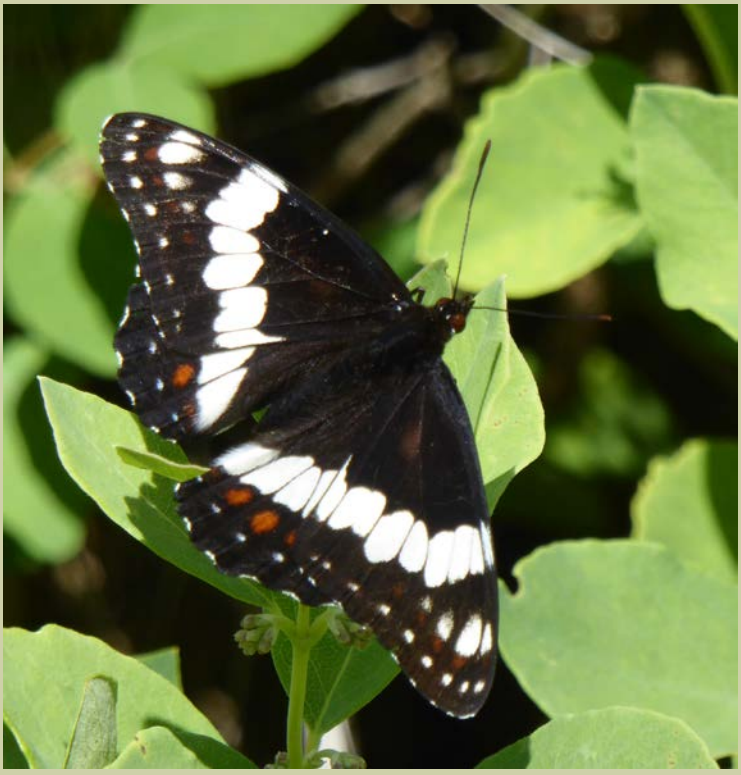
Species at Risk Act
Management Plan Series

Management Plan for the Weidemeyer's Admiral (*Limenitis weidemeyerii*) in Canada

Weidemeyer's Admiral



2019

Government of Canada
Gouvernement du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2019. Management Plan for the Weidemeyer's Admiral (*Limenitis weidemeyerii*) in Canada. *Species at Risk Act* Management Plan Series. Environment and Climate Change Canada, Ottawa. iii + 35 pp.

For copies of the management plan, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

Cover illustration: Weidemeyer's Admiral resting on Western Snowberry © Environment and Climate Change Canada Photographer: Lynne Burns.

Également disponible en français sous le titre
« Plan de gestion de l'amiral de Weidemeyer (*Limenitis weidemeyerii*) au Canada »

ISBN 978-0-660-28965-6
Catalogue no. En3-5/101-2019E-PDF

[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] 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 management plans for listed species of special concern and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change Canada is the competent minister under SARA for the Weidemeyer's Admiral and has prepared this management plan, as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with province of Alberta, as per section 66(1) of SARA.

Success in the conservation 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 plan and will not be achieved by Environment and Climate Changes Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Weidemeyer's Admiral and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

Acknowledgments

This document was written by Medea Curteanu, Environment and Climate Change Canada. Norbert Kondla provided extensive species information and data. Victoria Snable and Lynne Burns (Environment and Climate Change Canada) are acknowledged for undertaking field surveys and providing input to this document. Staff at the Alberta Conservation Information Management System provided updated element occurrences. John Swann (University of Calgary) provided data for nine Weidemeyer's Admiral and two White Admiral specimens collected from southern Alberta and held at the University of Calgary. Special thanks are given to the staff at Writing-on-Stone Provincial Park who provided accommodations during field surveys. The co-operation of all the landowners, lessees and land managers who granted access to their land to do surveys and who continue to provide habitat for species at risk is greatly appreciated. The cover photo of was generously provided by Lynne Burns (Environment and Climate Change Canada). Mark Wayland, Paul Johanson, Greg Wilson, Lynne Burns, and Keri McFarlane (Environment and Climate Change Canada) have reviewed the document and provided valuable comments. Lynne Burns prepared the distribution maps.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6B319869-1%20

Executive Summary

Weidemeyer's Admiral (*Limenitis weidemeyerii*) is a large butterfly that is easily recognized by its rapid flight and distinct black and white wings. In Canada, Weidemeyer's Admiral is only known from a very small geographic area of southern Alberta and this distribution is at the northern periphery of the species' global range. Weidemeyer's Admiral is associated with woody riparian habitats that occur along a 100 km region of the Milk River and its tributaries..

This butterfly is listed as Special Concern on Schedule 1 of the *Species at Risk Act* (SARA) and in the Province of Alberta under the *Wildlife Act*. In 2012, the Province of Alberta prepared the Weidemeyer's Admiral Conservation Management Plan. The federal Management Plan incorporates information from the Alberta Plan as well as includes more recent information about the species.

The primary limiting factor for Weidemeyer's Admiral is the natural availability and connectivity of suitable habitat such as riparian floodplains and shrubby coulees where preferred host plants for larvae and nectar sources for adult butterflies occur. Threats facing this rare butterfly include livestock farming and ranching activities, dams and water management, invasive non-native/alien species, fires, hybridization, and drought as a result of climate change; however, some of these threats are poorly understood. Further studies are needed to quantify the impacts of these threats on Weidemeyer's Admiral.

The objectives of this management plan are:

- In the short term, to improve knowledge on population demographics, habitat use, and threats to the species in Canada; and
- In the long-term, to maintain the current distribution of the Canadian population at all known 13 inhabited sites, as well as any additional populations discovered in the future.

Broad strategies and conservation measures have been identified to help achieve the management objectives for the Weidemeyer's Admiral.

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1. COSEWIC* Species Assessment Information

Date of Assessment: May 2012

Common Name (population): Weidemeyer's Admiral

Scientific Name: *Limenitis weidemeyerii*

COSEWIC Status: Special Concern

Reason for Designation: This large butterfly has a small Canadian population and is restricted to valleys and prairie coulees of southern Alberta. The threat of invasive Russian Olive and Saltcedar that outcompete the butterfly's larval host plant is predicted to increase.

Canadian Occurrence: AB

COSEWIC Status History: Designated Special Concern in May 2000. Status re-examined and confirmed in May 2012.

* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

2. Species Status Information

The Weidemeyer's Admiral (*Limenitis weidemeyerii)* consists of six recognized subspecies that occur in North America with the range of some subspecies overlapping and exhibiting some level of interbreeding (hybridization) along their zone of contact (Perkins and Perkins 1967, Porter 1989, Bird et al. 1995). This management plan applies to *L. w. oberfoelli*, the only subspecies found in Canada.

Less than 0.1% and 0.5% of the North American range of Weidemeyer's Admiral species and *L. w. oberfoelli* subspecies, respectively, occurs in Canada (COSEWIC 2012). The species was listed as Special Concern in Schedule 1 of the federal *Species at Risk Act* (SARA) in 2002. The species occurs only in Alberta where it is listed as a Species of Special Concern (ASRD 2012).

NatureServe (2017) ranks the global population of Weidemeyer's Admiral as Secure (G5; status last reviewed 2016). Nationally, the species is considered Critically Imperiled (N1) in Canada and Secure (N5) in the United States (U.S.) (NatureServe 2017). In Alberta, it is ranked as Critically Imperiled (S1) but it has not been ranked (SNR) in a majority of the states where it occurs (NatureServe 2017). Table 1 shows the subnational conservation status ranks of Weidemeyer's Admiral in the 15 states where it occurs in U.S.

Table 1. Weidemeyer's Admiral NatureServe[a] conservation status (NatureServe 2017).

	Global (G) Rank*	National (N) Rank	Subnational (S) Rank
Weidemeyer's Admiral (*Limenitis weidemeyerii*)	G5	Canada (N1)	Alberta (S1)
		United States (N5)	Arizona (SNR), California (SNR), Colorado (S5), Idaho (SNR), Kansas (SNR), Montana (S5), Nebraska (S3), Nevada (SU), New Mexico (SNR), North Dakota (SNR), Oregon (SNR), South Dakota (SNR), Texas (SNR), Utah (SNR), Wyoming (SNR)
Weidemeyer's Admiral (*Limenitis weidemeyerii oberfoelli*)	TNR	Canada (NNR)	Alberta (SNR)

[a] *The NatureServe conservation status of a species is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational). The numbers have the following meaning: 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, and 5 = secure. NR =not ranked, T=infraspecific taxon, and U=unrankable.*

3. Species Information

3.1. Species Description

Weidemeyer's Admiral is a member of the Order Lepidoptera (butterflies and moths) and Family Nymphalidae (brushfoots or four-footed butterflies), the largest family of butterflies that occurs throughout the world, except Antarctica (Freitas and Brown 2004). The family is distinguished by the reduced brush-like forelegs that are curled up and not functional for walking, giving the illusion of individuals having only four legs (Figure 1; Pohl et al. 2010). Weidemeyer's Admiral is one of Alberta's four species belonging to the Subfamily Limenitidinae (admirals) (Pohl et al. 2010). Members of this subfamily are strong and rapid fliers and are easily recognized by a "flap-and-glide" style of flying (Acorn 1993, Bird et al. 1995).

Figure 1 – Weidemeyer's Admiral resting on Western Snowberry © Environment and Climate Change Canada Photographer: Lynne Burns.

