

Recovery Strategy for the White Flower Moth (*Schinia bimatrix*) in Canada

White Flower Moth



2011

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PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of Environment is the competent minister for the recovery of the White Flower Moth and has prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with the province of Manitoba and the Department of National Defence.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the White Flower Moth and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

The White Flower Moth is a relatively small distinctive flower moth endemic to North America. Only a single population is known to exist in Canada and this is located within the Spirit Sands sand dunes of southwestern Manitoba. Due to its restricted distribution and small population size, the species was listed in August 2006 as Endangered in Canada under the *Species at Risk Act* (SARA).

Very little is known about the ecology and host plants of the White Flower Moth. In Canada, the species has been associated with active sand dunes and found to be active both during the night and day.

Although threats to the White Flower Moth are unknown, it is speculated that factors that cause dune stabilization will in turn threaten the White Flower Moth population. Other potential threats that could negatively impact the White Flower Moth include stochastic events, military activities, invasion of exotic species and climate change.

There are unknowns regarding the feasibility of recovery of White Flower Moth in Canada. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery is determined to be feasible. This recovery strategy addresses the unknowns surrounding feasibility of recovery.

The short-term population and distribution objective for the White Flower Moth is to secure and maintain its current distribution at the single known occupied site in Canada and at all new sites that may be discovered through future surveys. To achieve the objective, more information on the species' biology is required and all potential threats need to be identified.

Critical habitat for the White Flower Moth is identified in this recovery strategy in seven quarter-sections within Spirit Sands sand dunes, Manitoba. Within these quarter-sections critical habitat is defined as the open active sand dune area from the crest of the dune to the edge of the dune where vegetation grows and the dune becomes stabilized.

An Action Plan for the White Flower Moth will be completed by December 2014.

RECOVERY FEASIBILITY SUMMARY

Under the *Species at Risk Act* (Section 40), the competent minister is required to determine whether the recovery of the listed species is technically and biologically feasible. Analysis of recovery feasibility for this species, based on the four criteria outlined in Government of Canada (2009), demonstrates that some uncertainties exist relating to the feasibility of recovery of the White Flower Moth. In keeping with the precautionary principle, a Recovery Strategy has been prepared as per section 41(1) of SARA, as is done when recovery is determined to be feasible. This recovery strategy addresses the uncertainties surrounding the feasibility of recovery.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. There seems to be a robust White Flower Moth population of a couple of thousand individuals in Manitoba that are capable of successful reproduction. Under similar conditions, individuals are likely to continue to reproduce and persist at this location as they have historically.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Unknown. Currently, suitable habitat is available to support the White Flower Moth population, however since sand dunes are disappearing at a rapid rate, it is unknown if this habitat will continue to support a viable population of this species in Canada over the long term. While the current habitat might be sufficient to maintain the small White Flower Moth population, it is not likely that the current habitat could ever support a large White Flower Moth population. Further surveys may result in the discovery of more suitable habitat and additional populations.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Unknown. The main known threat to the White Flower Moth is the loss of active sand dunes. It is currently unknown if and what types of management practices can be used to mitigate this natural process. The impact and severity of other threats are currently unknown. Stochastic events could eradicate this single small population. Further investigation into the species' habitat requirements and larval host plants would allow for more effective habitat management and restoration projects to be initiated in the future.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Unknown. It is currently unknown what recovery techniques could be applied to achieve population and distribution objectives. The conservation of suitable habitat and the management of active sand dunes to prevent or slow the process of dune stabilization are thought to be effective approaches.

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1. COSEWIC SPECIES ASSESSMENT INFORMATION

Date of Assessment: May 2005

Common Name (population): White Flower Moth

Scientific Name: *Schinia bimatrix*

COSEWIC Status: Endangered

Reason for designation: This moth is associated with dune habitats and is known from a small number of scattered sites in North America, with only one extant site in Canada. Most dune habitats in Canada appear to be too dry for this species. Dune habitat has undergone serious declines and the moth has likely declined as well.

Canadian Occurrence: Manitoba

COSEWIC Status History: Designated Endangered in May 2005.

2. SPECIES STATUS INFORMATION

The White Flower Moth (*Schinia bimatrix*, Harvey) is listed as Endangered under Schedule 1 of the Canadian *Species at Risk Act* (SARA) but is currently not listed under Manitoba's *Species at Risk Act* (Manitoba Conservation 2010). Globally, the White Flower Moth has received a rounded conservation status of vulnerable (G3) while in Canada and Manitoba it has been ranked as critically imperiled (N1, S1, NatureServe 2009). The species has not been ranked in United States (U.S) or in any of the states where it occurs (NatureServe 2009). Since the global population has not yet been quantified, it is unknown what percentage of the White Flower Moth global distribution is currently found in Canada but it is likely less than 5%.

