

Recovery Strategy for the Western Harvest Mouse (*Reithrodontomys megalotis dychei*) in Canada

Western Harvest Mouse *dychei* subspecies



2015



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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 recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment is the competent minister under SARA for the Western Harvest Mouse and has prepared this strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Department of National Defence, the Government of Alberta, and the Government of Saskatchewan.

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 Western Harvest Mouse 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

Greg Wilson and Tara L. Fulton (Environment Canada), Ray G. Poulin (Royal Saskatchewan Museum), L. Danielle Todd, and Iain Edye are acknowledged for preparing this document. Karl Zimmer, Todd Kemper and Robin Bloom (Environment Canada) helped refine the habitat model. Medea Curteanu (Environment Canada), Todd Kemper, Robin Bloom, and Lea Craig-Moore reviewed and provided comments on this recovery strategy.

² <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

Executive Summary

- The Western Harvest Mouse, *dychei* subspecies, is a small, long-tailed brownish mouse with a light underbelly and white feet. It is omnivorous, nocturnal, and nests near the base of shrubs in dry shrub-steppe habitats that contain extensive cover.
- The Western Harvest Mouse is listed as Endangered under the *Species at Risk Act* in Canada due to its limited range and isolation from other populations, limited dispersal distance, and fluctuating population size.
- Very little is known about the distribution of the Western Harvest Mouse on the Canadian prairies. They are currently only known to occur in the Canadian Forces Base Suffield National Wildlife Area in Alberta, although one recent incidental specimen was found along the Red Deer River in southern Alberta, north of Suffield National Wildlife Area. It is possible that the Western Harvest Mouse inhabits other areas of Alberta and Saskatchewan where they were observed historically. It is unknown if the Canadian population is isolated from the continuous range of the species in the United States. The current known Canadian range is separated from the United States range by ~235 km.
- Currently identified threats to the Western Harvest Mouse mainly relate to actions that limit or remove the taller, thicker grass and shrub cover from an area. Threats include alteration of the natural fire regime, high-intensity prolonged grazing, industrial activities, roads and trails, conversion of native habitat to crop and forage production, climate change, urban development, increased predation, military activities, and application of rodenticides.
- There are unknowns regarding the feasibility of recovery of the Western Harvest Mouse, as further knowledge of the primary threats is required. This strategy outlines studies to address these unknowns.
- The population and distribution objective for the Western Harvest Mouse, *dychei* subspecies, is to maintain the current distribution and maintain or attain self-sustaining populations at all currently occupied locations in Alberta and Saskatchewan. Broad strategies to address the threats to recovery are listed in Section 6.2, Strategic Direction For Recovery.
- Critical habitat is partially identified as low relief, flat or gently undulating grasslands or shrub-grasslands with cool-season (C3) grasses such as Needle and Thread Grass (*Stipa comata*), Blue Grama (*Bouteloua gracilis*), and June Grass (*Koeleria macrantha*), and the presence of associated shrubs such as Silver Sagebrush (*Artemisia cana*), Choke Cherry (*Prunus virginiana*), Snowberry (*Symphoricarpos* spp.) and Thorny Buffalo-berry (*Shepherdia argentea*). 287 km² of land in or immediately adjacent to Suffield National Wildlife Area are identified as critical habitat.

- An Action Plan for the Western Harvest Mouse, *dychei* subspecies, throughout its Canadian range will be posted on the Species at Risk Public Registry by 2019.

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 by the Government of Canada (2009), demonstrates that an uncertainty exists relating to the recovery of the Western Harvest Mouse, *dychiei* subspecies. 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 uncertainty 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. The population of Western Harvest Mouse, *dychiei* subspecies in Suffield National Wildlife Area (NWA) was first discovered in 1994 during a three-year wildlife inventory (Reynolds et al. 1999). In 1994 and 1995, 95 Western Harvest Mice were caught; however, none were caught in 1996. Trapping efforts between 2009 and 2011 caught ~40 individuals in Suffield NWA, reconfirming the continuous existence of this population. This suggests the population is capable of resilience to environmental stresses. Western Harvest Mice in this area are successfully reproducing and are capable of achieving high population growth rates under suitable conditions. This subspecies is widespread throughout much of the western United States.

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

Yes. The species has maintained a population in Suffield NWA since at least 1994, suggesting the habitat is available to support the species in this location. In the United States, this species is not a habitat specialist but inhabits a wide range of grassland habitats, provided sufficient cover is present.

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

Unknown. Information regarding the severity and causality of most of the possible threats to the species is lacking. Further research on the impacts of all of the possible threats is required, as outlined herein.

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

Yes. Although other populations may exist, the presence of only one population located in Suffield NWA has been confirmed at this time. The current population and distribution objective of maintaining this population is achievable through proper management such as maintaining suitable habitat, mitigating impacts of development, and avoiding increased disturbances.

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1. COSEWIC* Species Assessment Information

Date of Assessment: April 2007

Common Name (population): Western Harvest Mouse *dychei* subspecies

Scientific Name: *Reithrodontomys megalotis dychei*

COSEWIC Status: Endangered

Reason for Designation: This subspecies has a limited range and has been found at only one location in the past 40 years; this location is isolated from others. Dispersal distance is limited and the population fluctuates. This species is commonly found in owl pellets in the United States, but only one has been reported in owl pellets (including Burrowing Owls) in Suffield NWA or other areas in southeast Alberta, despite substantial sampling. Owl pellet analysis is an excellent means of sampling for these mice.

Canadian Occurrence: Alberta

COSEWIC Status History: Species considered in April 1994 and placed in the Data Deficient category. Re-examined in April 2007 and designated Endangered.

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

2. Species Status Information

Throughout North America, there are at least 16 recognized subspecies of the Western Harvest Mouse (Webster and Jones 1982). Two subspecies are found in Canada: *Reithrodontomys megalotis megalotis* in British Columbia, and *R.m. dychei* (Alan 1895) in southern Alberta. This recovery strategy applies only to the *R.m. dychei* subspecies. The Western Harvest Mouse (*Reithrodontomys megalotis dychei*) was listed as Endangered under the *Species at Risk Act* (SARA) in 2008. The province of Alberta has assigned a General Status Category of Undetermined to the Western Harvest Mouse. Alberta is the only province in which it is presently known to occur. The distribution in Canada represents 1% of the subspecies' global distribution (COSEWIC 2007).

The global, national, and sub-national NatureServe rankings for the Western Harvest Mouse species and the subspecies found in Canada are provided in Appendix A. *Reithrodontomys megalotis dychei* is not yet ranked globally (status G5TNR) by NatureServe (2012), but is rank N1 (critically imperiled) nationally in Canada and is listed on SARA Schedule 1 as Endangered.

3. Species Information

3.1 Species Description

The Western Harvest Mouse *dychei* subspecies (hereafter Western Harvest Mouse) is a small, non-descript rodent of the grasslands. The Western Harvest Mouse has an overall brownish colour with buff flanks and a whitish to grayish underside. It has a faint, darker-coloured mid-dorsal stripe that runs the length of its body. Their tail is bi-coloured, grayish/brown on the dorsal surface, white on the ventral surface. They have prominent ears. There are no apparent differences in size or colour between sexes. Weighing only ~11 g, the Western Harvest Mouse is among the smallest of mouse species in Canada; only about half the size of a Deer Mouse (*Peromyscus maniculatus*). They average 136 mm in length, half of which is their tail (COSEWIC 2007). Harvest mice can be distinguished from most other mice by the prominent groove that runs the length of the anterior surface of the upper incisors. This mouse looks similar to the common Deer Mouse or House Mouse (*Mus musculus*), with which it coexists. Compared to a Western Harvest Mouse, a juvenile Deer Mouse can be distinguished by its dull grey fur and a House Mouse by its naked tail.

Like most small mammals on the prairies, the Western Harvest Mouse is thought to breed during snow-free periods, generally from March to September (as seen in the *megalotis* subspecies in British Columbia, Sullivan and Sullivan 2008). Females reach sexual maturity at about 4 months of age (Webster and Jones 1982). Litter sizes range from 1 to 9 (Long 1962) and average litter size is usually around 4 (Jones 1964, Fisler 1965, Hayssen et al. 1993). Gestation is about 23 days (Webster and Jones 1982). Weaning occurs at approximately 20 days. Females produce up to 4-5 litters in a year (Hayssen et al 1993). Few individuals live longer than a year. Fisler (1971) found a complete population turnover occurred each year in a California population. Generation time is about 6 months. Some Western Harvest Mouse subspecies are able to enter torpor in periods of cold or starvation-induced stress (Thompson 1985). See COSEWIC (2007) for additional species information.

3.2 Population and Distribution

The Western Harvest Mouse in Canada is found at the northern limit of its range (Figure 1). It is found in the mixed grassland prairie ecoregion in southern Alberta in Canada, and across much of the Midwestern and Central United States. The total extent of occurrence of the Western Harvest Mouse in Alberta is approximately 483 km² (Figure 2), based on survey data from 1994 to 2011. The current area of occupancy is

unknown, due to uncertainty in how these mice currently use and occupy their habitat. In the United States, there have been no large-scale changes in their geographic distribution, although the subspecies has been slowly expanding into northeastern Illinois and Indiana (Ford 1977, Pigage and Pigage 1994, Leibacher and Whitaker 1999).