Weidemeyer's Admiral, like all butterflies, has a life cycle composed of four stages: egg, larvae (or caterpillar), pupa (or chrysalis), and adult. In general, very little is known about the biology of Weidemeyer's Admiral in Canada. Information is presented from general knowledge of US populations; where applicable, observations are provided from the Canadian Weidemeyer's Admiral population.

Adults: Weidemeyer's Admiral is a black and white butterfly and one of Alberta's larger butterfly species (55 to 72 mm wingspan) (Layberry et al. 1998, COSEWIC 2000). It is recognized by the bold broad, white bands that mark the upper (dorsal) surface of the fore and hind wings and the extensive white scaling at the base of the underside (ventral) of the hindwings (Figure 1; Bird et al. 1995). The black and white pattern makes it difficult to detect individuals when perching on plants, especially in direct light. Both sexes are similar in appearance, but females tend to be larger (Boyd et al. 1999).

Throughout its global range, Weidemeyer's Admiral can be mistaken in flight with two other admirals, White Admiral (*Limenitis arthemis*) and Lorquin's Admiral (*L. lorquini)*, and the three species frequently hybridize where their ranges overlap (Remington 1968, Pinel and Kondla 1985, Pike 1987, Porter 1990, Bird et al. 1995, Boyd et al. 1999). While some authors have considered *L. weidemeyrii* as a subspecies or sister taxa of *L. lorquini* (*e.g.*, Porter 1990, Mullen 2006), more recent work suggests that species-level designation should be maintained (*see* Boyd et al. 1999). Accepting the current species and subspecies nomenclature (ASRD and ACA 2005, COSEWIC 2012; *but for greater taxonomic details see* COSEWIC 2000), in Canada Weidemeyer's Admiral can only be mistaken with the White Admiral where their ranges overlap in southern Alberta (Bird et al. 1995). White Admiral can be recognized by extensive reddish-brown markings on the ventral surface of the hind wing (Bird et al. 1995, Boyd et al. 1999). Presumed hybrids, individuals that exhibit morphological phenotypes from both species, occur at various Canadian sites (Pinel and Kondla 1985, Curteanu and Burns 2017), and these are more difficult to identify..

In Alberta, Weidemeyer's Admiral is univoltine (one generation per year) and the flight period has been reported to range from June 7 to July 22, with the peak flight period occurring from late June to early July (Bird et al. 1995). Based on the records available for Alberta the earliest observation of an adult was June 12 and the latest observation was August 8 (Alberta Conservation Information Management System [ACIMS] 2016 data). Snable and Burns (2015) reported two individuals mating on July 15, 2015. Adult life span is unknown but Rosenberg (1989) recorded a male defending a territory for 37 days.

Egg: In Canada, only a single oviposition event has been observed for Weidemeyer's Admiral (Pike 1987). In US, the eggs have been described as grey-greenish and these are laid singly on the leaf tips of a wide variety of larval host plants (Scott 1986a).

Larvae: The larval stages of the Weidemeyer's Admiral have not yet been found in Canada. Scott (1986b) describes larvae in the U.S. as olive-green with a yellowish thorax, red-brown head, and a whitish or yellowish saddle in the middle of the abdomen. Similar to other *Limenitis*, the larvae is cryptic and resembles bird droppings. In the fall, induced by the short photoperiod (the number of hours of sunlight during the day), the third instar makes a leaf shelter (hibernaculum) by rolling a portion of the leaf in silk and attaching it to the stem of the host plant (Scott 1979, Platt and Harrison 1988, Stout 2016). The hibernaculum remains on the host plant during the winter and the larva

resume feeding and developing in spring when temperatures rise (Platt and Harrison 1988).

Pupa: The pupal stage has not been found in Canada. From the U.S., Scott (1986b) describes the pupa as blackish-brown with a black streak extending back from the saddle horn. Similar to other *Limenitis*, the fifth instar larva attach to a stem or underneath a leaf via silk and form a cremaster (a hook-like tip) from which the larva will then attach itself and hang in the shape of a "J" before pupating (Stout 2016).

3.2. Species Population and Distribution

Global Population and Distribution

Weidemeyer's Admiral is endemic to North America and is widely distributed throughout the Rocky Mountain and the Great Basin region, from extreme southern Alberta in the north, south into much of Montana, Idaho, southeastern Oregon, extreme east-central California, Nevada, Utah, Wyoming, Colorado, Arizona, New Mexico, and northern Mexico and east into the western portions of North and South Dakota and Nebraska (Figure 2) (Perkins and Perkins 1967, Bird et al. 1995, Boyd et al.1999, ASRD 2012, COSEWIC 2012). The maximum global extent of occurrence was estimated at 2.3 million km^2; however the occurrence of suitable habitat is extremely patchy and fragmented across the species' range (COSEWIC 2012).

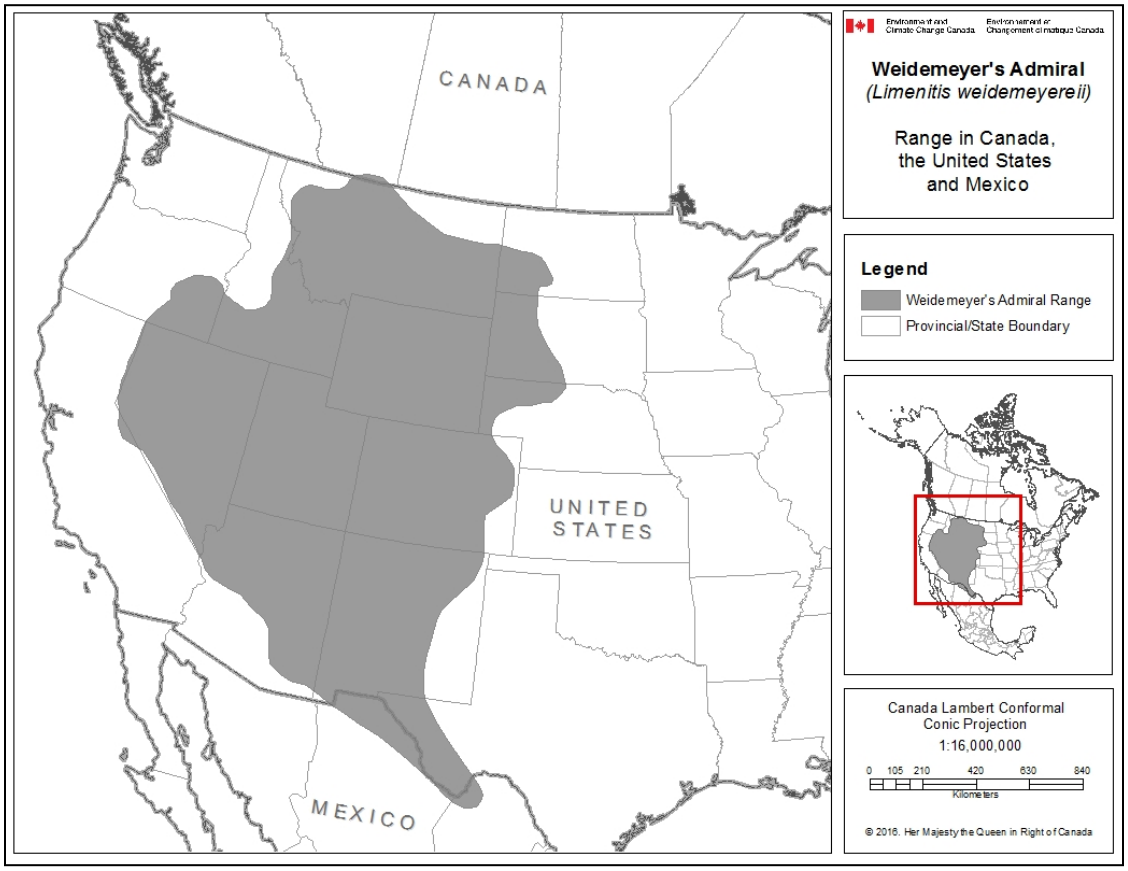

Figure 2. Weidemeyer's Admiral global distribution (adapted from COSEWIC 2012, data courtesy of R. Foster).

The geographic distribution of the six recognized subspecies is not well known due to the high level of introgression of these subspecies across their range. Also, a taxonomic review of these subspecies has not yet been completed (ASRD and ACA 2005). Perkins and Perkins (1967) provided a general distribution map of these subspecies in the US; however these ranges are incomplete and out-of-date. Largely, the range of *oberfoelli* can be described as occurring in southern Alberta, south into extreme eastern Montana, east into the Slope County badlands of western North Dakota, south through the Black Hills of western South Dakota, and the Pine Ridge of northwestern Nebraska (Brown 1960, Perkins and Perkins 1967, Kohler 1980, Royer 1988). Much of Montana is reported as an area of integration with other subspecies (Perkins and Perkins 1967).