3. SPECIES INFORMATION

3.1 Species Description

The White Flower Moth is a member of the Order Lepidoptera (butterflies and moths), Family Nocturidae (owlet moths), and subfamily Heliothinae (flower moths).

As its name implies, the White Flower Moth has white glossy wings and a white abdomen and thorax (Figure 1; COSEWIC 2005). Its head and collar are yellow-orange and it occasionally has a few brown scales along the leading margin of the hindwing (Brou 2003). It is distinctive from all other species of moths in Canada.

Little is known about the biology of the White Flower Moth in North America (Westwood and Friesen 2009). In Canada, they have been described as nocturnal and attracted to ultraviolet light (COSEWIC 2005), but recent surveys in Manitoba found them to be also active during the daytime (Westwood and Friesen 2009).

The details of the life cycle of the White Flower Moth are unknown, but are likely similar to all other Lepidoptera, in which an egg hatches into a larva, which then molts several times before becoming a pupa and eventually emerges into an adult. Adult female flower moths lay their eggs in the blossoms of the larval host plant and the larvae feed on the flowers or developing seeds of the plant before pupating at or below the surface of the soil (Hardwick 1996). Adult flower moths are short-lived and may only survive for seven days (Hardwick 1996). In Canada, there is likely only one generation per year (COSEWIC 2005). The flight period of the White Flower Moth in Manitoba during 2007 surveys was observed to occur from early-July to late-July, but may in fact have been longer (Westwood and Friesen 2009).



Figure 1. White Flower Moth a) © J.T. Troubridge / Canadian Biodiversity Information Facility (2003) b) © C. Friesen (2007)

3.2 Population and Distribution

The White Flower Moth has been collected from southwestern Manitoba, Colorado, Nebraska, Kansas, eastern Texas, Louisiana, Mississippi, Alabama, and there are several records from South Carolina (Figure 2; COSEWIC 2005, L. Koehn pers. comm. 2010).

In Canada, the White Flower Moth occurs as a single population at the northern edge of its range. The species was historically collected near present-day Brandon, Manitoba, between 1910 and 1927, and was not collected again until 2003 when it was found within Spirit Sands of Spruce Woods Provincial Park (COSEWIC 2005). The Spirit Sands are also known as the Bald Head Hills (D. Nernberg pers. comm. 2011). It was found again in 2007 at Spirit Sands in Spruce Woods Provincial Park and the adjacent Canadian Force Base (CFB) Shilo (Figure 3; Westwood and Friesen 2009). Despite repeated light-trapping surveys, the White Flower Moth has not been captured or observed in other active sand dunes in Saskatchewan or Alberta.

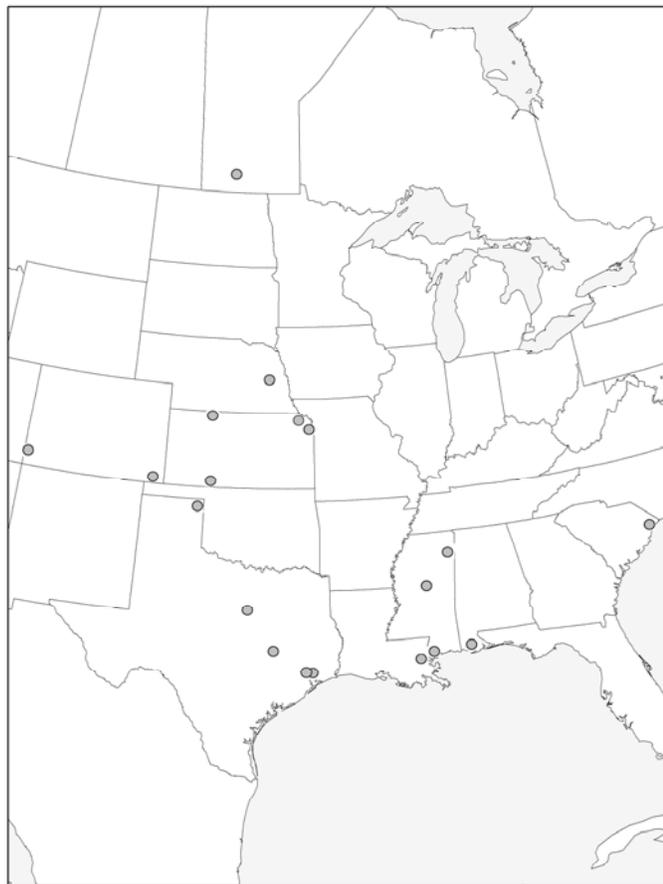


Figure 2. North American distribution of the White Flower Moth (adapted from COSEWIC 2005).