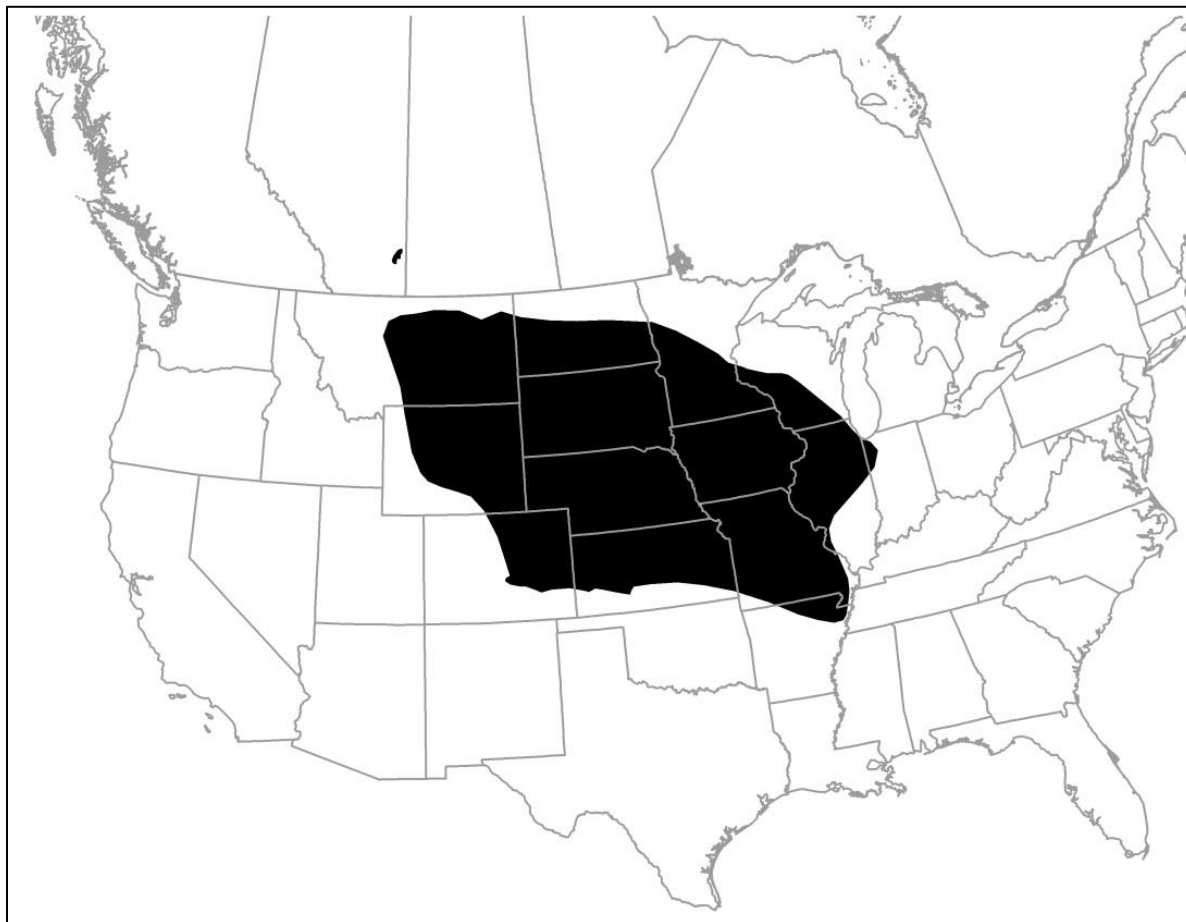


Figure 1. Global distribution map of the Western Harvest Mouse, *dychei* subspecies. The black shaded area indicates the present range of *Reithrodontomys megalotis dychei*. Adapted from Hall (1981), Webster and Jones (1982), COSEWIC (2007), Patterson et al. (2007).

In Canada, the Western Harvest Mouse is known from one current population, three historic records, and two unconfirmed records (Figure 2). The known distribution is based on the current population, and the potential distribution includes historic records, unconfirmed reports, and similar habitat between these points. Historic sites include Pinhorn Grazing Reserve south of Manyberries, AB in 1966 (Smith 1993), near Medicine Hat, AB in 1951 (Moore 1952), and near Milk River, AB in 1951 (Moore 1952). The only confirmed contemporary location is in the Canadian Forces Base Suffield National Wildlife Area (hereafter Suffield NWA), with 95 captures from 1994-1996 (Reynolds et al. 1999), and ~ 40 captured individuals from 2009-2011 (Bloom et al. 2009, Bloom and Wilson 2010, Kemper et al. 2013).

In 2009, one individual's remains were identified in a Burrowing Owl (*Athene cunicularia*) pellet near Bindloss, AB (R. Poulin, *pers.comm.*), south of the Red Deer River (Heisler 2013, Heisler et al. 2014). The average home range of a Burrowing Owl varies widely within Alberta and Saskatchewan (Environment Canada 2012), but adult males from nearby Brooks, AB, averaged 328 ha (34-756 ha; Sissons 2003). Bindloss is ~20 km north of the known range in Suffield NWA, which is beyond the home range of a single owl. However, since the occurrence is based on the location of the owl and not where its prey was taken, it is possible that this individual may have been taken from within Suffield NWA. This occurrence is indicated as an unconfirmed record in Figure 2.

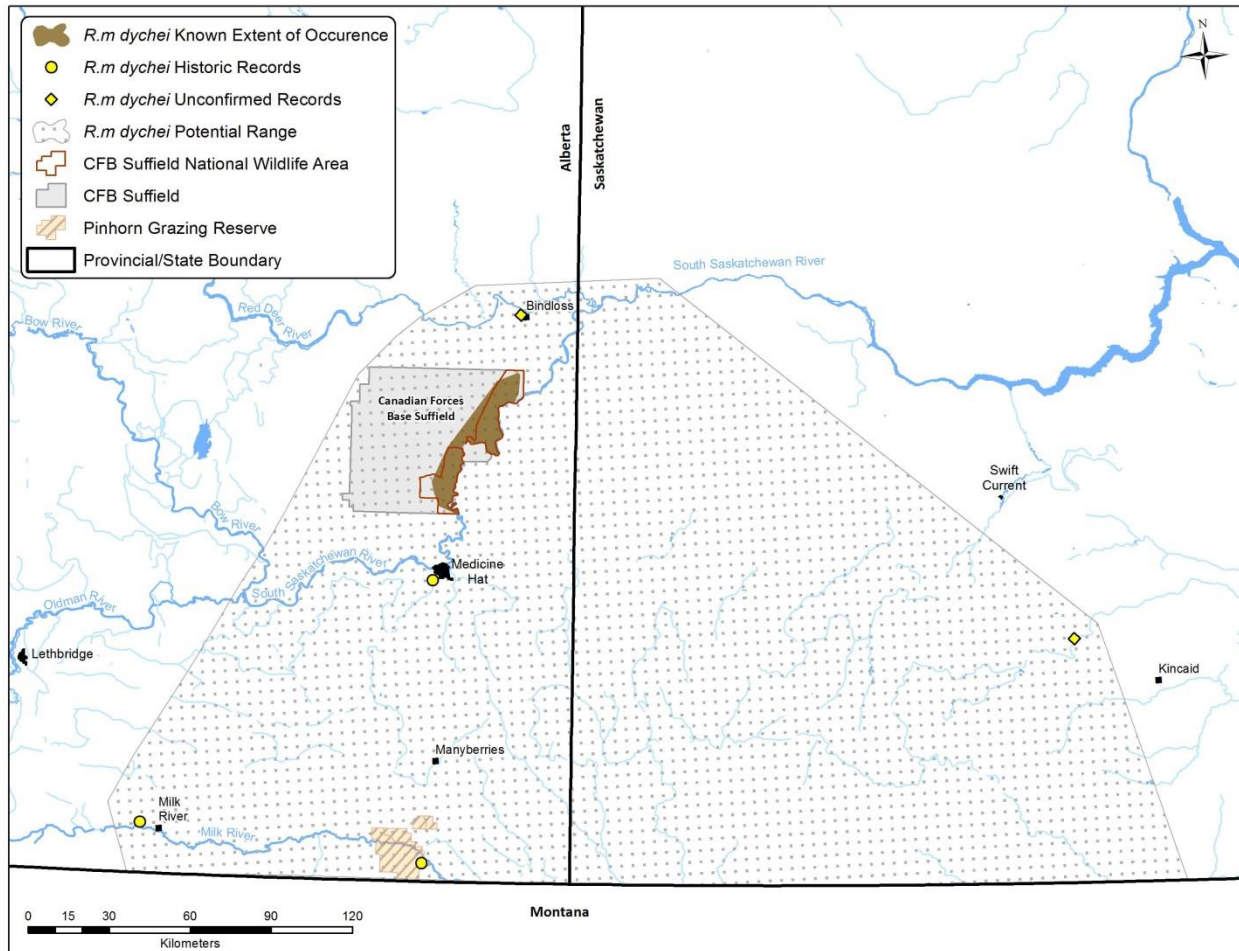


Figure 2. Known and potential distribution of the Western Harvest Mouse *dychei* subspecies in Canada. Locations of three historic (Milk River and Medicine Hat in 1951, Pinhorn Grazing Reserve in 1966) and two unconfirmed records (skeletal remains in an owl pellet near Bindloss in 2009; putative hairs recovered from scat near Kincaid in 2012) discussed in text are shown. The potential range encompasses the historic and unconfirmed records and extends across similar habitat to the known range of the subspecies in the United States.

In Saskatchewan, hairs recovered from carnivore scat and attributed to Western Harvest Mouse have been recently reported from southeast of Swift Current, near Kincaid (unconfirmed record in Figure 2; Proulx and Proulx 2012). However, extensive live-trapping efforts from 2010 to 2013 throughout the southern part of the province,

including the Kincaid area, have not recovered any Western Harvest Mouse specimens (R. Poulin, *pers. comm.*). During the same trapping survey, Western Harvest Mouse individuals were trapped in Malta, Montana, suggesting that the sampling protocol was appropriate for detecting the species (R. Poulin, *pers. comm.*). Until this reported occurrence is confirmed by direct capture, this region is not included within the known Canadian distribution of the Western Harvest Mouse.