It is unknown if Weidemeyer's Admiral's global distribution has changed or declined in the last century. Perkins and Perkins (1967) described the species as occurring in nearly one-fifth of the total area of the Unites States but not in Canada or Mexico. They also noted vagrants from Kansas and Oregon. Since this species occurs at low densities and in isolated areas (particularly in Canada), it is most likely that these observations reflect issues with survey coverage and detection within peripheral populations rather than expansion of the species' range.
The Sweet Grass Hills of Montana, located approximately 15 km south of the Weidemeyer's Admiral Canadian population, is the closest source population (Pinel and

Kondla 1985, COSEWIC 2012, Curteanu and Burns 2017). Smith and Bird (1977) speculated that wind-blown strays from the Sweet Grass Hills may colonize northern areas and thus have an overall influence the Milk River-Lost River butterfly fauna. Thus, it is likely that the Sweet Grass Hills region could serve as a source population given the species' tendency to use riparian corridors for dispersal (ASRD and ACA 2005, COSEWIC 2012). However, the status of the Montana population is currently unknown. Furthermore, it remains unknown whether suitable habitat connecting the two populations still exists. Thus, it is unknown whether the potential exists for the Canadian population to be rescued by natural colonization by a Montana-based population.

Canadian Population and Distribution

In Canada, Weidemeyer's Admiral is restricted to a very small geographic area of southern Alberta at the northern periphery of the species' global range (Figure 3). Very few targeted surveys have been completed in Canada, thus population and distribution data are limited and incomplete since extensive suitable habitat has not been surveyed. The current known range occurs along the various tributaries that drain into a 100 km stretch of the Milk River (Smith and Bird 1997, COSEWIC 2000, ASRD 2012, COSEWIC 2012). The maximum extent of occurrence is estimated at 1,081 km^2 and the area of occupancy is estimated at 164 km^2 (using a 2 km x 2 km grid); however this distribution is thought not to be complete (COSEWIC 2012) and not accurate (Curteanu and Burns 2017). It has been suggested that the distribution extends farther east than currently recorded, as well as farther west along the Milk River, and around Ross Lake Natural Area (T. Pike pers. comm. 2016).

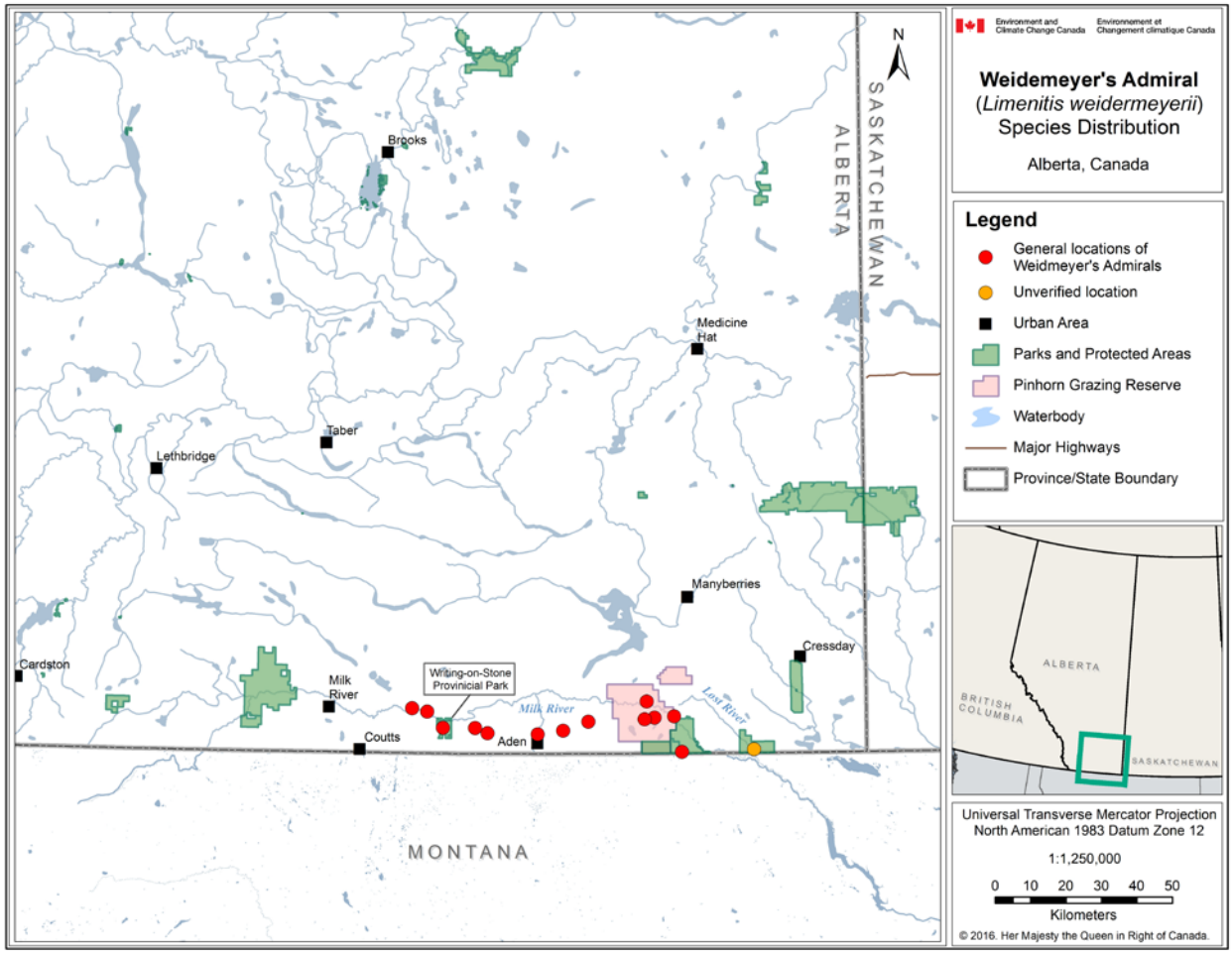

Figure 3. The Canadian distribution of Weidemeyer's Admiral.

Based on two Weidemeyer's Admiral specimens collected in 1974 and deposited at University of Calgary Museum, Lost River has been included as part of the species' distribution (ASRD and ACA 2005, ASRD 2012, COSEWIC 2012, ACIMS 2016). However, recent evidence suggests that this location may be erroneous (Curteanu and Burns 2017). Given that this location is historical and cannot be verified, present, the occurrence of the species at this location is described as "unverified". Due to the uncertainty of this observation, Lost River was not considered to contribute to achieving the management objective.

The Canadian range of the Weidemeyer's Admiral falls within the Dry Mixedgrass and Mixedgrass Natural Subregions of Alberta. These regions are characterized by flat to gently undulating semiarid prairie, coulees[3], valleys, badlands and dune fields and have a typical continental prairie climate of cold winters, warm summers, and low precipitation (Pinel and Kondla 1985, Natural Regions Committee 2006). Brown Chernozem and Brown Solonetzic are the dominant soils types (Natural Regions

[3] Coulee is a term used in southern Alberta to refer to semi-arid, tributary stream valleys of major rivers (Blain et al. 2014), especially when the valley is long steep-sided ravine that once carried melt water from a glacier.

Committee 2006). The Milk River watershed is a unique ecosystem, being the smallest of Alberta's major river basins and the only watershed in Canada that drains to the Gulf of Mexico (MRWCC 2013). The Milk River starts in the foothills of the Rocky Mountains in Montana, then flows northeast into southern Alberta and continues east across the semiarid plains of the province before turning south to Montana and joining the Missouri River (Figure 3). The Milk River watershed provides habitat for numerous rare plant and animal species that are not found in other parts of the province (Appendix A).

It has previously been reported that the Canadian Weidemeyer's Admiral population consists of two metapopulations that are 60 km apart: the West metapopulation centered in Writing-on-Stone Provincial Park and the East metapopulation around the Pinhorn Provincial Grazing Reserve (ASRD and ACA 2005, COSEWIC 2012). Because Weidemeyer's Admiral is a fast and rapid flier, it was speculated that individuals use the coulees and riparian habitat as corridors for dispersal and therefore these two metapopulations are connected to some degree (ASRD 2012, COSEWIC 2012). Since the completion of the COSEWIC status report in 2012, several new occurrences have been reported (Snable and Burns 2015, ACIMS 2016, Curteanu and Burns 2017) confirming that the Canadian Weidemeyer's Admiral population is indeed connected to some extent (Figure 3). The maximum distance between known occurrences is 10 km and suitable habitat exists between those occurrences. As such the distance between occurrences could be much smaller.

COSEWIC (2012) reported that the species occurs at seven locations[4]. However, these locations are analogous to sites due to the close proximity to one another (majority less than 10 km apart) and the occurrence of suitable but unsurveyed habitat that exists among these sites. Thus, it is not possible to calculate the number of locations for this species at this time without further surveys of suitable habitat and a better undertaking of this species' threats. This species is very localized, although it likely occurs throughout the branching coulee systems of the Milk River which have not yet been fully surveyed. Therefore, the threats remain unclear. In the absence of clearly defined threats over Weidemeyer's Admiral's range, the term 'location' cannot be applied at this time and only the sites are presented in this Management Plan.

[4] IUCN defines a location as a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present (IUCN 2012). NatureServe defines an occurrence for this taxon based on a separation distance of 20 km through suitable habitat and 5 km through unsuitable habitat.[5] Kondla (2004) refers to *Symphoricarpos sp.* as Buckbrush.

Table 2. Summary of Weidemeyer's Admiral occurrence records in Canada[a].