The Spirit Sands consist of a small portion of active dunes within the greater and mostly inactive Brandon Sand Hills (Wolfe et al. 2000). The Brandon Sand Hills were formed over 11,000 years ago from the sandy material deposited by the Assiniboine River as it flowed into glacial Lake Agassiz (David 1977, Wolfe et al. 2000). The majority of the Brandon Sand Hills are now stabilized by parkland vegetation; only a few areas are open and still active, including the Spirit Sands area (Wolfe et al. 2000). The majority (65%) of the Spirit Sands occurs within Spruce Woods Provincial Park boundary while the remainder occurs in CFB Shilo (Westwood and Friesen 2009). Spruce Woods Provincial Park was created to preserve and maintain Manitoba's remaining sandhills and native mixed grass prairie ecosystem while offering public recreational opportunities (Schykulski and Moore 1996). CFB Shilo is administered by the Department of National Defence and managed for military training.

An initial population estimate in 2005, based on limited data, suggested that the Canadian White Flower Moth population was between 100 and 5,000 individuals (COSEWIC 2005). Recent surveys suggest that the population likely numbers several thousand, although five thousand individuals may be a high estimate given the limited areas covered by active sand dune habitat (Westwood and Friesen 2009). It is possible that in Canada the White Flower Moth occurs at low densities and undergoes large population fluctuations similar to other Lepidoptera populations (COSEWIC 2005).

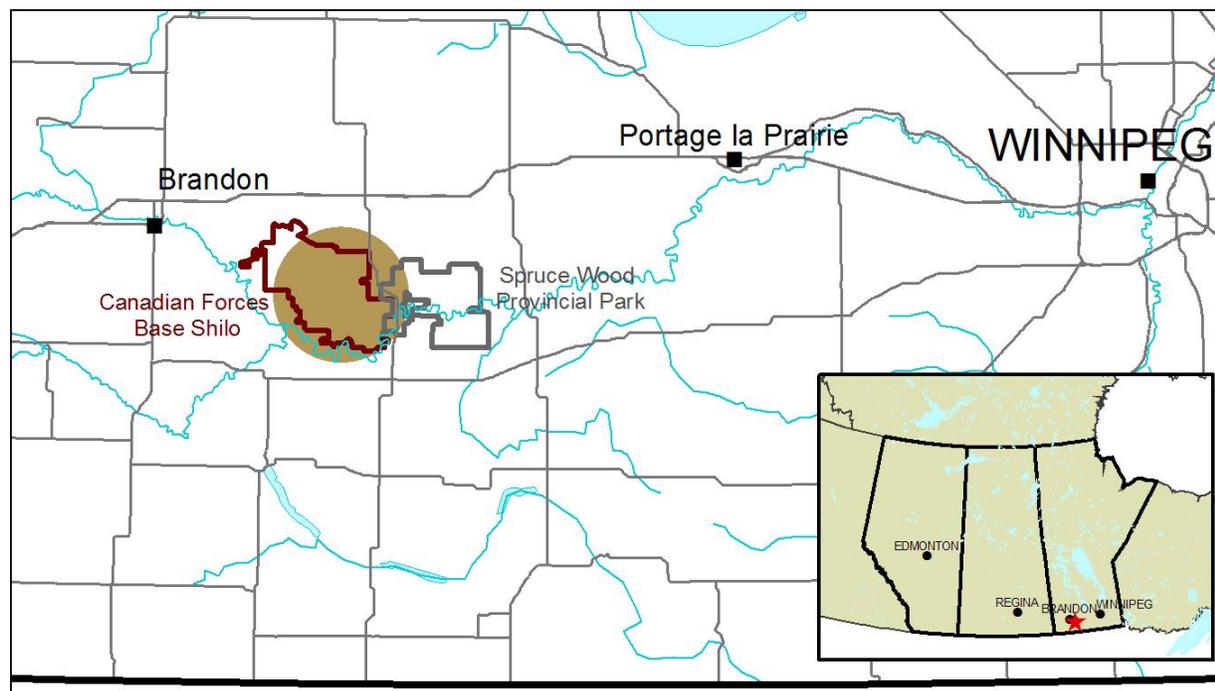


Figure 3. Presumed Canadian distribution of the White Flower Moth shown by shaded brown.

