 1977, Fairbarns 1985).

4.2 Identification and Rationale for the Amount and Arrangement

Soapweed exists naturally in two locations in Alberta; the Onefour and Pinhorn locations (as described in Section 2.3). The boundaries of critical habitat on the maps represent the perimeter of the soapweed populations. As a rule, the plants occur in lower densities towards the outside of

the polygon, so this area should accommodate population expansion. Because soapweed does not occur naturally outside of these locations and the amount of activity in the region is relatively low, identifying critical habitat outside of these boundaries for protection is not warranted. Thus, the 182 ha at the Onefour site and the 2.65 ha at the Pinhorn site outlined by the polygonal maps can be considered the extent of the critical habitat for soapweed in Canada (see figure 2 and 3 below). The boundaries will be reassessed in a period of five years to allow for more critical habitat designation if the population expands.

Because yucca moth has an obligate mutualistic relationship with soapweed, the critical habitat should be considered the same for both species. Protection measures related to critical habitat of soapweed will also ensure protection of critical habitat for the yucca moth.

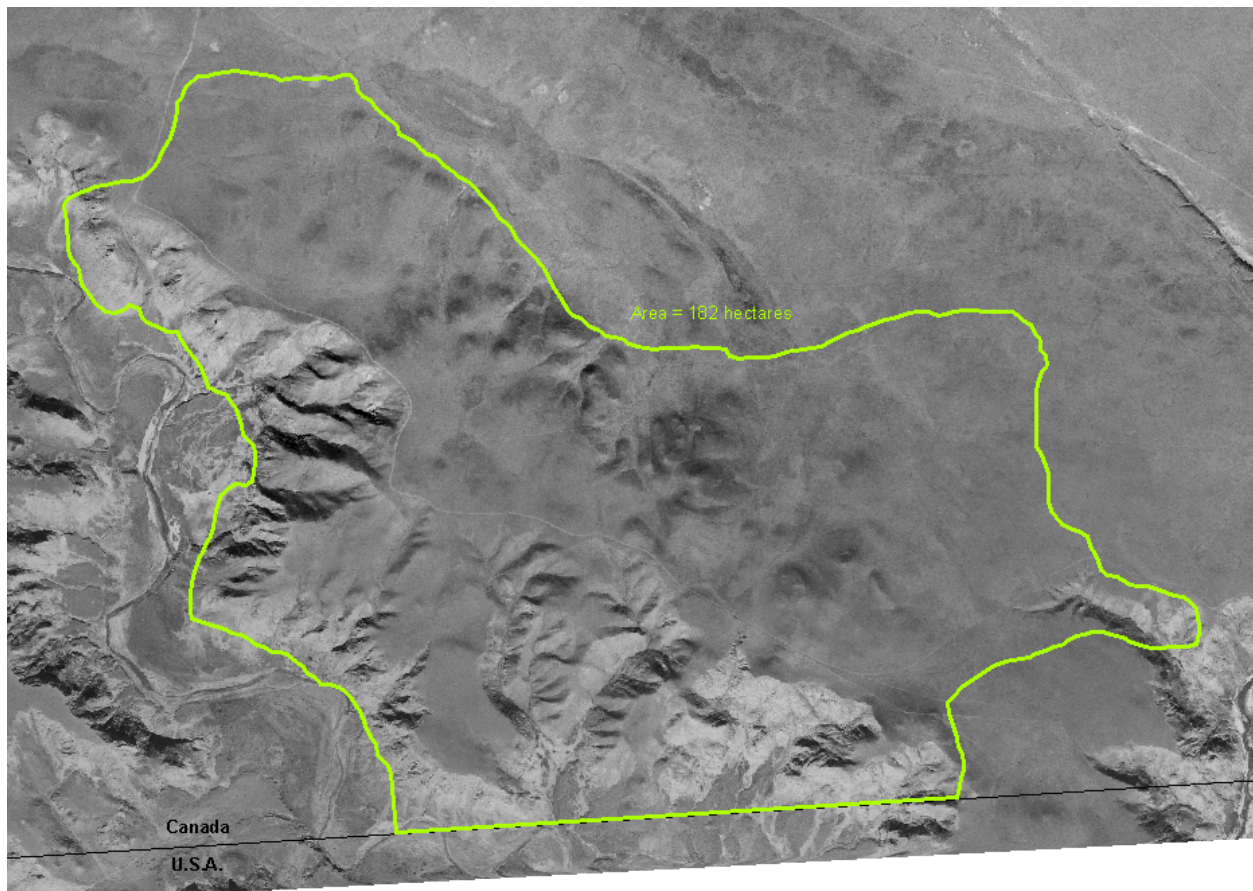


Figure 2. Range of soapweed at the Onefour Site.