SF # [b]	Sites[c]	Date First Observed	Date Last Observed	Total Number of Individuals Observed	Source
2089	Lost River [d]	July 3, 1974	July 3, 1974	min 2	Smith & Bird 1977; ACIMS 2016; University of Calgary Museum
2084	Verdigris Coulee	June 14, 1987	June 14, 1987	<17	ACIMS 2016 (T.Pike)
2085	Milk River Bridge	June 12, 1988	June 12, 1988	?	ACIMS 2016 (T.Pike)
2086 & 41862	Writing-on-Stone Provincial Park	July 22-23,1976	July 1-2, 2016	>25	Smith & Bird 1977; Pinel & Kondla 1985; Vujnovic 2011, University of Calgary Museum, Curteanu & Burns 2017
2088	MacDonald Creek	June 21, 1987	June 21, 1987	5	ACIMS 2016 (T.Pike)
41857	Kennedy Coulee	August 8, 2014	August 8, 2014	1	ACIMS 2016
44319	Deer Creek	July18, 2015	July18, 2015	1	Snable & Burns 2015
2090	Pinhorn Grazing Reserve - north	June 26, 2004	June 26, 2004	5	Kondla 2004
2087	Pinhorn Grazing Reserve - south	July 16, 1978	July 2, 2004	10	Kondla 2004
44321	Pinhorn Grazing Reserve - south	July 11, 2015	July 11, 2015	1	Snable & Burns 2015
44320	Pinhorn Grazing Reserve - south	July 15, 2015	July 15, 2015	2	Snable & Burns 2015
	Bear Creek	June 30, 2016	June 30, 2016	5	Curteanu & Burns 2017
	Philip Coulee	June 29, 2016	June 29, 2016	2	Curteanu & Burns 2017
	Breed Creek	June 28, 2016	June 28, 2016	1	Curteanu & Burns 2017
	Total Observed			**>75** [e]	

[a] This is the best information available to Environment and Climate Change Canada (up to 2017 at the time this management plan was finalized).

[b] SF # refers to the source feature number, as assigned by ACIMS. In COSEWIC (2012), locations are considered to be analogous to ACIMS Source Feature (COSEWIC identified seven locations).

[c] Due to the limited data on potential threats, locations were not identified and only the sites are presented here.

[d] ACIMS considers this occurrence historical. A historical rank is recommended by NatureServe for occurrences that have not been reconfirmed for 20 or more years when there are no known disturbances and the habitat is still extant (NatureServe 2008). Environment and Climate Change Canada surveyed the location in 2016 and considers this occurrence as unverified (Curteanu and Burns 2017).

[e] Estimate may include hybrids.

Since the COSEWIC status report was prepared in 2012, several new occurrences have been reported in Alberta and as of 2016, Weidemeyer's Admiral was known to occur at 13 sites in Canada (Snable and Burns 2015, Alberta Conservation Information Management System [ACIMS] 2016, Curteanu and Burns 2017). Although all the new observations fall within the known extent of occurrence of the species, these findings increase the species' area of occupancy.

The first contemporary record of Weidemeyer's Admiral in Canada is from 1974 (Smith and Bird 1977, COSEWIC 2012). The species historical distribution prior to this discovery is unknown, as is the amount, if any, by which this range has changed. Based on the distribution of suitable habitat, it is likely that this butterfly was never historically widespread in Canada and the amount of suitable habitat has not changed. According to COSEWIC (2012) there is no evidence of a decline in the species' current distribution. A recent survey carried out by Kondla (2004) did not find any individuals at five sites known to be occupied in 1987; however he attributed this to an early season and inappropriate survey timing rather than loss of suitable habitat (N. Kondla pers. comm. 2016).

COSEWIC (2000) roughly estimated the Canadian Weidemeyer's Admiral adult population to be between 1,800 and 3,200 individuals based on estimates made by Pike (1987). However, this is likely an overestimate as it assumed that all suitable habitat patches would be occupied (COSEWIC 2012). There is a high degree of uncertainty associated with the 2000 COSEWIC estimate, given that habitat occupancy is unknown, not all suitable habitat has been surveyed, and none of the field surveys conducted were designed to estimate population size. Furthermore, similar to other Lepidoptera, local populations of Weidemeyer's Admiral likely undergo natural cycles or substantial fluctuations depending on weather conditions, making population estimates extremely difficult (ASRD and ACA 2005). Therefore, estimating population abundance for such a rare and poorly studied species as the Weidemeyer's Admiral is not possible with the current available data. It is also unknown if historically the species was more widely abundant in Canada. It is assumed that because the Canadian population occurs at the northern periphery of the species' global range, Weidemeyer's Admiral exists in much lower numbers relative to warmer regions to the south.

3.3. Needs of the Weidemeyer's Admiral

General habitat requirements

Across its North American range, Weidemeyer's Admiral has been found at mid- and lower elevations in a wide variety of habitats such as deciduous and coniferous riparian forests, mountains, coulees, canyons, badlands, ravines, shrubby stream sides, aspen groves, and even small towns (Pike 1987, Boyd et al. 1999, Royer 1988, COSEWIC 2012). In North Dakota the species has been described as "thoroughly a badlands butterfly" (Royer 1988) while in the Great Basin as "largely montane" (Boyd et al. 1999). Within the Sweet Grass Hills, Montana, the species occurs within treed riparian areas at higher elevation and within smaller patches of shrubs at lower elevations (ASRD and ACA 2005). Weidemeyer's Admiral is associated with habitats where larval food plants

occur, which include various species of willow (*Salix* spp.), cottonwoods and poplars *(Populus* spp.), chokecherry (*Prunus* spp.), serviceberry (*Amelanchier* spp.) and oceanspray (*Holodiscus spp.;* Smith and Bird 1977, Scott 1986a, Pike 1987, Bird et al. 1995, Boyd et al. 1999). Although the species has been reported to occur largely in woody riparian habitat, it has also been found in drier montane habitat where larval foodplants occurs widely on arid slopes and in dry canyons, far from streams and other wet areas (Boyd et al. 1999).

In Canada, Eastern Cottonwood (*Populus deltoides*) is the predominant tree species found on the river sandbars or valley bottoms (also referred to as the floodplains) of the Milk River basin where Weidemeyer's Admiral is found (Smith and Bird 1977, Pearce and Smith 2001). Other tree and shrub species associated with Milk River floodplain include Sandbar/Coyote Willow (*Salix exigua*), Peach-leaf Willow (*S. amygdaloides*) and Thorny Buffaloberry (*Shepherdia argentea*) (Pearce and Smith 2001). Hybrid poplars (*Populus* spp.) are also a dominant tree species within the Milk River basin, and these generally occur in small clumps in the moister portions of some coulees (Smith and Bird 1977). The moisture supply on the north-east facing slopes or at the bottom of the coulees is sufficient to support a wide variety of shrub species during drought periods. Shrub communities associated with the coulee habitat in southern Alberta include a wide variety of species such as willow, rose (*Rosa* spp.), juniper (*Juniperus* spp.), Thorny Buffaloberry, Western Snowberry/Buckbrush[5] (*Symphoricarpos occidentalis*), Saskatoon (*Amelanchier alnifolia*), Wolf Willow (*Elaeagnus commutata*), Shrubby Cinquefoil (*Dasiphora fruticosa*), Silver Sagebrush (*Artemisia cana*), Greasewood (*Sarcobatus vermiculatus*), and Chokecherry (*Prunus virginiana*) (Smith and Bird 1977, Bain et al. 2014).

Smith and Bird (1977) who first reported the species in Canada noted that adults were common in areas with poplars and pools of standing water. Pike (1987) identified cottonwoods, poplar, Saskatoon, Western White Clematis (*Clematis ligusticifolia*), and Thorny Buffaloberry as indicator species for Weidemeyer's Admiral occurrence, while Kondla identified three distinct habitat types: 1) riparian forest and shrubbery along the Milk River floodplain; 2) pockets of trees and shrubs along coulees; and 3) small Saskatoon/Chokecherry shrub patches absent of trees (ASRD and ACA 2005).

From the limited surveys undertaken in Canada to date, several ecosystem attributes to characterize suitable Weidemeyer's Admiral habitat have been identified and these are discussed in more detail below. In general, the presence of moisture is likely an important ecosystem attribute that drives the presence of nectar and larval foodplants which are vital for larval development. Shrubs and flowering plants are confined to the moister north facing slopes of the coulees or the bottom. Often the drier south-facing slopes are devoid of any vegetation. Moisture also provides puddling opportunities since like many butterfly species, Weidemeyer's Admiral puddle on damp mud or soil for mineral uptake (Rosenberg 1987, ASRD and ACA 2005), although this behaviour has not been observed in Canada (L. Burns pers. comm., M. Curteanu pers. obser.). Deciduous trees and tall shrubs are also important as they can provide shelter from the

[5] Kondla (2004) refers to *Symphoricarpos sp.* as Buckbrush.

strong prairie wind (ASRD and ACA 2005), as well as offer elevated sites for males to perch and locate females (COSEWIC 2000, ASRD 2012).

Breeding Habitat

Male Weidemeyer's Admirals have been described as territorial, in that fixed areas are defended for extended periods of time (up to 37 days) by engaging in patrolling and aerial contest behaviour with male conspecifics, other insects, and even birds (Rosenberg 1989, Rosenberg and Enquist 1991). Little is known about habitat selection within territories but features within these sites are likely very important to the species' ecology and reproductive success. The importance of territories is evident as these sites can be used by successive generations and in certain circumstances these sites are quickly re-occupied by neighbouring males (often in less than one minute) once an individual is removed from the territory (Rosenberg 1989, Kondla 2004, Curteanu and Burns 2017). In Colorado, Rosenberg (1989) studied five Weidemeyer's Admiral populations and described territories (N=69) as always located in open, sunny corridors along a creek or trail; the average size was estimated to be 15 m long (range 9-28 m) and 6 m wide (range 5-14 m). Within territories, male Weidemeyer's Admiral flew every 2.5 minutes from perches overhanging the corridor (or flyway) to investigate any passing object (Rosenberg 1989). The researcher also examined the response times of individuals in relation to the height of their perches and reported that higher perched males responded more quickly to approaching conspecifics that lower perched males Rosenberg (1989).