3.3 Needs of the White Flower Moth

In the southeastern United States, the White Flower Moth inhabits longleaf pine woodlands, characterized by an open, herbaceous understory (COSEWIC 2005) while in central U.S. the species is associated with native prairie (L. Koehn pers. comm. 2010). In Canada, the only White Flower Moth population occurs within open active sand dunes but the reliance of the species on this type of habitat is poorly understood and requires further investigation. Although no night trapping has taken place in the stabilized areas adjacent to the occupied habitat, no moths were observed during the day in forest or mixed-prairie habitats (Westwood and Friesen 2007). Specifically, day-flying moths were typically observed at the edges of open or semi-open sand dunes where the vegetation was generally dominated by clumps of blue stem (*Andropogon sp*) grass species (Westwood and Friesen 2007).

The larval host plant of the White Flower Moth remains unknown. In the Spirit Sands, adult White Flower Moths were seen in association with the White Evening-primrose, likely *Oenothera nuttallii* (COSEWIC 2005). It was suggested that this is a possible host plant due to the synchrony of the plant's flowering with the moth's flight period as well as the flower's colour, which allows the moth to remain cryptic when resting on the petals during the day (COSEWIC 2005). Recent surveys in the Spirit Sands found that, although the White Evening-primrose was present in the area, it was not particularly abundant and there did not appear to be enough primrose present to support a population of several thousand moths (Westwood and Friesen 2009). The scarcity of the White Evening-primrose may indicate that the White Flower Moth may use one or more plant species as a larval host in addition to, or instead of the primrose (Westwood and Friesen 2009). Other forbs (broad-leaf herbs) commonly observed blooming in the vicinity of White Flower Moth occurrences included prairie clovers (*Dalea spp.*) and Hairy False Aster (*Heterotheca villosa*). Few other forbs were abundant and/or bloomed for any considerable length of time (Westwood and Friesen 2009).

The distribution and abundance of the Canadian White Flower Moth is extremely limited by the availability of open active sand dunes, and possibly to a greater extent the climate of the region. Although open sand dunes are more widespread in southern Alberta and Saskatchewan, there are no historic or current records of White Flower Moth from active sand dunes within these provinces (COSEWIC 2005). The Alberta-Saskatchewan active sand dunes occur within the more arid Mixed Grass Ecoregion, while the Brandon Sand Hills are located within the Aspen Parkland Ecoregion in a humid to sub-humid region (COSEWIC 2005). It is speculated that the species might depend on more humid conditions (COSEWIC 2005) that do not exist in the Mixed Grass Ecoregion. Furthermore, the open active dunes in the Brandon Sand Hills are naturally rare and small in size and have been progressively stabilizing, in part, due to recent natural changes in climate (Wolfe et al. 2000, Henderson et al. 2002), resulting in a further reduction in the amount of suitable habitat.

4. THREATS

Because very little is known about the biology and habitat associations of White Flower Moth in Canada, it is difficult to assess threats. It appears that the White Flower Moth is restricted to active sand dunes. Therefore factors that cause dune stabilization and threaten this habitat also threaten the persistence of the species (COSEWIC 2005). Since the COSEWIC (2005) status report several other threats, such as stochastic events, military activities, and invasive species, have also been identified as potential threats but further investigation is required to fully quantify the level of these threats.

Factors that Cause Dune Stabilization

Active sand dunes across the southern Canadian prairies have been stabilizing over the last century due to natural changes in climate in addition to changes in land-use practices since European settlement (Vance and Wolfe 1996, Geological Survey of Canada 2001). Specifically, increased moisture has been a major factor correlated with periods of vegetation growth and sand dune stabilization (Wolfe et al. 1995, Wolfe et al. 2000). In addition, recent land-use changes, such as suppression of wild fires, an end to the practice of using fire as a prairie management

tool, and the eradication of bison, have likely exacerbated the rate of vegetation encroachment and dune stabilization and altered the landscape structure (Vance and Wolfe 1996). Thus, in the absence of these disturbances, which can interact with cycles of drought, natural succession can cover and stabilize active sand dunes with vegetation (Potvin and Harrison 1984, Hulett et al. 1966).