The Western Harvest Mouse appears to have an extremely limited and isolated distribution in Canada (COSEWIC 2007) given that several different surveys have failed to find evidence of the species in its potential range outside of the known range in Suffield NWA. Small mammal trapping has occurred in at least 14 locations in southern Alberta outside Suffield NWA between 1982 and 2005, consisting of more than 6,000 trap nights, and has failed to find the species (D. Gummer *pers. comm.*, cited and mapped in COSEWIC 2007). Targeted surveys also occurred in 2009 at Onefour Research Station, Alberta, near historical sites, and did not result in any Western Harvest Mouse captures (Bloom et al. 2009). Additionally, tens of thousands of owl pellets have been analyzed for the presence of Western Harvest Mouse skulls from a wide area of southern Alberta and Saskatchewan (Smith 1981, 1992, Schowalter and Digby 1997, 1999, Schowalter 2000, Heisler 2013, Heisler et al. 2014). Only the single previously mentioned skull was discovered near Bindloss, AB with these surveys (Heisler 2013, Heisler et al. 2014). Owl pellet analysis is an effective method of surveying for Western Harvest Mouse (COSEWIC 2007) and the lack of findings by both trapping and owl pellet analyses suggest that the species is rare to nonexistent in these regions.

Two of the historic locations for Western Harvest Mouse occur along the Milk River system (Figure 2) and were reported more than 50 years ago. The Milk and South Saskatchewan/Red Deer River systems are separated by ~80 km, suggesting that these sampling locations are isolated. If the Milk River Western Harvest Mouse population is ephemeral or has been extirpated, then the South Saskatchewan/Red Deer River system population is isolated from the nearest populations in Montana by ~235 km. Unless future surveys of the potential range support a broader distribution, the current Canadian range for the subspecies is assumed to be limited to a single area in and adjacent to Suffield NWA, along the South Saskatchewan/Red Deer River system (Figure 2).

At present, it is not possible to estimate population size or trends in Canada. Based on studies elsewhere of this and other Western Harvest Mouse subspecies (Terman 1966, Skupski 1995), the Canadian population likely fluctuates widely based on vegetation and climatic condition. Populations likely respond quickly to prevailing vegetation cover, with high densities of the Western Harvest Mouse found in undisturbed areas (Webster and Jones 1982). In New Mexico, Whitford (1976) found populations swelled from 4 to 60 individuals per ha when ground vegetation became dense after September rains. The density of mice varies with vegetation conditions, with more individuals found in areas of ample grass growth (Whitford 1976, Abernethy 2011).

3.3 Needs of the Western Harvest Mouse

There is essentially no information about the biology, ecology and habitat associations of the Western Harvest Mouse on the Canadian prairies. Therefore, unless otherwise noted, the following information pertains to the information collected on the Western Harvest Mouse from other areas of North America. The Western Harvest Mouse is a dominant member of grassland small mammal communities in many areas of the United States. In surveys of Suffield NWA in 1994-1996, Western Harvest Mouse individuals were found to have a strong affinity for low relief, flat, or gently undulating grassland or shrub-grassland areas with associated dense cover of vegetation and shrubs, but were also found in sand dune and forested (e.g. cottonwood) areas with dense shrub cover (Reynolds et al. 1999). In more recent surveys of Suffield NWA, Western Harvest Mouse captures occurred in areas with between 10% and 100% shrub and grass cover (Bloom et al. 2009, Bloom and Wilson 2010, Kemper et al. 2013), though the highest densities were generally associated with microhabitats containing high quality litter and high complexity vertical vegetation structure, particularly tall, dense grass cover of cool-season (C3) grasses and shrubs. They were largely associated with Silver Sagebrush (*Artemisia cana*), although Choke Cherry (*Prunus virginiana*), Snowberry (*Symphoricarpos* spp.) and Thorny Buffalo-berry (*Shepherdia argentea*) may also be important in specific habitats. Detailed vegetative surveys during the 1994-1995 capture season illustrated that the primary native vegetation type at the majority of capture locations included Needle and Thread Grass (*Stipa comata*; usually in association with Blue Grama (*Bouteloua gracilis*)), Silver Sagebrush (*Artemisia cana*), Snowberry (*Symphoricarpos* spp.), and June Grass (*Koeleria macrantha*). As such, dense shrub cover appears important, but the Western Harvest Mouse is not an obligate of dense shrub, and has been observed using a wide range of habitat types (Webster and Jones 1982, Cummins and Slade 2007). In Wyoming, density and number of reproductive Western Harvest Mice increased with sagebrush (*Artemisia* spp.) cover and height (Abernethy 2011). Across its continental range, the Western Harvest Mouse is found in thick stands of grasses and shrubby edges of riparian areas of streams, rivers and wetlands (Hall 1981) and is not uncommon in agricultural or urban areas and uncultivated fallow fields with standing stubble and plant debris (Kaufman and Kaufman 1990). Western Harvest Mice require the presence of litter and vegetation structure for making nests, foraging, and hiding from predators. Western Harvest Mice have been shown to be quite tolerant of other small mammal species (Webster and Jones 1982). They often utilize the runway systems created by Meadow Voles (*Microtus pennsylvanicus*) to traverse through dense grasses.

Western Harvest Mouse nests in Suffield NWA were observed to be low mounds consisting of thatched grasses at the base of shrubs (Kemper et al. 2013). Nests were no more than 10 cm high and 1 m wide, resembling the surrounding litter. This differs from nesting behaviour in the United States, where nests appear as small balls of grass about 12 cm in diameter, with a small entrance hole on the underside of the nest (Shump, Jr. 1974, Webster and Jones 1982). Nests in the United States are usually located on the ground, in a clump of grass or weeds, or as high as 1 m off the ground

within a small shrub (Webster and Jones 1982). Nesting within ground burrows has also been observed in the United States (Birkenholz 1967).

No studies have been carried out on the diet of the Western Harvest Mouse in Canada. Elsewhere, the Western Harvest Mouse is omnivorous, primarily consuming seeds, new plant growth and invertebrates (e.g. moth larvae, grasshoppers; Hall 1981, COSEWIC 2007). Individuals sometimes forage in shrubs, above the ground (Meserve 1977, Jekanoski and Kaufman 1995).

There is little information about home range size and dispersal distance for the Western Harvest Mouse. Meserve (1977) found that home ranges averaged 3,525 m² in California. Fisler (1966) found that 100 m was about the farthest distance between capture points of individual mice, but individuals displaced by 300 m could find their way back to their home areas. Long-distance movements of Western Harvest Mouse in the tallgrass prairie in Kansas ranged between 375 and 3200 m, but fewer than 2% of the sampled mice moved more than 300 m (Clark et al. 1988). In Suffield, two Western Harvest Mouse individuals were recaptured ~55m away from the original capture site one day later and third individual was recaptured ~50m from the original capture site 3 days later (Kemper et al., unpubl. data).

4. Threats

4.1 Threat Assessment

Table 1. Threat Assessment Table

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Habitat loss, degradation and fragmentation						
High-intensity prolonged grazing	Medium	Widespread	Historic and current	Recurrent	Unknown	Unknown
Industrial activities	Medium	Widespread	Current	Recurrent	Unknown	Unknown
Roads and trails	Medium	Localized	Current	Recurrent	Unknown	Unknown
Conversion of native habitat to crop and forage production	Low	Localized	Historic	Recurrent	Unknown	Medium
Urban development	Low	Localized	Historic	One-time	Unknown	Unknown
Changes in ecological dynamics or natural processes						
Alteration of natural fire regime	Medium	Widespread	Historic and current	Recurrent	Unknown	Unknown
Increased predation	Low	Widespread	Current	Continuous	Unknown	Unknown
Climate and natural disasters						
Climate change	Medium	Widespread	Current	Recurrent	Unknown	Unknown
Disturbance or harm						
Military activities	Low	Localized	Current	Recurrent	Unknown	Unknown
Application of rodenticides	Low	Localized	Current	Recurrent	Unknown	Unknown

¹ Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.

² Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).

³ Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).

4.2 Description of Threats

The Western Harvest Mouse is widespread across the United States Great Plains and is known to tolerate a wide variety of conditions. There is virtually no information on the biology, ecology, and threats to the Western Harvest Mouse on the Canadian prairies. The population in Suffield NWA has been found in a wide range of habitat types, including grassland areas, vegetated sand dunes, shrub-grasslands and riparian shrub-cottonwood stands. With such little information, the threats listed in Table 1 are only speculative and, as such, parts of this section are based on the knowledge of the species from elsewhere. However, higher density Western Harvest Mouse populations are found in Suffield NWA in regions with high quality litter and tall grass or shrub cover, so most of the threats identified here are based on the premise that Western Harvest Mouse populations respond negatively to events that decrease grassland productivity, structure, and shrub cover. Threats are listed in order of decreasing level of concern. Even in situations where the magnitude of the threat is small, the potential for the interaction and cumulative effects between any or all of the threats could be significant.

Alteration of Natural Fire Regime

Fire is an important natural process in the mixed grassland prairies of Canada. Throughout their range, Western Harvest Mouse populations have evolved and persisted in the presence of both natural (lightning) and human-caused fires. Influences of fire on Western Harvest Mouse populations locally are due to both direct (mortality of individuals) and indirect (loss/change of habitat) effects. Short-term habitat alteration by fire involves loss of the dense litter layer required for cover and nesting and the destruction of seeds for food, which have been shown to have a negative impact on Western Harvest Mice in the tallgrass prairies of Kansas and the grasslands of Oklahoma (Peterson et al. 1985, Kaufman et al. 1988, Clark and Kaufman 1991, Clark et al. 1998). However, some (but not all) studies have found that these effects are short-lived, and Western Harvest Mice may move back in within a year (Kaufman et al 1988, but see Cook 1959).

Of greater importance than single-fire effects is the threat posed by human-caused changes in fire regime that may have long-term or irreversible effects on habitat conditions. Western Harvest Mice reside in the dry mixedgrass natural subregion in Alberta, characterized by a mix of short and medium-height grasses. The pre-settlement fire frequency in this area is not well known, but has been estimated for this type of community at <35 years (Tirmenstein 2000). Higher fire frequency in certain range types in CFB Suffield has been shown to result in a shifting of the plant community composition from C3 to C4 grasses, leading to decreased cover of vegetation and litter and decreasing overall range condition (Smith and McDermid 2014). This likely equates to a decline in habitat suitability or an overall loss of habitat for Western Harvest Mouse.