During the 2016 surveys carried out in southern Alberta, the majority of encountered individuals, believed to be males, were observed frequently perching, patrolling a fixed area, and chasing intruders such as Weidemeyer's Admirals, Silver-spotted Skippers (*Epargyreus clarus*), and other various butterflies. Only three individuals were observed either high up in the tree canopy moving from plant to plant or flying quickly through the area without stopping; these individuals were hard to observe and were assumed to be the females in search for ovipositioning sites (Curteanu and Burns 2017). The male territories were located at the bottom of the coulee along the trail, rather than on the steep shrubby slopes or hilltops even though those areas were thoroughly searched; only one territory was located along a creek with moving water (Curteanu and Burns 2017). Individuals were recorded perched on a wide range of shrubs including Wolf Willow, Silver Sagebrush, Western Snowberry, Saskatoon, Chokecherry, Shrubby Cinquefoil, Golden Rod, juniper, willow, and rose (Kondla 2004, Snable and Burns 2015, Curteanu and Burns 2017); a few individuals were observed perched on rocks or dead branches (Curteanu and Burns 2017). The exact perch site was always higher than the surrounding vegetation and hanged over the corridor. Only one mating, observed at the Pinhorn Provincial Grazing Reserve in 2015, has been reported from Canada; the habitat consisted mainly of Western Snowberry, Saskatoon, Chokecherry, Shrubby Cinquefoil, Wild Bergamot (*Monarda fistulosa*), and goldenrod (*Solidago* spp.; Snable and Burns 2015).

Lederhouse (1993) suggested that males of *Limenitis* genus defend territories not because such areas have suitable feeding or ovipositioning sites but because these areas have a high female visitation rates. Circumstantial evidence from the 2016 field surveys suggests that the coulee bottoms in southern Alberta act as flyways or corridors for females traveling in search of ovipositioning sites, and established territories offer males a better vantage point to quickly locate receptive females and exclude intruders (Curteanu and Burns 2017). However, Rosenberg (1989) found that even over successive generations, the majority (79%, N=48) of eggs, larvae, and pupae occurred within established territories, suggesting that males might be defending ovipositioning sites but also access to newly emerging females as males emerge one week before females. Furthermore, it was concluded that Weidemeyer's Admiral might be a relatively sedentary butterfly as both sexes exhibited low dispersal capabilities (average of 166 m; range 0 - 2850m), and little genetic exchange was observed between two populations that were only 4 km apart. On the other hand, long-distance dispersal is difficult to quantify in the field as tagged individuals can disperse outside the study area to unknown areas. Much work is needed in filling-in ecological knowledge gaps in respect to dispersal rates and habitat features selected by male and female Weidemeyer's Admirals in Canada.

Feeding Habitat

Weidemeyer's Admiral adults depend on an adequate supply of nectar as a source of energy for metabolic functions, flying, patrolling, defending territories, and reproduction. Weidemeyer's Admirals have been observed feeding on a variety of food items including flower nectar, tree sap, carrion, mud, and honeydew excreted by aphids (Scott 1986b, Pike 1987, Rosenberg 1987, 1989). Specifically, in Colorado, adults have been observed nectaring on a variety of flower species such as White Globe-flower (*Trollius albifloria*), Flowery Phlox (*Phlox multiflora*), Trailing Fleabane (*Erigeron flagellaris*), Big-flower Cinquefoil (*Potentilla fissa*), Western Wallflower (*Erysimum asperum*), Black-eyed Susan (*Rudbeckia hirta*) and Cow Parsnip (*Heracleum lanatum*) (Rosenberg 1987). It was also noted that although adults fed throughout the day, morning seemed to be the busiest time for feeding (Rosenberg 1987).

In Canada, Western White Clematis has been identified as the major nectar source for adults (Pike 1987, COSEWIC 2012), but this flowering plant was not observed at any of the sites surveyed in 2015 and at only at one site, Writing-on-Stone Provincial Park, surveyed in 2016 (Snable and Burns in 2015, Curteanu and Burns 2017). Several individuals were recorded to nectar on Western Snowberry flowers, which were in bloom and abundant during the 2016 flight period (Curteanu and Burns 2017) and one individual was observed perched on a Goldenrod, although it was not noticed if it was actually nectaring (Snable and Burns 2015). Bull Thistle (*Cirsium vugare*) and milkweed (*Apocynaceae* spp.) have been identified as additional nectar plants (T. Pike pers. comm. 2016). Other potential nectaring sources could be the flowers of Saskatoon, Chokecherry, Shrubby Cinquefoil, Wild Bergamot and rose that are in bloom during the species' flight period.

Oviposition and Larval Resources

Very little is known about the ecology and habitat needs of the Weidemeyer's Admiral immature stages and larval host plants in Alberta. Most of what is known comes from occurrences in other parts of the species' range. According to Scott (1986a), larva are polyphagous (utilizing many different kinds of food) of various deciduous shrub and tree species. Specifically, females have been observed laying eggs on Saskatoon, Narrow-leaved Cottonwood (*Populus angustifolia*), Yellow Willow (*Salix lutea*), Coyote Willow, Chokecherry, Oceanspray (*Holodiscus discolor*), Fremont's Cottonwood (*P. fremontii),* Trembling Aspen (*P. tremuloides*), and Utah Serviceberry (*A. utahensis*) (Emmel et al. 1970, Scott 1986a, Boyd et al. 1999).

In Alberta, only one record exists of a Weidemeyer's Admiral female laying a single egg on the upper surface near the tip of a Saskatoon leaf (Pike 1987). Additional larval food plants have not been confirmed in Canada, but similar to observations in U.S. the larva is assumed to use a wide range of plant species that are common to the area. It has been noted that females do not lay eggs readily in captivity and they possibly need large areas for flight between ovipositioning (T. Pike pers. comm. 2016). Pike (1987) did not find any individuals in large willow stands suggesting that this genus might not be used for ovipositioning or as a larval host plant in Alberta. Some larval host plants identified in the U.S. such as Oceanspray, Fremont's Cottonwood, and Utah Serviceberry do not occur in Alberta. The tree and shrub communities that have been found at Weidemeyer's Admiral occurrences in Alberta vary slightly from the ones listed for the U.S. populations, reflecting the varied micro-habitats and moisture conditions found across the species' range. More research is required on the early life stages of the Weidemeyer's Admiral in Canada in order to better understand this butterfly's habitat needs and identify all other larval host plants.

3.4. Limiting Factors

Limiting factors influence a species' survival and reproduction, and play a major role in the ability to reach certain population levels or to recover following a decline. The primary factor limiting the distribution of Weidemeyer's Admiral in Canada is the natural availability and connectivity of suitable habitat such as riparian floodplains and shrubby coulees that contain this butterfly's preferred larval host plants and adult nectar sources (ASRD and ACA 2005). Riparian areas and wetlands make up a very small part of the land cover type in the Milk River basin (MRWCC 2013) while shrubby coulees have a naturally small and patchy distribution throughout Alberta and the Canadian prairies.

4. Threats

4.1. Threat Assessment

The threat assessment for the Weidemeyer's Admiral is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future, the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). In carrying out the threat assessment, only present and future (within a 10-year timeframe) threats are considered. Threats are characterized here in terms of scope, severity, and timing. The overall threat "impact" reflects a reduction of a species population or decline/degradation of the area of an ecosystem and is calculated from scope and severity. See the footnotes to Table 3 for details on how the values are assigned in the table. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the narrative section. Limiting factors are not considered during this threat assessment process.

Table 3. Threat assessment table for the Weidemeyer's Admiral in Canada.

Threat #[a]	Threat Description	Impact[b]	Scope[c]	Severity[d]	Timing[e]	Detailed Threats
2	**Agriculture & aquaculture**					
2.3	Livestock farming & ranching	Low	Pervasive	Slight	High	Throughout species' range, grazing occurs at different intensities (except Kennedy Coulee). Some suitable habitat is not used by cattle (steep coulees); however, there is potential for trampling of coulee bottoms and the consumption of individuals during periods of drought, or if cattle use the floodplain.
7	**Natural system modifications**	Medium	Restricted	Serious	High	
7.1	Fire & fire suppression	High	Large	Serious	High	Although present day fires are quickly extinguished, with increased drought conditions on the prairies as well as more people on the landscape (working, camping), there is an increased risk of fires.

Threat #[a]	Threat Description	Impact[b]	Scope[c]	Severity[d]	Timing[e]	Detailed Threats
7.2	Dams & water management/use	Low	Small	Serious	High	Potential for a portion of the population that inhabits the floodplain habitat to be flooded if a dam is constructed on the Milk River. Also floodplain habitat may become degraded over time due to unnatural flood regimes and decline in cottonwood recruitment.
8	**Invasive & other problematic species & genes**	Unknown	Small	Unknown	High	
8.1	Invasive non-native/alien species	Unknown	Small	Unknown	Low	Currently only a very small area (2 km north from US border) is known to be impacted by Russian Olive. This threat will possibly become more serious in the next 15 - 20 years. Severity is unknown.
8.3	Introduced genetic material	Unknown	Large	Unknown	High	An unknown portion of the population may be composed of hybrids. The severity of this phenomenon to the persistence and evolution of the Weidemeyer's Admiral species in Canada is unknown.
11	**Climate change & severe weather**	Unknown	Pervasive	Unknown	High	
11.2	Droughts	Unknown	Pervasive	Unknown	High	Climate change models predict an increase in drought conditions in the Prairie Provinces. The severity of this threat and thus the scope are currently unknown; it could be a negative or positive outcome.