Furthermore, within the Brandon Sand Hills, north of CFB Shilo, an intensive tree planting program was undertaken from 1904 to the mid 1970s with thousands of native and non-native tree seedlings such as Scots pine (*Pinus sylvestris*), white spruce (*Picea glauca*), jack pine (*P. banksiana*), and lodgepole pine (*P. contorta*) being planted in the area (Henderson et al. 2002). The plantation programs, in combination with the anthropogenic suppression of prairie fires and lack of grazing, have encouraged plant establishment and dune stabilization (Potvin and Harrison 1984, Hulett et al. 1966). Currently, the Brandon Sand Hills are largely stabilized by parkland type vegetation and native grasses and shrubs (David 1977, Schykulski and Moore 1996). Aerial photos from the late 1920s indicate that the amount of bare sand within the Bald Head Hills has declined at a rate of 10–20% per decade, however there has been little change in the overall area of active sand since about the 1960s (Wolfe et al. 2000, Geological Survey of Canada 2001).

Stochastic events

Because only a single White Flower Moth population is known to occur in Canada, the species is extremely vulnerable to stochastic events or natural disasters, such as severe weather events or fires that could destroy the entire population and host plants. Natural recolonization is extremely unlikely given that the nearest known White Flower Moth population is in Nebraska, U.S.A., approximately 1,000 km away.

Additional Threats

Surveys have determined that the White Flower Moth occurs on property under the Authority of the Department of National Defence (CFB/ASU Shilo) (Westwood and Friesen 2007, 2009); however, the Department does not use these areas for military training or activities. Access to these areas is limited to periodic range and training area inspections and forest fire response. The impact of these activities on the White Flower Moth is expected to be minimal.

Within Spruce Wood Provincial Park, invasive species such as Leafy Spurge (*Euphorbia esula*), Kentucky Blue Grass (*Poa pratensis*), and Smooth Brome (*Bromus inermis*) are considered serious invaders that spread quickly and form dense stands that exclude native prairie plants (Schykulski and Moore 1996). These invasive species generally occur in former cultivated fields and along trails and are currently not believed to be an immediate concern for the active dune area (Schykulski pers. comm. 2010). Further research is required to determine the level of impact of these and other potential threats.

Furthermore, computer-based General Circulation models for climate change in the southern prairies project higher temperatures, increased winter and spring precipitation, and decreased precipitation in summer and fall, which could potentially increase evaporation rates and lower soil moisture levels (Geological Survey of Canada 2001). In addition, analysis of drought risks

suggests that the frequency of droughts could increase dramatically (Geological Survey of Canada 2001). These changes could potentially lead to an increase in dune activation and maintenance, and in turn benefit dune species; however, it is unknown if these same changes could potentially be detrimental to the White Flower Moth if they create hot, more arid climatic conditions not suitable for the species (COSEWIC 2005). Because the specific habitat requirements of the White Flower Moth and its host plant are largely unknown, it is difficult to evaluate the importance of this threat.

5. POPULATION AND DISTRIBUTION OBJECTIVES

The short-term population and distribution objective for the White Flower Moth in Canada is to secure and maintain its current distribution at the single known occupied site in Canada and at all new sites that may be discovered through future surveys.

Because the historical population size for the White Flower Moth in Canada is unknown and the current population size is only a rough estimate, it is not possible at this time to develop quantitative population objectives. Once base line population abundance data are available, a quantitative population objective will be developed, if feasible.

Furthermore, in Canada, the White Flower Moth occurs as a single population at the northern periphery of its range. The species is, and likely has always have been, extremely rare and highly localized, thus there is no reasonable expectation that the White Flower Moth could ever become abundant and common in Canada. It is therefore recognized that the distribution objective and general approaches to meet objectives outlined in this document may never result in delisting the species.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

Very little work has been done to date on the White Flower Moth in Canada or worldwide. In 2003 and 2004, surveys were completed in dune areas of the southern Canadian prairies. Eleven individuals were collected in Spruce Woods Provincial Park (COSEWIC 2005). Surveys for the White Flower Moth were conducted in CFB Shilo and Spruce Woods Provincial Park, Manitoba in July/August 2007 (Westwood and Friesen 2007, 2009), confirming the presence of this species in both Spruce Woods Provincial Park and CFB Shilo.