Figure 3. Range of soapweed at the Pinhorn Site.

4.3 Range Coordinates

Range coordinates of soapweed site locations have been collected and are available to support appropriate conservation and management of the soapweed population in Alberta. However, the specific locations of critical habitat are not identified in this recovery plan so as to minimize potential human disturbance of the sites and protect the species. Range coordinates may be made available to individuals and organizations as needed; i.e. for specific declared purposes related to approved recovery related conservation, management, and research initiatives.

4.4 Destruction of Critical Habitat

Activities that destroy critical habitat for soapweed include anything that would risk conversion of the landscape. This would include cultivation or oil and gas activity such as drilling, conversion for wells or pipelines, or building roads.

Plants and moths may be damaged by off-road traffic through direct trampling of plants (Hurlburt 2001). Off-road vehicles may also increase potential for erosion (Wershler and Wallis 1986).

4.5 Effective Protection of Critical Habitat

Both soapweed/yucca moth sites in Canada have some protections in place from threats to the species. The Onefour site falls within a Heritage Rangeland Natural Area, which is afforded the some protections under *Wilderness Areas, Ecological Reserves and Natural Areas Act, R.S.A. 2000*. The Act limits using off highway or highway vehicles (except on roads), pollution, destroying or damaging plant/animal life, garbage disposal etc. The Federal Government also manages the Onefour site; thus it is treated as federal land and the SARA protections would apply. The Pinhorn site is at low risk for conversion as it is on Alberta public land, however, oil and gas activity could pose a threat if the site does not have protective notations (PNT) placed on it. A PNT will ensure that industrial users are not allowed to develop within the boundary of critical habitat. Additionally, Alberta Public Lands and Forests and Fish and Wildlife must be contacted prior to development to ask for recommendations and conditions about access and development to be submitted. The recovery team recommends PNTs be placed on the critical habitat designated for this species. As part of experimental treatments for moth translocation, parts of the Pinhorn site may be fenced, thus eliminating the possibility of vehicle access. It is recommended that an access management plan for the site is developed. See section 8.0 for further clarification of recovery actions for protecting critical habitat.

4.6 Schedule of Studies to Identify Critical Habitat Comprehensively

At this time, no further studies are needed to identify critical habitat for soapweed and yucca moth. The entire known populations of both species in Alberta are located within critical habitat areas outlined above. However, at the time of recovery plan review in 2011, it would be worthwhile to determine whether the boundaries of soapweed and yucca moth have expanded and if the boundaries of critical habitat also need to be expanded to support a larger population.

5.0 KNOWLEDGE GAPS AND INFORMATION NEEDS

Translocation is one management option for increasing fruit production at the Pinhorn site (see Section 8.0). However, it is unclear how a translocation should proceed and thus research needs to be concentrated on translocation methods and ensuring moth survival. It would be beneficial to conduct research on the factors affecting variation in flowering, fruit production and moth emergence to help elucidate population dynamics of these species to determine the timing of the translocations. It is also important to know what affects larval survival of yucca moths to help maintain viable populations of this species. In particular, this study would be useful to inform the method for translocating moths to the Pinhorn site. This may be best accomplished by conducting a formal population viability analysis on the yucca moth. Finally, research is also needed to determine how other moth species (*T. corruptrix* and *P. quinquepunctellus*) that exploit soapweed influence the soapweed-yucca moth mutualism. This information will be particularly important if upcoming national status evaluations of these moth species result in federal listing of these species. If so, recovery actions for soapweed and yucca moths will need to consider the requirements to conserve these other moth species.

6.0 RECENT RECOVERY AND CONSERVATION EFFORTS

Recent conservation and recovery efforts for soapweed and yucca moth include a survey of the Pinhorn population in 2004 to determine the size of the population, evidence of fruit production and the extent of herbivory occurring at the site (Nicholson, J. pers. comms.). The results of this survey are expected to be published in 2006.

Alberta Fish and Wildlife has initiated a project to erect interpretive signage at the Etzikom museum near a living display of soapweed plants to promote conservation of endangered species and increase awareness of soapweed and yuccamoth and other endangered species in Alberta.

Work is being completed by the University of Lethbridge to complete a translocation protocol for yucca moths to the Pinhorn site, and fencing options for experimental treatments are being considered.