Invasion of natural habitats by Downy Brome (*Bromus tectorum*), also known as 'cheatgrass', is a significant concern for fire frequency. Downy Brome has

characteristics (early green-up, fine litter accumulation, early drying) that contribute to increased fire frequency in grassland habitats, with a concomitant loss of native grass species and biodiversity (Young and Evans 1978). The increased fire frequency further contributes to increased Downy Brome predominance in those communities.

Communities where Downy Brome is dominant have a fire interval range <10 years (Howard 2002). Downy Brome already occurs at Suffield NWA in association with disturbances created by oil extraction, but has not yet significantly invaded native habitats within areas known to provide habitat for Western Harvest Mouse (T. Kemper, *pers. comm.*).

Conversely, an excessive fire return interval (the period of time that elapses between two fires in a particular defined area) can lead to an over-accumulation of fuels that eventually leads to an unusually intense fire when an ignition event occurs. Such high-intensity fires can have different impacts on local vegetation than lower intensity fires. For example, Silver Sagebrush, an important component of Western Harvest Mouse habitat at Suffield NWA, is typically able to survive top-kill in low intensity fires by resprouting from below ground biomass (Howard 2002) but is susceptible to high-intensity fires that destroy below-ground biomass in addition to top-killing. In this way, fire suppression in certain areas, either by rapid extinguishing of human-caused fires or construction of large fire guards, can ultimately lead to a decline in habitat quality or loss of important habitat components (shrubs) for the Western Harvest Mouse.

High-intensity Prolonged Grazing

Grazing by large native ungulates is an important natural process in grassland ecosystems, yet heavy prolonged grazing by livestock can have a negative effect on Western Harvest Mouse densities by reducing vegetation cover and litter below a threshold suitable for the species (e.g. Hayward et al. 1997, Jones et al. 2003). In Colorado, Western Harvest Mice were the most abundant small mammal in ungrazed sagebrush, but absent in sagebrush areas grazed moderately by livestock (Moulton et al. 1981). Whitford (1976) found an increase in density when grazing by cattle was removed.

There is currently not enough information to make an informed speculation as to a specific vegetative cover threshold below which Western Harvest Mouse populations would decline (locally or range-wide in Canada), nor is there enough information to comment on the specific timing, intensity, frequency, or duration of grazing that would create such conditions. At present, the assumption is that conditions for the Western Harvest Mouse improve with grassland productivity and range health, and decline with decreases in cover and productivity caused by over-grazing.

Industrial Activities

Native prairie habitats in Southern Alberta have been subject to significant oil and gas development. Activities associated with oil and gas development with the potential to disturb wildlife include: road construction, increased vehicular traffic, seismic

exploration, clearing of leases, drilling of wells, construction/installation of power lines, burial/tie-in of pipelines, lease abandonment, and potential accidents (e.g., spills, fire). The impacts of these activities on the Western Harvest Mouse are not well understood, although some of these activities have the potential to result in the loss or degradation of suitable Western Harvest Mouse habitat by eliminating vegetation and opening bare areas (e.g., temporary access roads, road grading, fireguards, pipelines). There is also the potential for increased individual mortality associated with traffic and other activities. For example, small mammals may become trapped in caissons (open air, below-ground oil and gas infrastructure). Roads and trails may also serve as barriers to dispersal (Kozel and Fleharty 1979), where individuals are reluctant to travel from one place to another if they must cross a road. Many of the activities associated with industrial development in native prairie also increase the prevalence of invasive plant species in adjacent native grasslands (Kotanen et al. 1998, Larson et al. 2001). Linear disturbances associated with industrial activity are more likely to be associated with long-lasting edge effects of increased presence of the invasive Crested Wheatgrass (*Agropyron cristatum*) than unaltered regions in Suffield NWA (Henderson and Henderson *in prep*). Crested Wheatgrass does not produce the same litter quality that native vegetation in the area does, over time producing more vertical litter surrounded by bare ground. Such litter patterns are likely less suitable for Western Harvest Mouse cover and nesting than more continuous litter cover produced by native grasses and shrubs.

Light and noise disturbance associated with industrial development have the potential to have significant negative consequences on the behaviour (and thus, presumably, the survival) of the Western Harvest Mouse. Harvest mice are depredated by a wide range of predators, and, as such, they have adapted to avoid high risk behaviour. One adaptation is a reduction in overall activity during moonlit nights (Banfield 1974, Bloom and Wilson 2010), when individuals would be more visible to potential predators. Any industrial activity that provides sources of nocturnal illumination has the potential to mimic intense moonlight conditions, and thus impact the activity patterns of Western Harvest Mouse. Small mammals also depend on an acute sense of hearing to detect predators and any industrial activity that creates noise has the potential to negatively impact this ability.

Roads and Trails

The use of linear features such as roads and trails may be important for Western Harvest Mouse dispersal, as Western Harvest Mice have been found to occur within roadside habitats (Whitaker and Mumford 1972, Bissonette and Rosa 2009). However, these linear features may also be functioning as a significant barrier to Western Harvest Mouse movement (Kozel and Fleharty 1979), which may fragment habitat and limit dispersal. It is possible that the Western Harvest Mouse is currently only found in Canada in Suffield NWA due to its comparatively unfragmented status, in comparison to more developed and populated regions outside Suffield NWA where it has not been recently recorded. The impacts of mortality and increased stress on Western Harvest Mice from roads are unknown. It is speculated that roads may create a sink habitat for

Western Harvest Mouse as linear features tend to be attractive to predators (e.g. canids, owls) for hunting. As with industrially-produced linear disturbances, roads and trails have been associated with an increase in invasive plants that reduce litter quality and subsequently, reduce the availability of suitable habitat for cover and nesting compared to the more continuous litter cover produced by native grasses and shrubs.

Conversion of Native Habitat to Crop and Forage Production

The historical conversion of native grassland to cultivated cropland has likely reduced the suitable Western Harvest Mouse habitat in Canada. Ford (1977) documented the range expansion of the Western Harvest Mouse into Indiana and found that they were associated with weedy, overgrown grassy areas with >90% cover. He captured Western Harvest Mice in areas of little cover, but none in a crop field or wheat field. Ford (1977) asserted that this was because of “no under-growth”. Harvest mice likely avoid inhabiting crop fields (Knopf and Samson 1997), and have been found in higher densities in uncultivated fallow fields than in wheat fields (Kaufman and Kaufman 1990). Western Harvest Mice were almost never captured in cultivated fields (Kaufman and Kaufman 1990). The conversion of native habitat to crop production is thought to have negative impacts on Western Harvest Mouse density (Kaufman and Kaufman 1990).

The extent of this threat to the Western Harvest Mouse across its potential range (Figure 2) is currently unknown, but the causal certainty is moderate to high when habitat is modified to something that does not seem to be preferred by the Western Harvest Mouse. Cultivating suitable habitat currently not inhabited by Western Harvest Mice may be detrimental to the species because these areas may potentially be colonized in the future or facilitate natural movements between suitable areas.

Climate Change

While the impacts of climate change on the Western Harvest Mouse are unknown, two main results of climate change may have negative impacts on the species: increased risk of drought and extreme winter conditions. Long periods of little or no precipitation are a natural phenomenon on the Canadian prairies. Drought conditions reduce or eliminate vegetative growth and likely have a negative consequence on local Western Harvest Mouse populations. Some climate change models (e.g. Henderson and Sauchyn 2008) predict that drought events could become more frequent and/or more severe on the Canadian prairies. The severity of a drought that would threaten the persistence of an entire Western Harvest Mouse population is unknown at this point. Conversely, conditions that significantly improve growing conditions (e.g. heavy spring runoff, above average spring/summer precipitation) may have a positive effect on Western Harvest Mouse populations.

In Canada, the Western Harvest Mouse exists at the northern limit of its range and experiences more extreme winter conditions (e.g. longer duration, lower temperature and greater depth of frost) than in more southern localities. Climate-imposed limitations may inflict a substantial cost on the Western Harvest Mouse in Canada, as their ability

to augment their food and fat reserves may be reduced. It is likely that the Western Harvest Mouse in Canada is existing close to its physiological limits and that any increase in extreme winter conditions may negatively impact the ability of this species to continue to survive in Canada.

Urban Development

The potential for new, large-scale urban development is generally limited across the potential range of the Western Harvest Mouse, although any removal of groundcover is likely to pose a threat to the species as discussed above. Even limited effects of urbanization, such as mowing along roads, is a potential threat, as the Western Harvest Mouse has been shown to inhabit roadside habitats (Whitaker and Mumford 1972, Ford 1977) and mowing reduces tall grass cover and possibly nesting sites.

Increased Predation

The Western Harvest Mouse is likely susceptible to depredation from a wide variety of predators such as owls, hawks, jays, shrikes, rattlesnakes, raccoons, foxes, weasels, skunks, badgers, and coyotes. Western Harvest Mouse populations in the prairies have adapted to, and survived with, natural levels of predation. However, any change in that rate of predation could threaten the persistence of Western Harvest Mouse populations. There have been no studies to determine if native predatory species have increased in abundance, or in the proportion of Western Harvest Mice they consume, but since European settlement most members of the predator community have likely undergone significant changes in relative abundance (some more abundant, some less). There are no data on the impact of introduced predators on the Western Harvest Mouse, but domestic cats should be considered a predator of potential concern.

Increased predation could also result from an increase in vertical structures (e.g. fences, light posts, oil and gas structures) used as perch sites by avian predators. This effect may be pronounced when the structures are associated with a linear clearing of the vegetative cover, reducing the ability of Western Harvest Mice to use the litter for predator avoidance.