6.2 Strategic Direction for Recovery

Table 1. Recovery Planning Table

Threat or Limitation	Priority	General Description of Research and Management Approaches
Broad Strategy: Inventory and Monitoring		
All	High	<ul style="list-style-type: none"> Continue to survey and monitor the only known White Flower Moth population and survey additional suitable habitats for potential new populations.
Broad Strategy: Research		
All	High	<ul style="list-style-type: none"> Identify habitat characteristics and host plants for the White Flower Moth. Further identify threats to the White flower Moth and its habitat.
Broad Strategy: Habitat Conservation and Management		
All	Medium	<ul style="list-style-type: none"> Integrate White Flower moth recovery efforts with those for other active dune specialist species and within Spruce Woods Provincial Park and CFB Shilo management plans.
	High	<ul style="list-style-type: none"> Determine and implement beneficial management practices for maintaining active sand dunes.
Broad Strategy: Communication/Outreach/Education		
All	Low	<ul style="list-style-type: none"> Increase public knowledge of White Flower Moth and other sand dune Lepidoptera specialists in the prairies.

6.3 Narrative to Support the Recovery Planning Table

Inventory and Monitoring

Additional survey effort is required to estimate population size and area of occupancy of the White Flower Moth in Canada. There is an incomplete inventory of potential habitat, particularly in the sand dunes that occur within the southeast corner of Spruce Woods Provincial Park (J. Elliott pers. comm. 2010) and within CFB Shilo. Reliable population estimates and trends need to be determined for the White Flower Moth in order to establish more quantitative population and distribution objectives. A monitoring scheme should be developed with the help of a population biologist to ensure complete data collection and be integrated with that for other dune specialists.

Research

Very little is known about the White Flower Moth in North America. Prior to establishing any management practices, micro-habitat characteristics of the White Flower Moth will need to be determined to assess habitat suitability and potential threats. Some key areas for future research include identifying habitat preferences and micro-habitat characteristics, and specifically confirming both larval and nectar host plants for this species (Westwood and Friesen 2009). Other research needs include determining the length and timing of various life-history stages, identifying movement patterns and dispersal abilities, identifying mortality factors,

residence time in patch, and density dependence. Research into the level and severity of population and habitat threats is also needed in order to develop effective recovery techniques.

Habitat Conservation and Management

The White Flower Moth is currently found in Spirit Sands which occur within Spruce Woods Provincial Park and CFB Shilo. These areas provide some protection for the species and its habitat, as habitat conversion of these areas is unlikely. Within CFB Shilo frequent fires from military activities may play an important role in maintaining open dune habitat (Henderson et al. 2002). Consequently, in Spruce Woods Provincial Park, prescribed spring burning, mechanical shrub mowing, and chemical applications are undertaken to prevent encroachment of the native prairie by native and non-native woody vegetation (Schykulski and Moore 1996), however no management techniques are in place for maintaining the open active dune areas.

Once more detailed information is known about the species and its potential threats, beneficial management practices should be developed and implemented to ensure important habitats are conserved and managed effectively. Any habitat management efforts should be integrated within the park management plans and with those for other dune specialist species (*see* Appendix A for list of dune specialists).

Communication / Outreach / Education

A communication plan should be developed to increase public awareness of this species, particularly for Spruce Woods Provincial Park which attracts large numbers of visitors. To use resources more effectively, such an outreach program could be developed for several at risk sand dune Lepidoptera specialists including the Gold-edged Gem (*Schinia avemensis*), Dusky Dune Moth (*Copablepharon longipenne*), Pale Yellow Dune Moth (*C. grandis*), and Aweme Borer (*Papaipema aweme*) moth.

7. CRITICAL HABITAT IDENTIFICATION

7.1 Identification of the Species' Critical Habitat

Critical habitat, in SARA, is defined as “...*the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.*”

Critical habitat for the White Flower Moth is identified in this recovery strategy in seven quarter-sections¹ within Spirit Sands dune complex, Manitoba (Appendix B). Five quarter-sections occur within Spruce Wood Provincial Park and two quarter-sections occur within CFB Shilo. Within

¹ The Dominion Land Survey system (McKercher and Wolfe 1986) is the grid system used in the Prairie Provinces to describe land locations. One unit of this system, the quarter-section (65 ha), is particularly useful for mapping critical habitat as it is used for ownership and management purposes. The quarter-section level is used in this strategy to aid in describing the location of White Flower Moth critical habitat.

these quarter-sections critical habitat is defined as the entire open active sand dune area to the edge where native vegetation grows and the active dune becomes stabilized. The total area is roughly 110 ha (1.1 km²). Critical habitat for White Flower Moth excludes unsuitable habitat such as stabilized native prairie, shrub land, forests, marshes, water bodies, and current anthropogenic features such as roads, trails and structures.