[a] **Threat #** - Threats are numbered using the IUCN Classification System.

[b] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is

insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[c] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[d] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[e] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2. Description of Threats

There is very little data on specific threats to Weidemeyer's Admiral in Alberta. Threats identified in other reports are speculative or unclear. For example, COSEWIC (2000) identified extensive livestock grazing at occupied sites as "the only potentially significant limiting factor" but the reason for designation of Weidemeyer's Admiral as special concern was based on the species' restricted occurrence with "no identifiable imminent threats" present. COSEWIC (2012) assessed the species based on its restricted distribution and the potential threat of invasive Russian Olive (*Elaeagnus angustifolia*) and Saltcedar (*Tamarix ramosissima*) that can outcompete the butterfly's larval host plants. However, Russian Olive is only known from a small area of the Weidemeyer's Admiral range and the direct impact on its habitat over the next ten years is unknown, particularly since the actual larval host plants in Canada are not yet known. Because Weidemeyer's Admiral occurs in riparian and coulee habitat that has not been significantly altered, the likelihood of anthropogenic activities such as residential development, agriculture, or oil and gas development is quite low. Furthermore, Protective Area Notations (PNTs) have been placed at the majority of Weidemeyer's Admiral sites. Overall it has been inferred that substantial natural habitat for prairie butterfly species still exists in the Milk River basin (Kondla 1999) and that currently there are no significant anthropogenic threats to Weidemeyer's Admiral populations in Alberta (Kondla 2001, ASRD and ACA 2005, N. Kondla pers. comm. 2016). Further studies are needed to quantify the impacts of potential threats on Weidemeyer's Admiral and its habitat.

IUCN Threat 2 - Agriculture and aquaculture

Threat 2.3 Livestock farming and ranching

Cattle grazing has a long history within the Milk River watershed and the native prairie within the Weidemeyer's Admiral range is grazed at different intensities (Gould and Hood 1992, Alberta Environment Protection 1997). The one exception is the Kennedy Coulee which is classified as an Ecological Reserve and is not currently grazed. Historically, grazing disturbances by large herbivores such as Bison (*Bison bison*) and Pronghorn (*Antilocapra americana*) occurred frequently, randomly, and at different scales and magnitudes within the region and contributed to the overall ecological integrity of the prairie (White 1979, Gould and Hood 1992). However, cattle do not always mimic the natural historical grazing disturbance, and compared to Bison, cattle tend to forage more on forbs and use wooded and riparian areas more intensively (Steuter and Hidinger 1999). Livestock grazing at high levels of intensity was identified as a potential threat to Weidemeyer's Admiral's habitat, particularly to the riparian floodplain areas, for a number of reasons (Pike 1987, COSEWIC 2000, ASRD 2012, COSEWIC 2012). First, livestock can consume the eggs, larvae, and pupae found on palatable host plants, directly leading to the mortality of immature stages (ASRD and ACA 2005, ASRD 2012, COSEWIC 2012). Secondly, intensive cattle grazing can negatively impact recruitment of cottonwoods on the river floodplains through excessive trampling of new seedlings, or compaction of the soil required for seedling

establishment (Pike 1987, Pearce and Smith 2001, COSEWIC 2012). The impact is more prevalent during fall or drought conditions when preferred grasses and forbs on the uplands are not available. At such times, cattle may move into the wooded and riparian areas (MRWCC 2013) and graze on the preferred host and nectar plants, potentially consuming the immature stages, or trampling the habitat.

Conversely, the persistence of Weidemeyer's Admiral populations in the Milk River area for the last 100 years even when livestock grazing was unregulated, has been put forth as evidence that grazing poses a negligible threat to this species (COSEWIC 2000, COSEWIC 2012, N. Kondla pers. comm. 2016). Moreover, stocking rates at a majority of the known occupied sites (ie. Writing-On-Stone Provincial Park, Onefour Heritage Rangeland Natural Area, Milk River Natural Area, and Pinhorn Grazing Reserve) are regulated through grazing leases (Gould and Hood 1992, Alberta Environment Protection 1997, COSEWIC 2012), and presumably this limits the damage that modern grazing practices pose to the species.

IUCN Threat 7 - Natural system modifications

Threat 7.1 Fire and fire suppression

Present day fires have been reported not to be a significant threat for Weidemeyer's Admiral populations because the majority of fires are quickly extinguished to protect buildings, crops, and livestock forage (COSEWIC 2012). To some extent this is correct, especially within Writing-on-Stone Provincial Park where management activities such as grazing practices and fire bans during dry periods are undertaken to decrease the potential for fires (Alberta Environment Protection 1997). However, because Weidemeyer's Admiral populations are quite small and the sites are in close proximity to one another, it is believed that human caused or natural prairie fires have the potential to negatively impact these populations and cause permanent damage (Pike 1987). Furthermore, fires can negatively impact populations by eliminating important larval and adult nectar plants that are crucial during breeding and development. In 2012, the Milk Ridge River Fire that started west of the town of Milk River burned approximately a 70 km^2 area as a result of windy conditions, but as much as 215 km^2 can be impacted by fires during optimal fire conditions (Alexander et al. 2013). With an increase in drought conditions that are predicted to occur on the prairies as a result of climate change (Sauchyn and Kulshreshtha 2008), combined with an increase in the number of visitors exploring the park and people conducting work in the area, the number of fires could potentially increase in the near future and have serious negative impacts on the small Weidemeyer's Admiral population.

Threat 7.2 Dams and water management

Habitat loss and degradation as a result to changes in hydrological flow to the Milk River has been identified within the provincial management plan as a major threat to the Weidemeyer's Admiral (ASRD 2012). It is well established that hydrological alterations including both flood-flow attenuation and river flow stabilization can have negative

impacts on riparian areas such as altering channel width, channel meandering, peak flows, sediment load, and recruitment of native riparian species (Rood and Heinze-Milne 1989, Rood at al. 1999, Polzin and Rood 2000) and this has been demonstrated for the Milk River basin (Bradley and Smith 1984, 1986, Jones 2003). However, the exact impact on the Weidemeyer's Admiral population is not well understood since some unknown proportion of the population is not directly associated with the floodplains but rather inhabits the coulee systems and patches of Saskatoon/Chokecherry bushes.

The Milk River watershed is an important water resource for a variety of users including municipal, domestic, agricultural and recreational users in both Canada and U.S. (COSEWIC 2012, MRWCC 2013). Within Alberta, the largest use (93.5%) of allocated water is for agricultural purposes, specifically for private irrigation, with approximately half (53%) of the allocated use being obtained from tributary sources (MRWCC 2013). Water allocation within the Milk River watershed has a long and complex history, which has been described by Bradley and Smith (1984) and MRWCC (2013). The Sherburne Dam, which is located on Swiftcurrent Creek, Montana, was built to capture mountain runoff and control the flow into the St. Mary River. The St. Mary River and Milk River were connected in 1917 through the St. Mary-Milk River Diversion project. Both projects allow Montana a greater ability to access and utilize their entitlement to the St. Mary River water (MRWCC 2013). Thus, the Milk River is comprised mainly of the St. Mary River water for much of the growing season (April to October) and the increase in discharge in Alberta is due to the imported flow from the St. Mary Canal. To expand irrigation potential and provide Alberta with a constant water supply during dry years, the lower Milk River has been considered in the past for dam construction and reservoir formation (Bradley and Smith 1984); however this proposal has not yet been approved. If the Milk River valley were to be flooded, Weidemeyer's Admiral habitat along the floodplain would be directly destroyed (ASRD 2012), but other breeding habitat further down the dam and higher up in ravines and coulees would be less affected (Kondla 2005, COSEWIC 20102).

In addition to the direct impact that damming the Milk River might have on Weidemeyer's Admiral populations that inhabit the floodplain, suitable habitat could be indirectly impacted over time especially when compounded with other land use practices such as livestock grazing and establishment of non-native plants. Natural flooding regimes are essential for seed germination and establishment, as is adequate soil moisture throughout the growing season (Rood and Heinze-Milne 1989). Stabilization of natural flooding regimes can result in a decline in cottonwood recruitment and riparian habitat abundance (Rood and Heinze-Milne 1989). Studies have shown that dams can have a significant and consistent negative impact on riparian forest abundance (Rood and Heinze-Milne 1989). Bradley and Smith (1986) reported a significant decline in the density of cottonwood populations on the floodplain of the Milk River downriver of Fresno Dam, Montana, which was built in 1939. As plans to build a dam in Alberta are not in place, the scope of the threat is considered small. However, changes in temperature and precipitation as a result of climate change will likely have substantial impacts on surface water supplies in southern Alberta and may

increase demands on water resources (COSEWIC 2012), thus increasing the risk of this threat in the near future.