Military Activities

The only known Western Harvest Mouse population in the prairies occurs in or immediately adjacent to Suffield NWA, although the range of this population may also include areas outside of Suffield NWA. Surveys have not been done for this species within CFB Suffield outside of the NWA. Although military activities do not occur within Suffield NWA, military training in areas adjacent to the NWA impact the fire frequency, and prevailing winds typically push fires in the direction of the NWA. Fires that cross the boundary road between CFB Suffield and Suffield NWA (where present) directly impact Western Harvest Mouse habitat. There is also the potential for auditory, olfactory and visual senses to be affected by nearby military exercises. Outside of Suffield NWA, Western Harvest Mouse populations that may exist within the military

maneuver and training areas of CFB Suffield could be directly impacted by heavy machinery, fires caused by live ammunition exercises, night time illumination, explosion of ordnance, and indirectly impacted by habitat degradation or loss through soil compaction, soil erosion, increased fire frequency, and increases in invasive species. However, the impact of these activities is currently unknown.

Application of Rodenticides

Rodenticide use is not permitted within Suffield NWA, but it can be applied to control rodent populations in agricultural settings near the known range of the Western Harvest Mouse or within the potential range of this species. Rodenticide mortality in Western Harvest Mice is likely low, as they do not prefer the types of habitats in which rodenticides are most likely to be applied.

5. Population and Distribution Objectives

Limited information is available on Western Harvest Mouse abundance and distribution in Canada. The information available is largely derived from a few surveys undertaken in Suffield NWA and non-targeted small mammal surveys or owl pellet analyses elsewhere. Furthermore, extensive knowledge gaps pertaining to the species' biology and ecology exist, including habitat selection, dispersal, and mortality factors. As well, Western Harvest Mouse populations are capable of dramatic fluctuations within any given year (e.g. Reynolds et al. 1999, Brady and Slade 2004) and over longer periods (e.g. Skupski 1995). As a result, the establishment of quantitative population and distribution objectives is inappropriate at this time.

Thus, the population and distribution objective for the Western Harvest Mouse, *dychei* subspecies, is to maintain the current distribution and maintain or attain self-sustaining populations at all currently occupied locations in Alberta and Saskatchewan. Currently, the only known population occurs in, and possibly adjacent to, CFB Suffield. However, if more populations of this species are discovered, or the range of the species is expanded, they will also be included in the population and distribution objectives.

In Canada, the Western Harvest Mouse, *dychei* subspecies, occurs as a single population at the northern periphery of its range. The subspecies has likely always been highly localized in Canada and, thus, there is no reasonable expectation that the Western Harvest Mouse could ever become abundant and common in Canada.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Since the COSEWIC status assessment was completed in 2007, a number of scientific studies relating to the recovery of the Western Harvest Mouse have been performed or are currently underway:

- A survey of small mammal remains in owl pellets across the potential prairie range of the Western Harvest Mouse has been completed (Heisler et al. 2014).
- Western Harvest Mouse live-trapping within Suffield NWA from 2009-2013 has been performed to assess population abundance and distribution (Bloom and Wilson 2009, Bloom and Wilson 2010, Kemper et al. 2013) and will continue to help fill the knowledge gaps for the species.
- A habitat suitability model has been completed for Western Harvest Mouse in Suffield NWA.
- Hairs recovered from carnivore scat and attributed to Western Harvest Mouse have been reported from southeast of Swift Current, SK, near Kincaid (Proulx and Proulx 2012).
- Genetic analysis of modern and historically-collected Western Harvest Mouse DNA samples is underway. This study will examine:
 - if the Canadian population is genetically unique from the Montana population;
 - if the historical samples collected in the southern-most areas of Alberta are more closely related to the Suffield NWA population or the Montana population (i.e. whether gene flow in Western Harvest Mouse is more likely explained by river systems or as-the-crow-flies distance), and;
 - the relationships among Western Harvest Mice in Suffield NWA, and the potential existence of subpopulations in this area.
- Information about nesting behaviour and home range size, previously unknown in the Canadian population of the Western Harvest Mouse, has been partially described (G. Wilson, unpublished data).

6.2 Strategic Direction for Recovery

Table 2. Recovery Planning Table

Threat or Limitation	Priority¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
Research			
Knowledge gaps: Impact of all threats	High	Address gaps in knowledge of Western Harvest Mouse biology, determine severity of each threat and develop effective recovery actions	<ul style="list-style-type: none"> • Perform biophysical surveys at known Western Harvest Mouse locations • Apply and test parameters for habitat suitability model, as determined from monitoring density and fine-scale distribution of Western Harvest Mice, outside of Suffield NWA. Adapt the model and method for identifying critical habitat, as required. • Develop methods for managing threats to species based on habitat suitability parameters
Population Inventory and Monitoring			
Knowledge gaps: Species range and distribution	High	Conduct population studies to better understand distribution, abundance, isolation and connectivity in Canada	<ul style="list-style-type: none"> • Apply survey protocols at historic sites and across the putative range of Western Harvest Mice in Canada • Determine degree of genetic isolation between the population(s) in Canada and neighbouring Montana population(s) as a means to determine connectivity between them
Habitat Management			
All threats	High	Maintain suitable habitat for known population(s)	<ul style="list-style-type: none"> • Maintain shrub and/or grass cover for known Suffield NWA population • Avoid creating barriers to gene flow (e.g. new roads, removal of ground cover) between known locations

¹ "Priority" reflects the degree to which the approach contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.

6.3 Narrative to Support the Recovery Planning Table

Recovery planning for the Western Harvest Mouse is limited to three basic but essential components (Table 2): refine knowledge of where the subspecies currently occurs, conduct research into the general biology of the subspecies and impacts of putative threats, and maintain suitable habitat where the species occurs. The preservation of the Suffield NWA population, the only confirmed population in Canada, is critical to maintaining the subspecies *dychei* in Canada.

Research

Current information on the biology of the Western Harvest Mouse in Canada is sparse, which is a significant impediment to the development of an in-depth plan for recovery of this species. The Western Harvest Mouse is common across a wide range of grassland habitats in the United States, yet only a single, isolated population at Suffield NWA has been found in prairie Canada. A habitat suitability model developed from trapping the Western Harvest Mouse in Suffield NWA (Bloom and Wilson 2009, Bloom and Wilson 2010, Kemper et al. 2013) will be tested in regions of potential Western Harvest Mouse habitat outside of Suffield NWA to assess the broad applicability of the model. At a broad scale, there appears to be sufficient grassland habitats across much of southern Alberta and Saskatchewan that would seem to be suitable habitat, yet there are no recent records of the species outside the Suffield NWA area. Therefore, it must be determined if the distribution of the Western Harvest Mouse extends beyond the Suffield NWA population, and if not, what features in Suffield NWA make it a uniquely suitable habitat for the Western Harvest Mouse. Also, little is known about the potential threats to the Western Harvest Mouse, and their severity. This information is required in order to properly manage Western Harvest Mouse populations.

Population Inventory and Monitoring

First and foremost, the distribution of this species in Alberta and Saskatchewan must be examined to establish if there are currently populations of the Western Harvest Mouse outside of the Suffield NWA area. This effort will require a systematic sampling of a wide range of potentially suitable areas. Surveys of Burrowing Owl and Great Horned Owl (*Bubo virginianus*) pellets across the potential range (Heisler 2013) have so far not resulted in the discovery of other potential locations beyond the single occurrence in Bindloss, AB (Figure 2), but this work can be continued with different owl species. If other locations are found through owl pellet sampling, trapping will be conducted, as it is the most reliable method for detecting presence of the Western Harvest Mouse, but can be quite labour-intensive. If the habitat model developed for Suffield NWA is shown to be broadly applicable, this model will be used to identify regions elsewhere in Alberta and Saskatchewan that may contain suitable habitat for the Western Harvest Mouse.

Genetic analysis is a tool that should be able to determine the degree to which Western Harvest Mouse populations on the Canadian prairies are isolated from each other and from the more contiguous populations in Montana, and establish the length of time that

populations have been separated. This information is important because having the potential for immigration/emigration may be crucial for the recovery of the species. Genetic techniques may also be important for determining fine-scale gene flow and migration within Suffield NWA, which in turn can help identify barriers to gene flow and animal movements for this species.

Habitat Management

Shrub and grass cover appear important for the Western Harvest Mouse to undertake the biological processes necessary for survival and reproduction, such as nesting and dispersal. Efforts should be made to ensure that this cover continues to occur within the range of the Western Harvest Mouse. It is also important to examine the fine- and broad-scale habitat requirements for this species so that habitat disturbance and destruction can be mitigated.

7. Critical Habitat

7.1 Identification of the Species' Critical Habitat

Critical habitat is defined in the *Species at Risk Act* (Subsection 2(1)) 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 Western Harvest Mouse is partially identified in this recovery strategy. Western Harvest Mouse critical habitat is identified within the Suffield NWA (Appendix B), as this is currently the only known occupied location for the species in Canada. The specific areas containing critical habitat for Western Harvest Mouse are presented in Appendix B, Figure B1; see also Appendix C for list of applicable quarter sections. Critical habitat for the Western Harvest Mouse occurs within the shaded units where the critical habitat criteria and methodology described in this section are met. The 10 x 10 km Standardized UTM grid shown in Figure B1 is simply a Standardized national grid system that highlights the general geographic area containing critical habitat, for land use planning and/or environmental assessment purposes. Critical habitat for the Western Harvest Mouse does not include habitat features such as marshes, permanent water bodies, and current anthropogenic features such as buildings, structures, and roads because these do not possess the biophysical attributes of critical habitat. Consequently, these unsuitable habitat features within mapped critical habitat areas are not to be considered critical habitat.

A predictive occurrence-based model was used to identify critical habitat for Western Harvest Mouse within Suffield NWA, but not outside the NWA in CFB Suffield, as there are no confirmed species occurrences outside the NWA. One benefit of such predictive models is that they identify suitable habitat not only in areas where Western Harvest Mouse occurrence data are available (i.e. confirmed captures/records), but also where

occurrence data are currently unavailable (i.e. unconfirmed captures, locations that have not been directly assessed by trapping, or where no captures have been made). Specifically, this habitat suitability analysis related Western Harvest Mouse capture locations (93 captures; 1994–1996) (Reynolds et al. 1999) to environmental and habitat variables from the same time period using Maxent, a presence-only niche-based modelling method technique (Phillips et al. 2006). To account for variability in model training, the average of 10 Maxent model replicates was mapped as critical habitat. The model was validated using a subset of the data and tested using an independent set of Western Harvest Mouse capture data (N=35; 2009–2011) that was not used for model training or development. The majority of these recent captures (97%, 34 locations) fell within the independently-modelled critical habitat, confirming that the modelled habitat provides a good representation of suitable habitat for Western Harvest Mouse.