Initiation of other recovery and conservation efforts is pending completion and approval of this recovery plan.

7.0 RECOVERY STRATEGY

7.1 Biological and Technical Feasibility of Recovery

It is the belief of this recovery team that conservation of soapweed and yucca moth is possible and is compatible with a variety of land use activities. It is also a belief of the recovery team that a cooperative management approach involving all stakeholders is the best approach to allow for the persistence of these species in Alberta. Soapweed and yucca moths continue to persist at the Onefour site and maintaining sustainability of these populations at this site should be feasible with continued cooperation among stakeholders.

The most immediate threat to the Alberta populations of soapweed and yucca moth is extirpation of either of these species at the Pinhorn site. The most recent survey of yucca moths at the Pinhorn site (2002) located no yucca moth. One female moth was observed in 1999. These surveys show there has been no recent sexual reproduction of soapweed, or likely of yucca moths, at this site at least since 1997. It is also likely that there are no or few remaining dormant moth larvae in the soil at this site, since larvae generally remain viable in a dormant stage for one to four years. Recovery of soapweed and yucca moths at the Pinhorn site should be possible if attempts to reintroduce yucca moths and to manage grazing of soapweed by native ungulates are successful. The development of regulations under the *Wildlife Act* that protect *Endangered* and *Threatened* plants and invertebrates will also help ensure that losses of these species do not occur from horticultural, pharmaceutical, recreational, industrial and agricultural activities.

There are also several limiting factors affecting the recovery and conservation of soapweed and yucca moths that are beyond the control of the Alberta Soapweed and Yucca Moth Recovery Team and this recovery plan. These include the uncoupling of interactions between soapweed and yucca moths, exploitation by non-pollinators, pollen limitation, insect herbivory, and the effects of wind.

7.2 Guiding Principles

There are a number of soapweed plants in numerous towns and cities in southern Alberta. Most of these plants occur in household gardens and some may be the result of transplants from native populations of soapweed in Alberta. The recovery strategies and actions recommended in this plan, do not apply to these transplants.

The recovery and management of soapweed and yucca moths in Alberta will be guided by the following principles:

- Recovery and conservation of soapweed and yucca moths is possible and important.
- Loss of habitat for soapweed and yucca moths is unacceptable.
- A cooperative approach with land managers, landowners, industry and other agencies is essential to the success of this plan in conserving soapweed and yucca moth populations in Alberta. This includes shared stewardship, compatible land use and local commitment to management initiatives.
- Landowners and lessees will not be unduly affected by the costs associated with maintaining or enhancing habitat for soapweed and yucca moths.
- Knowledge gaps will be identified and will be communicated in the recovery plan.
- Management actions will use tools resulting in the most immediate benefits to soapweed and yucca moths and will be based on the best information available. Implementation will not be delayed because of lack of specific supporting information.
- Recovery actions will embrace an ecosystem (holistic) approach to management.
- Recovery actions will focus on achievable initiatives and on those initiatives deemed most effective in conserving soapweed and yucca moths in Alberta.
- The recovery process will be guided by the concept of adaptive management, whereby specific actions are implemented, evaluated, and altered to ultimately improve the outcome.

7.3 Recovery Goal

The long-term goal of the recovery plan is to maintain the existing habitat and distribution of soapweed in Alberta and to enhance yucca moth population at the Pinhorn site. This will require the maintenance of naturally self-sustaining populations of soapweed and yucca moth at the Onefour site and an increase in the reproductive capacity at the Pinhorn site.

7.4 Recovery Objectives

The specific population and distribution objectives that will lead to the long-term conservation of the soapweed and yucca moth in Alberta are:

1. Reduce herbivory by ungulates on soapweed populations, primarily the Pinhorn population over the life of the recovery plan.
2. Re-establish a reproducing population of yucca moths at the Pinhorn site by 2011.
3. By 2011, attain a value for annual fruiting success for the Pinhorn population of soapweed of at least 5% of flowers and maintain annual fruiting success for the soapweed population at Onefour of at least 7-10% of flowers as per Hurlburt 2004.
4. Eliminate loss of habitat quantity or quality due to human-caused disturbances.

5. Ensure no loss of soapweed plants due to harvesting for horticultural or medicinal purposes.

7.5 Recovery Strategies

The Alberta Soapweed and Yucca Moth Recovery Plan will serve for an initial period of five years (2006-2011), and consists of the following strategies that will be pursued concurrently:

7.5.1 Population Conservation and Management

In order to conserve and manage the population, the Soapweed/Yucca Moth Recovery team recommends monitoring Alberta soapweed and yucca moth populations for population size, distribution and reproductive success. As ungulates pose a threat to the Pinhorn population, management measures will be explored.