Given the extremely limited distribution of the White Flower Moth in Canada, the entire known occurrence of this species in Canada is identified as critical habitat. Thus, the identified critical habitat in this recovery strategy encompasses all known occurrences as of October, 2010 of the only known population of the White Flower Moth in Canada.

Whether the critical habitat identified in this recovery strategy is sufficient to achieve the population and distribution objective as outlined in this strategy is unknown as more information is needed on the moth's distribution, abundance, habitat requirements, and associated threats. It will also depend on whether new occurrences of the species are discovered and whether research shows that the White Flower Moth utilizes habitat outside of the open, active sand dunes. As such, more surveys will be undertaken and in the event that new populations are discovered, additional critical habitat will be identified at that time.

7.2 Examples of Activities Likely to Result in Destruction of Critical Habitat

Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Government of Canada 2009).

Examples of activities that may result in destruction of critical habitat include, but are not limited to:

- 1) **Stabilization of active sand dune habitat.** Seeding or re-vegetating the active dune by anthropogenic means to purposefully stabilize the area to decrease soil erosion and improve land use productivity is considered destruction of White Flower Moth critical habitat. Dune stabilization changes the plant diversity and community structure and directly contributes to the loss of open, active sand dunes necessary for the survival of the species.
- 2) **Conversion of sand dune habitat to crop or forage production.** Conversion of sand dune habitat to grow agricultural crops or forage is considered destruction of critical habitat. White Flower Moths are associated with active sand dunes where key adult and larval food resources occur; cropland does not support the species. Given that the single White Flower Moth population occurs on provincial and federal lands, it is unlikely that these dunes will be converted to crop or forage production.

- 3) **Indiscriminate application of harmful chemicals.** Direct spraying or drift from the application of certain types of herbicides can result in direct mortality of important larval and nectar plants. Broad-spectrum application of chemicals of a type or at concentrations likely to harm plants within identified critical habitat, for reasons other than the maintenance and improvement of active sand dune habitat, is considered destruction of critical habitat. Targeted or spot-spraying of herbicides may be used to prevent encroachment of woody, shrubby or exotic vegetation into active sand dune areas.
- 4) **Improper sand dune management.** Modification of the native plant community diversity and structure within sand dunes due to trampling, vehicular and recreational traffic, or deliberate introduction or promotion of invasive exotic species is considered destruction of critical habitat. The listed activities may result in the direct mortality of White Flower Moths, as well as reduce abundance and productivity of larval and adult host plants; invasive species contribute to dune stabilization.

8. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objective. Specific progress towards implementing the recovery strategy will be measured against indicators outlined in subsequent action plans.

Table 2. White Flower Moth recovery strategy performance measures

Population and Distribution objective	Performance Measure
Secure and maintain its current distribution at the single known occupied site in Canada and at all new sites that may be discovered through future surveys.	<ul style="list-style-type: none"> • Continued persistence of the single known occupied site. • The approximate number of individuals and distribution of the known occupied site are maintained or increased. • New populations are maintained and protected.

9. STATEMENT ON ACTION PLANS

An Action Plan for the White Flower Moth will be completed by 2014. Recovery actions for the White Flower Moth should be combined with activities for other species occurring in dune ecosystems in the southern prairies, in particular with Lepidoptera that occur in active dunes in southwestern Manitoba (Appendix A) for the most efficient use of resources, and to prevent duplication of effort. Creation of a multi-species action plan may be beneficial for the species inhabiting this ecosystem.

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APPENDIX A – EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