The critical habitat identified in this recovery strategy is known to support Western Harvest Mice and to contain habitat attributes required for their survival. The biophysical attributes of Western Harvest Mouse critical habitat include: low relief, flat or gently undulating grasslands or shrub-grasslands with cool-season (C3) grasses such as Needle and Thread Grass, Blue Grama, and June Grass, and the presence of associated shrubs such as Silver Sagebrush, Choke Cherry, Snowberry, and Thorny Buffalo-Berry (Reynolds et al. 1999, Bloom et al. 2009, Bloom and Wilson 2010, Kemper et al. 2013).

The Western Harvest Mouse critical habitat identified in this recovery strategy covers 287 km² and occurs within portions of 763 quarter-sections in or immediately adjacent to Suffield NWA (Appendix C). Of these, 572 quarter-sections are federal lands occurring in Suffield NWA, 117 quarter-sections include both types of federal lands (DND and NWA), and 74 quarter-sections include both federal and provincial lands. No quarter-sections are solely located within DND federal land outside of Suffield NWA.

Studies to identify additional critical habitat are outlined in Section 7.2. Additional critical habitat may be identified in an action plan (to be completed by 2019) if future studies identify areas that meet the criteria described above.

7.2 Schedule of Studies to Identify Critical Habitat

The critical habitat identified in this recovery strategy is necessary, but may not be sufficient for, recovery of the Western Harvest Mouse in Canada. Accordingly, a schedule of studies (Table 3) has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient to meet the population and distribution objectives. The identification of critical habitat will be updated when this information becomes available, either in a revised recovery strategy or action plan(s).

Should additional populations of Western Harvest Mice be discovered within the species' range it will be necessary to identify additional critical habitat to support the population and distribution objectives.

Table 3. Schedule of Studies to Identify Critical Habitat

Description of Activity	Rationale	Timeline
Quantify if the critical habitat identified will support self-sustaining Western Harvest Mouse populations.	Determine if more critical habitat has to be identified in order to meet the population and distribution objective.	2017-2019

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Destruction of critical habitat 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).

Critical habitat for the Western Harvest Mouse is destroyed by any alteration that adversely modifies any biological, chemical, or physical features (e.g. topography, geology, soil/water/air conditions, vegetation, microclimate) to the extent that individuals can no longer use the environment for foraging, locomotion, territory defense, communication, mating, escaping from predators, burrowing, taking shelter, caching food, rearing young, or resting (Table 4). It should be noted that some activities may not destroy critical habitat in a single instance, but the combination and cumulative effect as well as the frequency and duration of some activities could have a long-term destructive effect on critical habitat.

Table 4. Activities likely to destroy critical habitat for the Western Harvest Mouse. Activities are listed by decreasing threat level.

Description of Activity	Description of Effect	Details
Alteration of natural fire regime	Excessive fire frequency eliminates thatch and litter buildup. Alternatively, long periods without fire produce an unnatural build-up of fuel. When fire does eventually pass through such an area, the higher-intensity fire destroys shrubs that can normally tolerate top-kill from lower-intensity fires.	Excessive fire frequency destroys nesting material and the litter required for cover and predator avoidance by the Western Harvest Mouse. Higher-intensity fires can destroy shrubs that the Western Harvest Mouse needs for cover and nesting.
High-intensity prolonged grazing	High-intensity prolonged grazing can reduce the amount of litter and vegetation structure in an area. Grazing by cattle, or wild ungulates such as elk (<i>Cervus canadensis</i>) can result in destruction of critical habitat when their densities or distribution are excessive.	The Western Harvest Mouse requires the presence of litter and vegetation structure for making nests, foraging, and hiding from predators.
Compression, covering,	Examples of compression include the creation or expansion of structures and linear features such as	Soil compression can impact vegetation growth, lower soil temperatures in winter and

inversion, flooding, or excavation / extraction of soil	pipelines, transmission lines, fence lines, trails, roads and fireguards. Examples of covering soil include the creation or expansion of structures, spreading of solid waste materials, or road bed construction. Examples of soil inversion and/or extraction include new or expanded cultivation, sand and gravel extraction pits, dugouts, road construction, pipeline installation, and stripping of soil for well pads or fireguards.	increase the difficulty of digging burrows (if the Western Harvest Mouse engages in this behavior in Canada). Covering soil can affect the species' ability to move between suitable habitats, decrease vegetative structure and the survival of forage plants. Soil inversion or excavation/extraction can alter soil porosity and temperature, affecting vegetative structure, increasing the difficulty of digging burrows and decreasing winter survivorship. Flooding can alter soil porosity and moisture content, which can result in direct mortality or the alteration of the vegetation community.
Light and noise pollution	Industrial development and installations can produce night-time illumination. Industrial development, seismic surveys, drilling operations, and other machinery or infrastructure that produce an auditory disturbance are considered destruction of Western Harvest Mouse critical habitat.	Western Harvest Mice generally limit movement to dark nights (Bloom and Wilson 2010), so night-time illumination may alter their natural behaviour. They may also be sensitive to auditory disturbance and seismic activity, although the information necessary to support thresholds is not available. As such, these forms of disturbance may affect the ability of Western Harvest Mice to use critical habitat for shelter, forage, search for mates, avoid predators, and/or ability or desire to disperse among suitable habitat patches, decreasing population viability and destroying critical habitat.
Modification of native plant community	Modification of the native plant community diversity and structure due to vehicular and recreational traffic, waste application, or deliberate introduction or promotion of invasive exotic species is considered destruction of critical habitat. Invasive species may also displace native plant species.	Modification of the native plant community may reduce habitat availability and quality of food resources. Some invasive species do not produce the same level of high quality litter as native plants, reducing the required litter available to Western Harvest Mice to nest, forage, and avoid predators.
Installation of perch sites	The installation of structures such as poles and some oil and gas structures can increase rates of predation by avian predators.	Modification of critical habitat through the installation of these structures can result in the failure of harvest mice to use the habitat for shelter, foraging, and reproduction, and impact population dynamics by artificially increasing mortality rates.

Activities required to manage, inspect, or maintain existing facilities and infrastructure which are not critical habitat but whose footprints may be within or adjacent to the identified critical habitat may not result in the destruction of critical habitat, provided that appropriate mitigation measures are implemented to protect the Western Harvest Mouse's habitat. Existing roads are not included in the description of critical habitat and therefore the continuation of maintenance activities on the road bed are not likely to result in destruction of critical habitat. For more information on what constitutes an activity likely to destroy critical habitat, it is recommended that the proponent contact Environment Canada, Prairie and Northern Region, to ensure that the activity does not destroy critical habitat.

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives.

In five years, the success of the recovery strategy will be measured by:

- The maintenance of the current distribution and self-sustaining population status for all currently occupied population locations in Alberta and Saskatchewan.

9. Statement on Action Plans

An Action Plan for the Western Harvest Mouse throughout its Canadian range will be posted on the Species at Risk Public Registry by 2019. There is the potential for a multispecies or ecosystem-based Action Plan that could benefit multiple species at risk inhabiting this ecosystem (Appendix D).

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Appendix A: Species and Subspecies Conservation Status Ranks

Table A1. List and description of various conservation status ranks for the Western Harvest Mouse species and subspecies found in Canada (NatureServe 2012).

	Global (G) Rank	National (N) Rank	Sub-national (S) Rank	SARA Status	IUCN
Western Harvest Mouse , no subspecies (<i>Reithrodontomys megalotis</i>)	G5	United States: N5	Colorado (S5) Illinois (S4) Indiana (S2) Iowa (S4) Kansas (S5) Minnesota (SNR) Missouri (SNR) Montana (S4) Nebraska (S5) North Dakota (SNR) Oklahoma (S2) South Dakota (S5) Texas (S5) Wisconsin (SU) Wyoming (S5)		LC (Least Concern)
Western Harvest Mouse , <i>dychiei</i> subspecies (<i>R.m.dychiei</i>)	G5TNR	Canada – N1 United States NNR	Alberta - S1 Arizona - S5 Colorado - SH	Schedule 1, Endangered	
Western Harvest Mouse , <i>megalotis</i> subspecies (<i>R.m.megalotis</i>)	G5T5	Canada - N2N3 United States - N5	British Columbia- S2S3	Schedule 1, Special Concern	

NatureServe assessment: G = global, N = national, S = subnational (state/provincial/territorial), T = infraspecific taxon; NR = not yet ranked, H = possibly extinct, U=unrankable; 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, and 5 = secure. Two rankings side by side (e.g., S1S2) indicates a range of uncertainty about the status (NatureServe 2012).