7.5.2 Habitat Conservation and Management

Enhancing protection measures and means of limiting human disturbance in the area will be necessary to conserve habitat. This should be done in a cooperative fashion with land users.

7.5.3 Information and Outreach

Measures will be taken to increase public awareness and understanding of the need for and requirements to conserve soapweed and yucca moths in Alberta.

7.5.4 Research

Research will be focussed on providing information necessary for the conservation of soapweed and yucca moths. There will be agency support for researchers in their efforts to secure funding to undertake these investigations.

7.5.5 Resource Acquisition

It is important to secure logistical, financial, and in-kind support to implement the recovery plan.

7.5.6 Legislation

Agencies will work to review provincial government policy or legislation necessary to ensure the long-term conservation and maintenance of soapweed and yucca moths in Alberta.

7.5.7 Plan Management and Administration

Throughout the life of the plan, the Soapweed/Yucca Moth Recovery Team will convene to ensure that actions are being completed and are contributing to the recovery of the species.

8.0 ACTION PLAN

8.1 Population Conservation and Management

1. Government agencies, non-government organizations or universities will conduct annual surveys of soapweed and yucca moth populations to monitor distribution, abundance and trends of these species. Data should be used to undertake a population viability analysis for yucca moth before year 3.

2. Government agencies, non-government organizations or universities will establish a protocol and program for translocation of yucca moth larvae and/or adults from the Onefour site to the Pinhorn site and for monitoring the success of translocations. The number of individuals that are translocated each year will be dependent on the annual population sizes of soapweed (e.g., fruiting success) and yucca moths at the Onefour site and should not compromise the sustainability of these populations. The Soapweed and Yucca Moth Recovery Team recommends that the feasibility analysis and protocol be developed in year 2.
3. When the translocation protocol is complete, government agencies, non-government organizations or universities will translocate yucca moth larvae and/or adults from the Onefour site to the Pinhorn sites following the translocation protocol and will monitor moth numbers and soapweed fruiting success in subsequent years. The Soapweed and Yucca Moth Recovery Team recommends that translocations be conducted in years 3 to 5.
4. Alberta Fish and Wildlife Division will ensure appropriate management of native ungulates in WMU 102 where soapweed and yucca moths occur, including ungulate population management (e.g., harvesting goals) and ungulate repellents and fencing, as required.

8.2 Habitat Conservation and Management

1. Alberta Fish and Wildlife Division, with the assistance of other government agencies, or non-government organizations will develop and deliver maps denoting critical habitat for soapweed and yucca moths this area to resource managers (e.g., Alberta Fish and Wildlife Division, Alberta Community Development, Alberta Public Lands and Forests Division, Alberta Energy). These maps should be used as the basis for permitting/mitigating land use. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in year 2.
2. Alberta Fish and Wildlife Division will make application to the Alberta Public Lands and Forests Division to place protective notations, consultative notations, or other protective designations on all quarter sections with naturally occurring populations of soapweed and/or yucca moths. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in year 1 and be updated as necessary.
3. A variety of agencies and organizations, including Alberta Fish and Wildlife Division, Alberta Public Lands and Forests Division, Agriculture and Agri-Food Canada, and universities, in coordination with land users, will cooperate to develop and deliver best management practices (BMP) for livestock grazing within habitat supporting soapweed and yucca moths. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in year 2 and will be updated in years 3 to 5 as new information becomes available.
4. When necessary, government agencies or non-government conservation organizations will assist lessees and land managers to manage their land in a manner that sustains soapweed and yucca moths through the provision of various improvements. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in years 1 to 5.
5. Agriculture and Agri-Food Canada (Onefour Research Station) and Pinhorn Grazing Reserve, in association with Alberta Fish and Wildlife Division, Alberta Public Lands and Forests

Division, and Alberta Community Development, will develop access management plans to ensure that vehicles are not used within or immediately adjacent to habitat supporting soapweed and yucca moths. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in year 2.

6. The recovery team will reconvene to reassess the boundaries of critical habitat to allow for population expansion over time. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in year 5.