IUCN Threat 8 - Invasive and other problematic species & genes

Threat 8.1 Invasive non-native/alien species

Invasion of the non-native Russian Olive has been identified by COSEWIC (2012) and ASRD (2012) as the main threat to Weidemeyer's Admiral riparian habitat. Russian Olive was introduced to northern Montana in 1950 approximately 10 km south of the Canada/U.S. border and has been dispersing upriver into southern Alberta (Pearce and Smith 2001). Throughout the U.S., the species is widespread along streams and rivers and once established, can outcompete native species such as cottonwoods (COSEWIC 2012). Russian Olive has the ability to produce fruit and seed after only 3- 5 years (compared to 10 years for cottonwoods), as well as to fix atmospheric nitrogen leading to disruption of nutrient cycles (AISC 2016). The species spreads quickly and is difficult and expensive to eradicate once established (Pearce and Smith 2001, COSEWIC 2012). Furthermore, the species is available at many garden stores and is still being widely planted across Canada and U.S. The Alberta Invasive Species Council categorizes the species as an "Unregulated" invasive species (AISC 2016).

COSEWIC (2012) also identified Saltcedar (also known as Tamarisk) as a potential threat. This non-native, invasive species does not currently occur within the Milk River basin but has spread throughout western U.S., specifically Montana. Alberta Invasive Species Council categorizes the species as a "Prohibited Noxious" invasive species (AISC 2016).

Currently, Russian Olive has been found only within a distance of 2 km north of the Canada-U.S. border (Pearce and Smith 2001). During surveys in 2015 and 2016, Russian Olive and Saltcedar were not observed (Snable and Burns 2015, Curteanu and Burns 2017); however only one surveyed site occurred within the floodplain area where these species are generally found. Collette and Pither (2015) have recently examined Russian Olive planting records across the Canadian Prairie Provinces and although some seedlings were planted along the Milk River, none of the plantings within the Weidemeyer's Admiral range occurred at sites that favour Russian Olive invasion. Thus, due to the small area of occurrence of Russian Olive in comparison to Weidemeyer's Admiral extent of occurrence and the fact that COSEWIC (2012) concluded the these invasive species are unlikely to impact the Weidemeyer's Admiral population within the next ten years, the scope of the threat of these invasive species is currently perceived as low. However, the severity and scope of these invasive species is currently unknown, especially in the next 15 to 20 years considering these species rapid establishment and highly negative impact on the riparian habitat.

Threat 8.3 Introduced genetic material

The hybridization tendencies of members of the genus *Limenitis* have been recognized and studied for over 80 years (Gunder 1932, Patt and Greenfield 1971, Porter 1989,

Porter 1990, Boyd et al. 1999) with hybrid zones identified in British Columbia (Lorquin's Admiral X White Admiral) and Alberta (Weidemeyer's Admiral x White Admiral) (Remington 1968, COSEWIC 2000). Porter (1990) reported high gene exchange between Weidemeyer's Admiral and Lorquin's Admiral in western U.S. and concluded that since this taxa share significant portions of their gene pools, Weidemeyer's Admiral should be considered the subspecies of Lorquin's Admiral. In Canada, Pinel and Kondla (1985) were the first to collect several Weidemeyer's Admiral specimens from Police Coulee, Writing-on-Stone Provincial Park, that exhibited hybrid morphological characteristics with the White Admiral, a much more common and widespread species in Canada. In a recent survey within Writing-on-Stone Provincial Park and surrounding area, putative hybrids represented 14% of the total individuals identified (Curteanu and Burns 2017); however this proportion may not be representative due to the small area surveyed. Individuals exhibiting hybrid characteristics showed combined morphological characteristics of each parent species, with the most evident feature being the darker overscaling in the ventral hindwing ground colour. It is unknown if these putative hybrids are the result of introgressive hybridization between Weidemeyer's and White Admirals since only three (20%) White Admirals were observed during the survey period (Curteanu and Burns 2017). Another source of hybridization could be the result of dispersal of other Weidemeyer's Admiral subspecies,(*L.w. latifascia* and *L. w. weidemeyerii,* to the area since these subspecies have been reported in the nearby Sweet Grass Mountains of Montana (COSEWIC 2012).

Hybridization can have a large impact on rare species like the Weidemeyer's Admiral, particularly if introgression occurs with common species (Allendorf et al. 2001). It is currently not clear if hybridization with other *Limenitis* species or subspecies is part of the natural evolutionary process (*see* Mullen 2006 for evolutionary description), or if this phenomenon is recent and considered an anthropogenic hybridization and thus a threat to Weidemeyer's Admiral's persistence in Canada. The interactions of Weidemeyer's' Admiral and White Admiral in Canada remain dynamic and mostly unknown. It is not known if the two species exhibit natural introgression and yet remain as separate species due to barriers to gene flow since there is no evidence on the ability of hybrids to successfully reproduce for several generations. Even if hybrid individuals are reproductively viable, local adaptations of native Weidemeyer's Admiral, which are essential during stochastic environmental events (e.g., winter storms, drought, fire), could potentially be lost as a result of hybridization (Allendorf et al. 2001). Detailed genetic and laboratory breeding studies between these two taxa and the Montana population would be required to fill in many knowledge gaps.

IUCN Threat 11 - Climate change and severe weather

Threat 11.2 Droughts

Climate change has been identified as a potential threat to Weidemeyer's Admiral (Kondla 2004, COSEWIC 2012). However, the potential effects of climate change on Weidemeyer's Admiral are difficult to predict due to the inherent complexity and uncertainty of climate change models that aim to predict interacting climatic and biotic

factors. In Canada, Weidemeyer's Admiral occurs at the northern limit of its range and the warming effect could have a positive impact on the Canadian population. Because the species passes the winter as a larva, slight changes in climate such as warmer and shorter winters may result in lower larval mortality rates and/or a northern shift in this butterfly's distribution. However, climate change scenarios also predict a reduction in precipitation on the Canadian Prairies (Sauchyn and Kulshreshtha 2008), and such drought could negatively impact the quality and quantity of larval and adult food resources (ASRD and ACA 2005, EALT 2013). Also, because the species occurs over a very restricted area, the Canadian population is at a greater risk from stochastic natural processes such as severe storms and extreme temperatures (ASRD and ACA 2005). The cumulative effects of climate change on Weidemeyer's Admiral are currently unknown.

5. Management Objective

The provincial *Weidemeyer's Admiral Conservation Management Plan* contains the following management goal for the Weidemeyer's Admiral (Section 2.1, ASRD 2012):

- Maintain current distribution and breeding populations of Weidemeyer's Admiral in Alberta.

Under SARA, management objectives for special concern species must be established. Consistent with the goal set out in the provincial management plan, the management objectives for the Weidemeyer's Admiral in Canada, as set out in this Management Plan, are:

- In the short term: improve knowledge on population demographics, habitat use, and threats to the species in Canada; and
- In the long term: maintain the current distribution of the Canadian population at all known 13 inhabited sites, as well as any additional populations discovered in the future.

As with the provincial management plan, emphasis for this management objective is placed upon maintaining the distribution (to be measured as the area of occupancy) of the current population of Weidemeyer's Admiral in Canada. At this time, it is not feasible to establish more quantitative management objectives due to the limited surveys completed throughout the Weidemeyer's Admiral Canadian range as well as the lack of knowledge of population abundance and variability. In Canada, the species exists at the northern fringe of its global range, and likely has always been limited by the restricted availability of suitable habitat. As knowledge gaps are filled and new surveys are carried out, it is expected that the distribution and area of occupancy of this butterfly species will increase somewhat. However, a species that was never historically widespread in Canada is unlikely to become widespread in the future and will probably always have a limited distribution and area of occupancy in Canada.

6. Broad Strategies and Conservation Measures

6.1. Actions Already Completed or Underway

Very little work has been done on advancing our knowledge of the Weidemeyer's Admiral in Canada since the first COSEWIC status report was prepared in 2000.

- A habitat suitability model and mapping based on the cover of woody species and slope was completed in order to focus future population surveys (Taylor 2004).
- In 2004, in preparation for a provincial status assessment, surveys were undertaken at previously known and new sites around Milk River area; a total of 44 sites were surveyed and 13 individuals were encountered at five sites (three of those being new sites) (Kondla 2004).
- In 2005, the provincial *Status of the Weidemeyer's Admiral (Limenitis weidemeyerii) in Alberta* was completed (ASRD and ACA 2005).
- In 2011, in preparation for Alberta's Conservation Management Plan, Alberta Environment and Parks staff surveyed areas within Writing-on-Stone Provincial Park and around Verdigris Coulee for a total of 153 person-hours; a total of 13 individuals were found within Police and Davis coulees of Writing-on-Stone Provincial Park (COSEWIC 2012, ACIMS 2016).
- Alberta's *Weidemeyer's Admiral Conservation Management Plan (2012-2017)* was prepared and various conservation measures were identified (ASRD 2013). This federal management plan is based on this document.
- COSEWIC status assessment prepared and status re-assessed as special concern (COSEWIC 2012)
- Information on Weidemeyer's Admiral was included in the *Species at Risk in Alberta, Identification Guide* booklet (EALT 2013).
- The Alberta MULTISAR (Multiple Species at Risk) Program includes Weidemeyer's Admiral on its list of Species at Risk in grasslands of Alberta. This program provides tools for landowners with ranching operations that are interested in conserving species at risk such as Habitat Conservation Strategies, Species at Risk Conservation Plans and Beneficial Management Practice Assessments.
- In 2015 and 2016, Canadian Wildlife Service staff surveyed potential areas around and within Writing- on-Stone Provincial Park, Pinhorn Grazing Reserve and Lost River; a total of 19 different sites were surveyed and 15 individuals (including hybrids) were observed at 6 new sites (Snable and Burns 2015, Curteanu and Burns 2017).