Appendix B: Map of Western Harvest Mouse Critical Habitat in or Immediately Adjacent to CFB Suffield

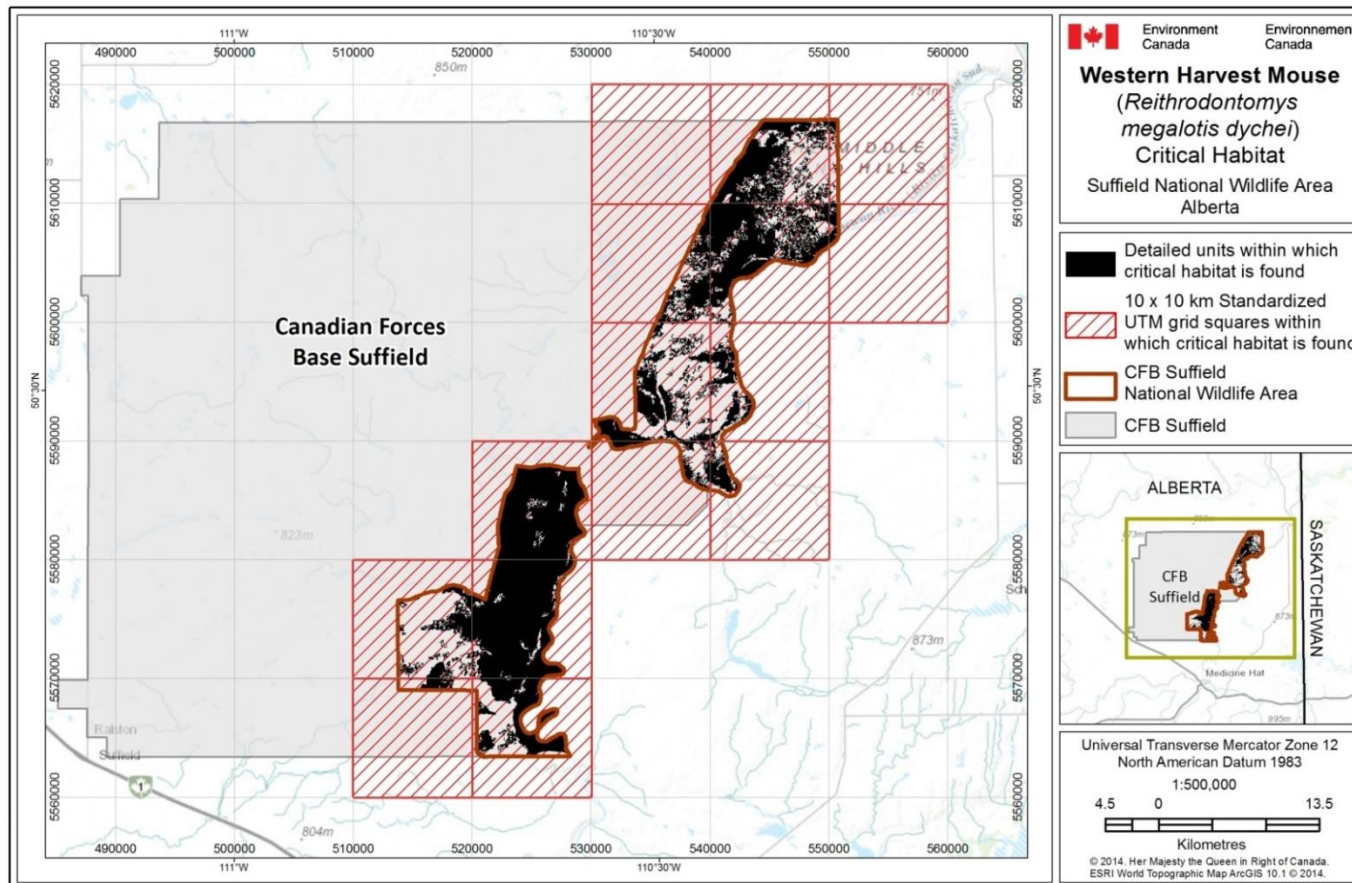


Figure B1. Critical habitat map for the Western Harvest Mouse, *dychi* subspecies. Western Harvest Mouse critical habitat occurs within the detailed units where the criteria described in Section 7.1 are met and does not include habitat features such as forests, marshes, permanent water bodies, and current anthropogenic features such as fences, buildings, structures, and roads because these do not possess the biophysical attributes of critical habitat. The 10 x 10 km UTM grid overlay shown on this figure is a standardized national grid system that flags the general geographic area containing critical habitat. Areas outside of the detailed units do not contain critical habitat identified at this time.

Appendix C: List of Quarter-sections in or Immediately Adjacent to CFB Suffield, Alberta, that Contain Western Harvest Mouse Critical Habitat⁴

Table C1. Quarter Sections that Contain Western Harvest Mouse Critical Habitat

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	NW	7	17	3	4	Federal-NWA
Alberta	NE	7	17	3	4	Federal-NWA, Provincial Crown
Alberta	NW, SE, SW	18	17	3	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SW	31	17	3	4	Federal-NWA
Alberta	SE	31	17	3	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	32	17	3	4	Federal-NWA, Provincial Crown
Alberta	SW	5	18	3	4	Federal-NWA
Alberta	NW	5	18	3	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	6	18	3	4	Federal-NWA
Alberta	NW, SW	7	18	3	4	Federal-NWA
Alberta	NE, SE	7	18	3	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	18	18	3	4	Federal-NWA
Alberta	NE, SE	18	18	3	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	19	18	3	4	Federal-NWA, Provincial Crown
Alberta	NW	30	18	3	4	Federal-NWA
Alberta	SW	30	18	3	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	31	18	3	4	Federal-NWA, Provincial Crown
Alberta	NE, NW	5	19	3	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	6	19	3	4	Federal-NWA
Alberta	NE, SE	6	19	3	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	7	19	3	4	Federal-NWA
Alberta	NE, NW, SW	8	19	3	4	Federal-NWA
Alberta	SE	8	19	3	4	Federal-NWA, Provincial Crown
Alberta	NW	9	19	3	4	Federal-NWA
Alberta	NE, SW	9	19	3	4	Federal-NWA, Provincial Crown
Alberta	NE, NW	10	19	3	4	Federal-NWA, Provincial Crown
Alberta	NW	11	19	3	4	Federal-NWA
Alberta	NE, SW	11	19	3	4	Federal-NWA, Provincial Crown
Alberta	NW	13	19	3	4	Federal-NWA
Alberta	NE, SE, SW	13	19	3	4	Federal-NWA, Provincial Crown

⁴ Western Harvest Mouse critical habitat occurs only on portions of the listed quarter-sections where the criteria described in Section 7.1 are met and does not include habitat features such as forests, marshes, permanent water bodies, and current anthropogenic features such as fences, buildings, structures, and roads because these do not possess the biophysical attributes of critical habitat.

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	NE, NW, SE, SW	14	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	15	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	16	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	17	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	18	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	19	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	20	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	21	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	22	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	23	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	24	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	25	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	26	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	27	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	28	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	29	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	30	19	3	4	Federal-NWA
Alberta	NE, SE, SW	31	19	3	4	Federal-NWA
Alberta	NW	31	19	3	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	32	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	33	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	34	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	35	19	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	36	19	3	4	Federal-NWA
Alberta	NE, SE	1	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	2	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	3	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	4	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	5	20	3	4	Federal-NWA
Alberta	NE, SE, SW	6	20	3	4	Federal-NWA/Suffield
Alberta	SE	7	20	3	4	Federal-NWA/Suffield
Alberta	NE, SE	8	20	3	4	Federal-NWA
Alberta	NW, SW	8	20	3	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	9	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	10	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	11	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	12	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	13	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	14	20	3	4	Federal-NWA
Alberta	NE, NW, SE, SW	15	20	3	4	Federal-NWA

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	NE, SE, SW	16	20	3	4	Federal-NWA
Alberta	NW	16	20	3	4	Federal-NWA/Suffield
Alberta	NE, SE, SW	17	20	3	4	Federal-NWA/Suffield
Alberta	NE	11	17	4	4	Federal-NWA/Suffield
Alberta	NE, NW	12	17	4	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	13	17	4	4	Federal-NWA
Alberta	NE, NW, SE	14	17	4	4	Federal-NWA
Alberta	SW	14	17	4	4	Federal-NWA/Suffield
Alberta	NE, SE	15	17	4	4	Federal-NWA/Suffield
Alberta	NE, NW	19	17	4	4	Federal-NWA/Suffield
Alberta	NE	22	17	4	4	Federal-NWA
Alberta	SE	22	17	4	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	23	17	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	24	17	4	4	Federal-NWA
Alberta	NW, SW	25	17	4	4	Federal-NWA
Alberta	NE, SE	25	17	4	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	26	17	4	4	Federal-NWA
Alberta	NE, NW, SE	27	17	4	4	Federal-NWA
Alberta	SW	27	17	4	4	Federal-NWA/Suffield
Alberta	NE, NW	28	17	4	4	Federal-NWA
Alberta	SE, SW	28	17	4	4	Federal-NWA/Suffield
Alberta	NE, SW	29	17	4	4	Federal-NWA
Alberta	NW, SE	29	17	4	4	Federal-NWA/Suffield
Alberta	NW, SE, SW	30	17	4	4	Federal-NWA
Alberta	NE	30	17	4	4	Federal-NWA/Suffield
Alberta	NW, SE, SW	31	17	4	4	Federal-NWA/Suffield
Alberta	NE, SE	32	17	4	4	Federal-NWA
Alberta	NW	32	17	4	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	33	17	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	34	17	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	35	17	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	36	17	4	4	Federal-NWA
Alberta	NE, NW, SE	1	18	4	4	Federal-NWA
Alberta	NE, NW, SW	2	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	3	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	4	18	4	4	Federal-NWA
Alberta	NE, SE	5	18	4	4	Federal-NWA
Alberta	NW, SW	5	18	4	4	Federal-NWA/Suffield
Alberta	NE, SE	8	18	4	4	Federal-NWA
Alberta	NW, SW	8	18	4	4	Federal-NWA/Suffield