8.3 Information and Outreach

1. Alberta Fish and Wildlife Division will update the current fact sheet on soapweed and yucca moth, as necessary. Fact sheets will be made available to the public, including lessees and land managers on the Alberta Species at Risk website and in hardcopy through the Alberta Sustainable Resource Development Information Centre.
2. Government agencies or non-government organizations will develop displays at the Onefour site and at the Etzikom Windmill Museum to promote conservation of soapweed and yucca moth to the public. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in year 2.
3. Alberta Fish and Wildlife Division will make the recovery plan available to the public and interested stakeholders on the Alberta Species at Risk Program web site and in hardcopy through the Alberta Sustainable Resource Development Information Centre. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in year 1.

8.4 Research

The Alberta Soapweed and Yucca Moth Recovery Team recommends the following research, in order of priority, that will provide information necessary to help conserve and maintain soapweed and yucca moths in Alberta.

1. Researchers from government agencies, non-government organizations, or universities will monitor currently marked individual soapweed plants across seasons and years to understand life history of soapweed and yucca moths, including the effects of variation in flowering levels, moth emergence, and fruit production on population dynamics of soapweed and yucca moths. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in years 2 to 5.
2. Researchers from government agencies, non-government organizations, or universities will investigate the factors influencing larval survival of yucca moths to understand how larval survival impacts population dynamics and to help develop and refine a translocation protocol for this species. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in years 3 to 5.
3. Researchers from government agencies, non-government organizations, or universities will investigate the direct and indirect effects of the moths, *T. corruptrix* and *P. quinquepunctellus*,

on the soapweed-yucca moth mutualism. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in years 3 to 5.

8.5 Resource Acquisition

1. Government agencies, non-government organizations, and researchers, will approach government, non-government, industry, land managers, leaseholders, universities, and private conservation organizations to participate in or fund recovery initiatives for soapweed and yucca moths. The Soapweed and Yucca Moth Recovery Team recommends that this initiative be undertaken in years 1 to 5.

8.6 Legislation

1. The Alberta Soapweed and Yucca Moth Recovery Team supports the development of regulations under the *Wildlife Act* for the protection of *Endangered and Threatened* plants and invertebrates, and their habitat. The Recovery Team has expressed a desire to review the draft regulations after their development to ensure they adequately protect soapweed and yucca moths and their habitat while allowing for compatible landuse activities, such as livestock grazing.

8.7 Plan Management and Administration

1. Alberta Fish and Wildlife Division will convene the Alberta Soapweed and Yucca Moth Recovery Team a minimum of once annually. At these meetings, the team will review progress on implementation of the plan, review the effectiveness of recovery actions, and will develop new recovery actions, as required. The Chair of the recovery team will provide an annual report to the Director of Wildlife Management that details progress on implementation of the plan and any recommended changes to the plan.
2. The Alberta Natural Heritage Information Centre (ANHIC), in cooperation with other agencies and researchers, will enter all accumulated soapweed and yucca moth data into the ANHIC database following each survey season.
3. The Chair of the Alberta Soapweed and Yucca Moth Recovery Team, in association with Alberta Fish and Wildlife Division (Medicine Hat office) and Alberta Community Development, will ensure that all research activities are properly permitted and coordinated each year, in order to maximize benefits from research and to keep the recovery team informed of ongoing research.
4. The Chair of the Alberta Soapweed and Yucca Moth Recovery Team will liaise with other recovery teams to ensure that recovery actions for soapweed and yucca moths complement, where possible, the recovery of any other provincially or federally listed species.

9.0 TIMETABLE FOR IMPLEMENTATION AND SCHEDULE OF COSTS

The following table provides a timeline for implementation and estimate of costs of activities identified by the Alberta Soapweed and Yucca Moth Recovery Team as being important to the conservation of soapweed and yucca moths. It is anticipated that a variety of agencies will participate in the funding and implementation of these activities. Costs are not provided for activities that are part of the daily operations of the identified organizations. Costs associated with team members' expenses to attend recovery team meetings are not included, but represent valued and necessary contributions associated with implementation of the recovery plan.