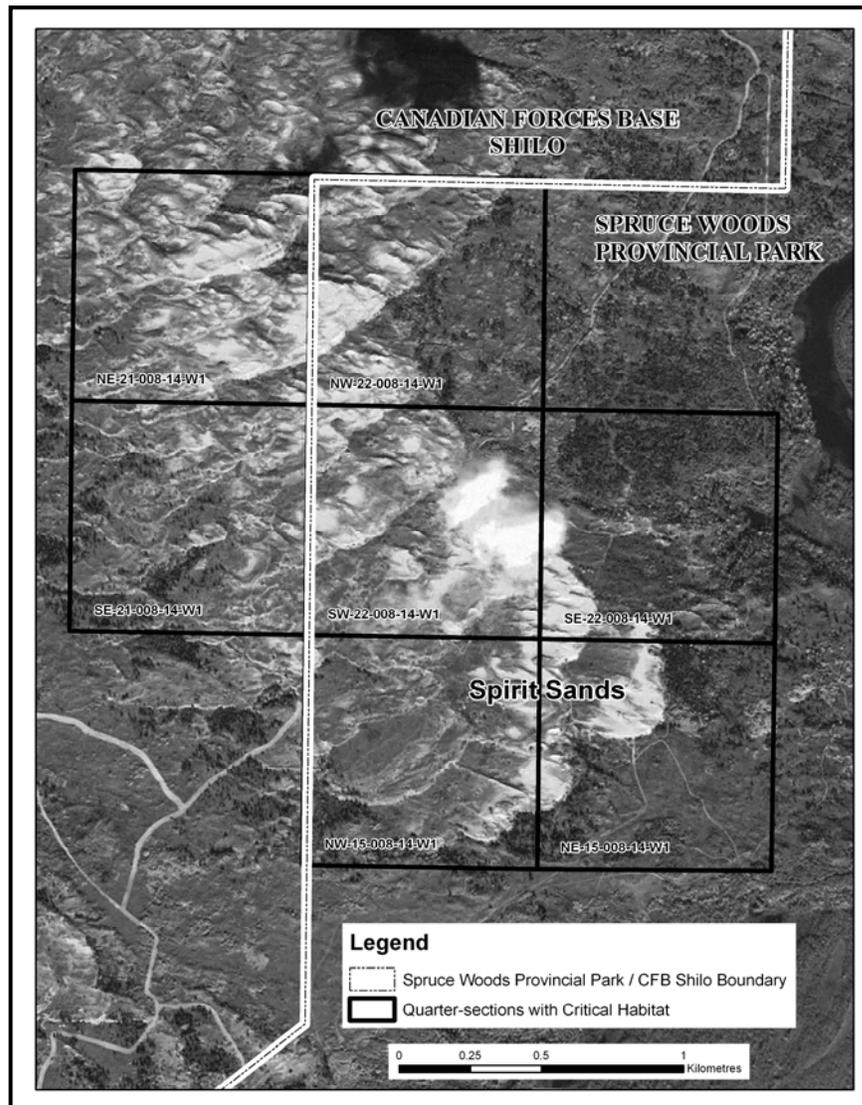
A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

There are a number of rare plants, invertebrates, and vertebrates that are closely associated with sand dune environments. Specifically, within in the Spirit Sands there are a number of rare plants including the threatened Hairy Prairie-clover (*Dalea villosa* var. *villosa*) and Smooth Goosefoot (*Chenopodium subglabrum*). The endangered Ottoo skipper (*Hesperia ottoe*) was last seen in Canada in sandy environments in Spruce Woods Provincial Park in the late 1980s. In addition, the endangered Gold-edged Gem and Dusky Dune Moth, the threatened Verna's Flower Moth (*Schinia verna*), and the special concern Pale Yellow Dune Moth have been found in the Spirit Sands dune complex. The endangered Aweme Borer moth was collected by Norm Criddle in 1905 in the Aweme area, which incorporated parts of Spruce Woods Provincial Park (Roughley 2000); it is believed that this species was associated with sand dunes. There are also a number of rare vertebrate species that use sandy habitat in Manitoba including the endangered Prairie Skink (*Eumeces septentrionalis*), the Plains Hognose Snake (*Heterodon nasicus*), and the Plains Spadefoot Toad (*Spea bombifrons*) (Dubois 1976), as well as the Northern Grasshopper Mouse (*Onychomys leucogaster*), and Olive-backed Pocket Mouse (*Perognathus fasciatus*) (Wrigley 1974, Dubois 1976). All of these species could benefit from habitat conservation and management of the dune ecosystem in and around Spirit Sands dune complex.

APPENDIX B – WHITE FLOWER MOTH CRITICAL HABITAT IN MANITOBA, CANADA²

Province	Quarter	Section	Township	Range	Meridian	Ownership
Manitoba	SE	21	08	14	W1	Province of Manitoba leased by DND
Manitoba	NE	21	08	14	W1	Province of Manitoba leased by DND
Manitoba	SW	22	08	14	W1	Province of Manitoba
Manitoba	SE	22	08	14	W1	Province of Manitoba
Manitoba	NW	22	08	14	W1	Province of Manitoba
Manitoba	NW	15	08	14	W1	Province of Manitoba
Manitoba	NE	15	08	14	W1	Province of Manitoba



² White Flower Moth critical habitat occurs only on portions of the listed quarter-sections and excludes unsuitable habitat such as stabilized native prairie, shrub land, forests, marshes, water bodies, and current anthropogenic features such as roads, trails and structures.