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	NE, NW, SE, SW	9	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	10	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	11	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	12	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	13	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	14	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	15	18	4	4	Federal-NWA
Alberta	NE, NW, SW	16	18	4	4	Federal-NWA
Alberta	SE	17	18	4	4	Federal-NWA
Alberta	NE, SW	17	18	4	4	Federal-NWA/Suffield
Alberta	NE, SE, SW	21	18	4	4	Federal-NWA
Alberta	NW	21	18	4	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	22	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	23	18	4	4	Federal-NWA
Alberta	NE, SE, SW	24	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	25	18	4	4	Federal-NWA
Alberta	NE, NW	26	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	27	18	4	4	Federal-NWA
Alberta	SE	28	18	4	4	Federal-NWA
Alberta	NE, NW, SW	28	18	4	4	Federal-NWA/Suffield
Alberta	NE, SE	33	18	4	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	34	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	35	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	36	18	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	1	19	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	2	19	4	4	Federal-NWA
Alberta	SE	3	19	4	4	Federal-NWA
Alberta	NE, SW	3	19	4	4	Federal-NWA/Suffield
Alberta	NE, SE	10	19	4	4	Federal-NWA/Suffield
Alberta	NE, SE, SW	11	19	4	4	Federal-NWA
Alberta	NW	11	19	4	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	12	19	4	4	Federal-NWA
Alberta	NE, NW, SE, SW	13	19	4	4	Federal-NWA
Alberta	SE	14	19	4	4	Federal-NWA
Alberta	NE, NW, SW	14	19	4	4	Federal-NWA/Suffield
Alberta	NE, SE	23	19	4	4	Federal-NWA/Suffield
Alberta	NE, SE, SW	24	19	4	4	Federal-NWA
Alberta	NW	24	19	4	4	Federal-NWA/Suffield
Alberta	SE	25	19	4	4	Federal-NWA
Alberta	NE, NW, SW	25	19	4	4	Federal-NWA/Suffield

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	NE, SE	36	19	4	4	Federal-NWA/Suffield
Alberta	NW, SW	3	15	5	4	Federal-NWA
Alberta	NE, SE	3	15	5	4	Federal-NWA, Provincial Crown
Alberta	SE, SW	4	15	5	4	Federal-NWA
Alberta	NE, NW	4	15	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	5	15	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	6	15	5	4	Federal-NWA
Alberta	NE, SE, SW	7	15	5	4	Federal-NWA
Alberta	SW	8	15	5	4	Federal-NWA
Alberta	NW, SE	8	15	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SW	9	15	5	4	Federal-NWA, Provincial Crown
Alberta	SE, SW	10	15	5	4	Federal-NWA, Provincial Crown
Alberta	SW	15	15	5	4	Federal-NWA, Provincial Crown
Alberta	NW, SE, SW	16	15	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW	17	15	5	4	Federal-NWA
Alberta	SE, SW	17	15	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE	18	15	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	19	15	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	20	15	5	4	Federal-NWA
Alberta	NW, SW	21	15	5	4	Federal-NWA, Provincial Crown
Alberta	NW, SE, SW	27	15	5	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	28	15	5	4	Federal-NWA
Alberta	NE, SE	28	15	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	29	15	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	30	15	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	31	15	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	32	15	5	4	Federal-NWA
Alberta	NW, SW	33	15	5	4	Federal-NWA
Alberta	NE, SE	33	15	5	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	4	16	5	4	Federal-NWA
Alberta	NE, SE	4	16	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	5	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	6	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	7	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	8	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	9	16	5	4	Federal-NWA
Alberta	NW, SW	10	16	5	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	15	16	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	16	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	17	16	5	4	Federal-NWA

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	NE, NW, SE, SW	18	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	19	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	20	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	21	16	5	4	Federal-NWA
Alberta	NW	22	16	5	4	Federal-NWA
Alberta	NE, SE, SW	22	16	5	4	Federal-NWA, Provincial Crown
Alberta	NW	23	16	5	4	Federal-NWA, Provincial Crown
Alberta	SW	26	16	5	4	Federal-NWA, Provincial Crown
Alberta	NE, NW, SE, SW	27	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	28	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	29	16	5	4	Federal-NWA
Alberta	NE, SE	30	16	5	4	Federal-NWA
Alberta	NW, SW	30	16	5	4	Federal-NWA/Suffield
Alberta	NE, SE	31	16	5	4	Federal-NWA
Alberta	NW, SW	31	16	5	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	32	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	33	16	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	34	16	5	4	Federal-NWA
Alberta	NW	35	16	5	4	Federal-NWA
Alberta	NE, SW	35	16	5	4	Federal-NWA, Provincial Crown
Alberta	NW, SW	2	17	5	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	3	17	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	4	17	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	5	17	5	4	Federal-NWA
Alberta	NE, SE	6	17	5	4	Federal-NWA
Alberta	NW, SW	6	17	5	4	Federal-NWA/Suffield
Alberta	NE, SE, SW	7	17	5	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	8	17	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	9	17	5	4	Federal-NWA
Alberta	NE, NW, SE, SW	10	17	5	4	Federal-NWA
Alberta	NW	11	17	5	4	Federal-NWA
Alberta	NE, SE, SW	11	17	5	4	Federal-NWA/Suffield
Alberta	SW	14	17	5	4	Federal-NWA
Alberta	NW, SE	14	17	5	4	Federal-NWA/Suffield
Alberta	NW, SE, SW	15	17	5	4	Federal-NWA
Alberta	NE	15	17	5	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	16	17	5	4	Federal-NWA
Alberta	NE, SE, SW	17	17	5	4	Federal-NWA
Alberta	NW	17	17	5	4	Federal-NWA/Suffield
Alberta	SE	18	17	5	4	Federal-NWA/Suffield

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	SE, SW	20	17	5	4	Federal-NWA/Suffield
Alberta	SE, SW	21	17	5	4	Federal-NWA/Suffield
Alberta	SE, SW	22	17	5	4	Federal-NWA/Suffield
Alberta	NE	25	17	5	4	Federal-NWA
Alberta	NW, SE, SW	25	17	5	4	Federal-NWA/Suffield
Alberta	SE	26	17	5	4	Federal-NWA/Suffield
Alberta	SE	36	17	5	4	Federal-NWA
Alberta	NE, NW, SW	36	17	5	4	Federal-NWA/Suffield
Alberta	NE, SE	1	15	6	4	Federal-NWA
Alberta	NW, SW	1	15	6	4	Federal-NWA/Suffield
Alberta	SE	12	15	6	4	Federal-NWA
Alberta	SW	12	15	6	4	Federal-NWA/Suffield
Alberta	NE, SE	13	15	6	4	Federal-NWA
Alberta	NW, SW	13	15	6	4	Federal-NWA/Suffield
Alberta	NE, NW	21	15	6	4	Federal-NWA
Alberta	SE, SW	21	15	6	4	Federal-NWA/Suffield
Alberta	NE, NW	22	15	6	4	Federal-NWA
Alberta	SE, SW	22	15	6	4	Federal-NWA/Suffield
Alberta	NE, NW, SE	24	15	6	4	Federal-NWA
Alberta	SW	24	15	6	4	Federal-NWA/Suffield
Alberta	NE, NW, SE, SW	25	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	26	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	27	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	28	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	29	15	6	4	Federal-NWA
Alberta	SE	31	15	6	4	Federal-NWA/Suffield
Alberta	SW	32	15	6	4	Federal-NWA
Alberta	SE	33	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	34	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	35	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	36	15	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	1	16	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	2	16	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	3	16	6	4	Federal-NWA
Alberta	NE, NW	4	16	6	4	Federal-NWA
Alberta	NW, SW	5	16	6	4	Federal-NWA
Alberta	NE, SE	6	16	6	4	Federal-NWA/Suffield
Alberta	NE	7	16	6	4	Federal-NWA/Suffield
Alberta	NW	8	16	6	4	Federal-NWA
Alberta	SE	9	16	6	4	Federal-NWA

Province	Quarters	Section	Township	Range	Meridian	Ownership
Alberta	NE, SE, SW	10	16	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	11	16	6	4	Federal-NWA
Alberta	NE, NW, SE, SW	12	16	6	4	Federal-NWA
Alberta	NE, SE, SW	13	16	6	4	Federal-NWA/Suffield
Alberta	SW	14	16	6	4	Federal-NWA
Alberta	NE, NW, SE	14	16	6	4	Federal-NWA/Suffield
Alberta	SE	15	16	6	4	Federal-NWA
Alberta	NE, NW	15	16	6	4	Federal-NWA/Suffield
Alberta	SW	16	16	6	4	Federal-NWA/Suffield
Alberta	SE, SW	17	16	6	4	Federal-NWA/Suffield
Alberta	SE	18	16	6	4	Federal-NWA/Suffield
Alberta	NE, SE	24	16	6	4	Federal-NWA/Suffield
Alberta	SE	25	16	6	4	Federal-NWA/Suffield

Appendix D: 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](#)⁵. 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](#)'s⁶ (FSDS) goals and targets.

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.

A number of federally-listed species at risk exist within the potential range of Western Harvest Mouse including: Ord's Kangaroo Rat (*Dipodomys ordii*), Eastern Yellow-bellied Racer (*Coluber constrictor*), Burrowing Owl (*Athene cunicularia*), Loggerhead Shrike (*Lanius ludovicianus*), Common Nighthawk (*Chordeiles minor*), Sprague's Pipit (*Anthus spragueii*), Small-flowered Sand-verbena (*Tripterocalyx micranthus*), Tiny Cryptanthe (*Cryptantha minima*), Smooth Goosefoot (*Chenopodium subglabrum*), Slender Mouse-ear-cress (*Halimolobos virgata*), and Gold-edged Gem (*Schinia avemensis*).

Many of these species may benefit from recovery activities intended to recover the Western Harvest Mouse as most are prairie species that co-evolved with the Western Harvest Mouse and have similar ecological requirements. Management strategies should strive to benefit all target species and minimize negative effects on other native species. Efforts should be coordinated with other recovery teams working in the prairie ecosystem to help ensure the most efficient use of resources, and to prevent duplication of effort and conflicts with research. The creation of a multiple-species action plan may be beneficial for species inhabiting this ecosystem and should be considered (e.g. Multiple Species at Risk, or MultiSAR in Alberta, Downey et al. 2005).

This recovery strategy directly contributes to the goals and targets of the *Federal Sustainability Development Strategy for Canada*. Specifically, it contributes to Goal 5: "Wildlife Conservation – Maintain or restore populations of wildlife to healthy levels", and to Goal 6: "Ecosystem/Habitat Conservation and Protection- Maintain productive and resilient ecosystems with the capacity to recover and adapt".

⁵ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

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