6.2. Broad Strategies

The provincial *Weidemeyer's Admiral Conservation Management Plan* contains the following four objectives for the Weidemeyer's Admiral (Section 2.2, ASRD 2012). The Alberta objectives are adopted as broad strategies in this Management Plan.

1. **Inventory and monitoring**: Monitor priority areas where Weidemeyer’s Admiral populations are known to exist and where prime habitat occurs along the Milk River valley to track population trends and conduct surveys to identify its distribution.
2. **Habitat management:** Implement appropriate habitat protection and management for both breeding and non-breeding habitat while improving our understanding of habitat requirements.
3. **Research and management:** Investigate ways to control harmful invasive pests such as Russian Olive.
4. **Education and communication:** Improve education and communication with government, industry, public, and landowners about habitat requirements of the Weidemeyer’s Admiral.

6.3. Conservation Measures

Table 4. Conservation measures and implementation schedule

Conservation Measure	Priority[a]	Threats or Concerns Addressed	Timeline
Broad Strategy- Inventory and Monitoring			
1. Survey suitable habitat in order to determine species distribution, population estimates, and trends.	High	Lack of knowledge of population dynamics	2019-2025
2. Survey suitable habitat between the West and East populations in order to determine the degree of population connectivity.	High	Lack of knowledge of population dynamics	2019-2025
3. Explore possibilities for surveying for the larval phase.	Medium	Lack of knowledge of population dynamics	2019-2024
Broad Strategy- Habitat Management			
4. Evaluate the health of riparian habitat	High	All threats except IUCN 11.2 - Drought	2019-2023
5. Develop Beneficial Management Practices	High	All threats except IUCN 11.2 - Drought	2019-2023
6. Address hydrological habitat impacts	Medium	IUCN 7.2 Dams & water management/use	2019-2023
Broad Strategy- Research and Management			
7. Evaluate the degree to which Canadian metapopulations are connected using genetic studies.	High	Lack of knowledge of population dynamics	2019-2023
8. Identify if Canadian and US populations are connected using genetic studies.	Medium	Lack of knowledge of population dynamics	2019-2023
9. Identify ways to eliminate Russian Olive.	Medium	IUCN 8.1 Invasive non-native/alien species	2019-2023
Broad Strategy- Education and Communication			
10. Promote collaboration amongst governments, conservation agencies, industries and landowners to conserve Weidemeyer's Admiral and its habitat.	High	All threats except IUCN 11.2 - Drought	2019-2023
11. Increase public awareness (schools, park visitors, industry and landowners).	Low	All threats except IUCN 11.2 - Drought	2019-2023

[a] "Priority" reflects the degree to which the measure contributes directly to the conservation of the species or is an essential precursor to a measure that contributes to the conservation of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the management objective for the species. Medium priority measures may have a less immediate or less direct influence on reaching the management objectives, but are still important for management of the population. Low priority conservation measures will likely have an indirect or gradual influence on reaching the management objectives, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

6.4. Narrative to Support Conservation Measures and Implementation Schedule

The provincial *Weidemeyer's Admiral Conservation Management Plan* contains the following management actions for the Weidemeyer's Admiral (Section 3.0, ASRD 2012), which are adopted as the conservation measures in this Management Plan.

Inventory and Monitoring

Inventory work should be conducted along the Milk River, Lost River and other suitable locations where this species might reside, including both public and private lands, to determine species distribution, population estimates and population trends within Alberta. Efforts should also be made to identify habitat and/or genetic connections between the East and West populations of Weidemeyer's Admiral and the Canadian and American populations.

Presence/absence surveys, using catch and release methods, should be conducted multiple times at each location during the flight period. When possible, a limited number of specimens should be collected from each new site to confirm presence and gather genetic material for future research (disposition of these specimens needs to be determined; donation to a University, such as the University of Alberta's Strickland Museum, is an option).

The possibility of surveying for the larvae phase of the species should be explored to assist in the determination of Alberta host plant species. Identifying host plants will assist in the protection and conservation of habitat for the Weidemeyer's Admiral. These surveys should be limited to areas with known populations of Weidemeyer's Admiral.

Habitat Management

Land disposition on which Weidemeyer's Admirals are found includes provincial parks, crown land, and private land. The first step would be to conduct an aerial videography to assess habitat in riparian areas and mid-land along these basins. Onsite riparian health assessments would follow to evaluate the overall health of suitable habitats and understand the impact of invasive species. Focus of habitat management for the species should be on the following: high quality habitat; potential habitat connections between known populations; and areas identified as requiring habitat improvement.

Beneficial management practices (BMPs) for the Weidemeyer's Admiral should be developed, in consultation with a variety of organizations. BMPs will help to maintain habitat by defining appropriate grazing pressure, rotations, timing and cattle distribution. These BMPs should be incorporated into local landholders' ranching operations to conserve and protect habitat for the Weidemeyer's Admiral. Information on appropriate BMPs should be communicated through conservation organizations already operating in the Milk River Basin (e.g., MULTISAR).

Some management practices are already in existence that help to reduce human disturbance and habitat alteration, including: a Protective Area Notation (PNT) for the Milk River Basin that prevents surface disturbance within a quarter section of the river; and prohibits upstream oil and gas activity within the river valley.

The risk of habitat loss due to changes in flood regimes needs to be addressed using a collaborative approach amongst all responsible governments and agencies (i.e., Government of Alberta, Government of Canada and relevant agencies in the USA). Education on the negative impacts of unnatural flooding events such as loss of cottonwood forests, changes in species composition, and impacts on biodiversity, is required to inform management decisions. Policy to address or mitigate these impacts is also required.

Research and Management

Genetic research would help to determine whether genetic material is being exchanged between neighbouring populations, both within and outside Alberta. This could indicate if habitat corridors need to be managed for this species.

Research is needed to find ways to eliminate invasive species such as Russian Olive. There is some evidence that pathogens such as Phomopsis Canker (*Phomopsis elaeagni*), Verticillium Wilt (*Verticillium albo-atrum*) or another more host-specific organism could be used as effective biological controls for Russian olive. However, all precautions should be taken when assessing biological control options to avoid the introduction of another non-native pest. Identified methods should be included with BMPs, and in education and conservation programs.

Education and Communication

It is essential to maintain communication with government, public, industry and landowners regarding Weidemeyer's Admiral populations and habitat needs. Many government agencies, municipal departments, and other agencies interested in participating in outreach should collaborate to develop outreach programs for the Weidemeyer's Admiral.

Education should emphasize habitat conservation of shrubby riparian areas containing host plants. Monitoring programs should have an educational component that includes school talks, interpretative talks at provincial parks, and displays at park and community events. Wildlife and habitat managers, range agrologists, and riparian specialists should work closely with industry and landowners to raise awareness regarding the importance of maintaining Weidemeyer's Admiral habitat, and should co-operate with other initiatives when possible. Education and communication needs to provide an ecosystem perspective and identify how the Weidemeyer's Admiral is one of several species dependent on riparian and shrub land habitat in the Milk River Basin.

Education efforts should be evaluated based on the number of participating agencies, programs, and people reached, and should be reviewed in five years to address whether they were effective.

7. Measuring Progress

The performance indicators presented below provide a way to measure progress towards achieving the management objectives and monitoring the implementation of the Management Plan:

- In the short term: knowledge on population demographics, habitat use, and threats to the species in Canada has been improved and,
- In the long term: the distribution of the Canadian population has been maintained at all 13 sites where the species is currently known to exist and at any newly-discovered occurrences.

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Personal Communications

Foster, Robert – Northern Bioscience, Ontario.

Kondla, Norbert – Lepidopterist, Rimbey, Alberta.

Pike, Ted – Lepidopterist, Calgary, Alberta.

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*[6]. 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 and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[7] (FSDS) goals and targets.

Conservation planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans 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 management plan itself, but are also summarized below in this statement.

The majority of the identified conservation measures for Weidemeyer's Admiral (e.g., inventory and monitoring, habitat management, research and management, and education and communication) will promote the conservation of other species at risk whose ranges overlap with that of the Weidemeyer's Admiral. Numerous species at risk are known occur within the Weidemeyer's Admiral range and are expected to benefit from proposed conservation measures including: Swift Fox (*Vulpes velox*, threatened), Burrowing Owl (*Speotyto cunicularia*, endangered), Sprague's Pipit (*Anthus spragueii*, threatened), Loggerhead Shrike (*Lanius ludovicianus excubitorides*, threatened), Eastern Yellow-bellied Racer (*Coluber constrictor flaviventris,* threatened), Greater Short-horned Lizard (*Phrynsoma hernandesi,* endangered), Ferruginous Hawk (*Buteo regalis*), Soapweed (*Yucca glauca*) and yucca moths (*Tegeticula yuccasella, T. corruptri, Prodoxus quinquepunctellus*). Negative impacts to other species at risk are not anticipated. Recovery planning activities for Weidemeyer's Admiral will be implemented with consideration of all co-occurring species at risk, such that there are no negative impacts to these species or their habitats.

[6] www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[7] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1