Recovery Plan Section	Activity	Lead Agency	Cost (thousands/year)					Total
			2006-07	2007-08	2008-09	2009-10	2010-11	
7.1	Population Management							
1	Surveys	Various	15	15	15	15	15	75
2	Translocation protocol	FWD		5				5
3	Translocations	FWD		5	5	5	5	20
4	Ungulate management	FW		5	5	5	5	20
			15	30	25	25	25	120
7.2	Habitat Management							
1	Maps	FWD		2				2
2	Protective notations	FWD, PL						0
3	Best mgt practices	FWD, PL		2	2	2	2	8
4	Habitat improvements	FWD		2	2	2	2	8
5	Access management	AAFC, PGR		5				5
			0	11	4	4	4	23
7.3	Education / Information							
1	Fact sheets	FWD	1				1	2
2	Displays	FWD		10				10
3	Publish and promote plan	FWD	0.5					0.5
			1.5	10	0	0	1	12.5
7.4	Research							
1	Life history	FWD		20	20	20	20	80
2	Moth larvae survival	FWD			20	20	20	60
3	Influence of other moths	FWD			20	20	20	60
				20	60	60	60	200
7.5	Resource Acquisition							
1	Secure funding	FWD	2	2	2	2	2	10
			2	2	2	2	2	10
7.6	Legislation							
1	Review legislation	FWD						0
			0	0	0	0	0	0
7.7	Plan Management							
1	Annual meeting/report	FWD	1	1	1	1	1	5
2	Database management	ANHIC						0
3	Research coordination	FWD						0
4	Liason with other RT's	FWD	0.5	0.5	0.5	0.5	0.5	2.5
			1.5	1.5	1.5	1.5	1.5	7.5
	TOTAL		24.5	75	92.5	92.5	93.5	373

Lead agencies: Alberta Fish and Wildlife Division (FWD), Alberta Public Lands and Forests Division (PL), Alberta Natural Heritage Information Centre (ANHIC), Agriculture and Agri-food Canada (AAFC), Pinhorn Grazing Reserve (PGR), Recovery Team (RT).

10.0 SOCIO-ECONOMIC CONSIDERATIONS

The approximately 189 ha over which soapweed and yucca moths occur is a small enough area to limit potential socio-economic costs of implementation of the recovery plan. It is a guiding principle of the recovery plan that landowners and leaseholders should not be unduly affected by costs associated with implementation of the plan. Potential economic costs may include changes to grazing management that could involve decreased productivity or increased costs for livestock production. Potential costs associated with industrial development may include restrictions on resource extraction or increased costs for extraction or development resulting from mitigation measures. Other potential costs to recreational users and naturalists in the area may include reduced accessibility to view populations of soapweed and yucca moths and prohibition on their collection. The current management regime at Onefour has allowed the population to exist and expand, thus no significant changes to operations at Onefour should be anticipated.

There are several benefits that may be realized from implementation of the recovery plan. There is the potential for leaseholders to obtain improvements that increase the quality and productivity of their rangelands. The need to manage native ungulates in habitat supporting soapweed and yucca moths may increase recreational hunting opportunities in WMU 102. Soapweed and yucca moths are unique prairie species and there is considerable public interest in these species. Information and living displays of soapweed/yucca moth in local towns in Alberta (e.g. Etzikom Windmill Museum) may enhance tourism in these centres and reduce visits and disruption to natural sites.

11.0 PLAN REVIEW AND AMENDMENT

The life of this plan is 5 years. The Alberta Soapweed and Yucca Moth Recovery Team will conduct an annual review of the plan. The purpose of these annual reviews is to monitor the implementation of the plan and to determine the effectiveness of recovery actions. The Chair of the recovery team will provide an annual report to the Director of Wildlife Management that details progress on implementation of the plan. Recovery plans are considered “living” documents and can be amended during these reviews. At the end of 5 years, the recovery team will meet again to determine whether any other amendments are required, prior to the plan being renewed for another five years. The team may determine that the existing recovery plan is suitable, in need of minor edits, or in need of a major revision.

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List of Titles in the Alberta Species at Risk Recovery Plan Series
(as of July 2006)

- No. 1 Maintenance and Recovery Plan for Western Blue Flag (*Iris missouriensis*) in Canada. (2002)
- No. 2 Alberta Piping Plover Recovery Plan 2002-2004. (2002)
- No. 3 Alberta Peregrine Falcon Recovery Plan 2004-2010. (2005)
- No. 4 Alberta Woodland Caribou Recovery Plan 2004/05-2013/14. (2005)
- No. 5. Recovery Plan for Ord's Kangaroo Rat in Alberta. (2005)
- No. 6 Recovery Plan for Burrowing Owl in Alberta. (2005)
- No. 7 Alberta Northern Leopard Frog Recovery Plan 2005-2010. (2005)
- No. 8 Alberta Greater Sage-Grouse Recovery Plan. (2005)
- No. 9 Maintenance and Recovery Plan for Western Spiderwort in Alberta 2005-2010. (2005)
- No. 10. Alberta Piping Plover Recovery Plan 2005-2010. (2006)
- No. 11. Recovery Plan for Soapweed and Yucca Moth in Alberta 2006-2010.