

Management Plan for the Woodland Vole (*Microtus pinetorum*) in Canada

Woodland Vole



2015



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[Proposition] »

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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 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 Woodland Vole and has prepared this management plan as per section 65 of SARA. To the extent possible it has been prepared in cooperation with the provinces of Ontario (Ministry of Natural Resources and Forestry) and Quebec (Ministère des Forêts, de la Faune et des Parcs du Québec).

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 Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Woodland Vole 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 management plan was drafted by Tanya Pulfer (Consulting Ecologist). Development of this management plan was facilitated by Allison Foran (Environment Canada, Canadian Wildlife Service – Ontario). Early drafts of the plan were prepared by Jennie L. Pearce (Pearce & Associates Ecological Research) and David Kirk (Aquila Conservation & Environment Consulting). Amelia Argue, Jeff Bowman, Chris Risley (Ontario Ministry of Natural Resources and Forestry); and Don Sutherland (Ontario Natural Heritage Information Centre, Ontario Ministry of Natural Resources and Forestry) provided advice during management plan development. Contributions were provided by Graham Buck (Ontario Ministry of Natural Resources and Forestry), Jarmo Jalava (Carolinian Canada Coalition), and Dan Kraus (Nature Conservancy of Canada). The management plan benefited from input, review, and suggestions from the following individuals: Madeline Austen, Elizabeth Rezek and Lesley Dunn (Environment Canada, Canadian Wildlife Service – Ontario); Pierre-André Bernier and Sylvain Giguère (Environment Canada, Canadian Wildlife Service – Quebec).

Acknowledgement and thanks are given to all other parties that provided advice and

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

input used to help inform the development of this management plan including various Aboriginal organizations and individual citizens and stakeholders who provided input and/or participated in consultation meetings.

Executive Summary

The Woodland Vole (*Microtus pinetorum*) is listed as a species of Special Concern on Schedule 1 of the federal *Species at Risk Act* (SARA), and under the Ontario *Endangered Species Act, 2007* (ESA 2007; S.O. 2007, c. 6). It has no designated status in Quebec, but is listed on the *Liste des espèces susceptibles d'être désignées menacées ou vulnérables* (list of wildlife species likely to be designated threatened or vulnerable³); this list is produced according to the *Loi sur les espèces menacées ou vulnérables* (*Act Respecting Threatened or Vulnerable Species*; R.S.Q., c. E-12.01).

The Woodland Vole is a stocky, small, mammal that has thick, silky, chestnut fur; a short tail; and small eyes and ears. Although the Woodland Vole is wide-ranging in the United States, it has a limited distribution in Canada, with the only known locations in southwestern Ontario and in the administrative regions of Lanaudière, Estrie and Montérégie in Quebec. There are no population estimates for the Woodland Vole in Canada.

The Woodland Vole is a semi-fossorial⁴ species most commonly associated with deciduous forests and woodlands. The Woodland Vole spends a large portion of time underground in tunnel networks, burrows or nests. Little is known about the biology, ecology, distribution, population trends, and threats of the Woodland Vole in Canada. Intolerance to cold temperatures has been identified as a limiting factor for Woodland Voles. Current threats are thought to include: urban development, agricultural intensification, and forest harvesting.

The objective of this management plan is to maintain, and where feasible increase, its current distribution in Canada through the maintenance of habitat and reduction of threats and, where possible improve knowledge on distribution and biological needs (e.g. habitat requirements) of the species in Canada. Broad strategies to help achieve this management objective are outlined in Section 6.2 of this document and the conservation measures and implementation schedule are presented in Section 6.3.

Conservation of the Woodland Vole is also likely to benefit the environment, including a number of species at risk in Ontario and Quebec (Appendix A).

³ Species on this list receive special consideration for knowledge acquisition and may eventually become listed.

⁴ Digging or adapted for digging; burrowing underground.

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1. COSEWIC* Species Assessment Information

Date of Assessment: November 2010

Common Name (population): Woodland Vole

Scientific Name: *Microtus pinetorum*

COSEWIC Status: Special Concern

Reason for Designation: This small, rare mammal has a Canadian range restricted to highly fragmented areas of southern Ontario and southern Quebec. However, a lack of adequate monitoring effort and quantification of threats made the reassessment of this species difficult. There is no evidence to suggest its status has changed since it was last assessed. Threats appear to be limited and not imminent or increasing.

Canadian Occurrence: Ontario, Quebec

COSEWIC Status History: Designated Special Concern in April 1998. Status re-examined and confirmed in November 2001 and November 2010.

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

2. Species Status Information

Found throughout eastern North America, the global conservation rank for the Woodland Vole (*Microtus pinetorum*) is Secure⁵ (G5; NatureServe 2013a). Less than 2% of the species' global range is within Canada, where the Woodland Vole is considered nationally Vulnerable⁶ (N3) and the subnational conservation status is Vulnerable (S3) in the provinces of Ontario and Quebec, however, there is uncertainty of the status in Ontario (S3?⁷). In the United States the conservation status is Secure (N5), and the subnational conservation status varies from Critically Imperiled⁸ (S1) to Secure (S5) in the 35 states in which it is found (Appendix B).

⁵ Secure (G5/N5/S5): At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

⁶ Vulnerable (G3/N3/S3): At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

⁷ Inexact Numeric Rank (G/N/S#?): Denotes inexact numeric rank.

⁸ Critically Imperiled (G1/N1/S1): At very high risk of extinction in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

The Woodland Vole is listed as Special Concern⁹ in Canada on Schedule 1 of the federal *Species at Risk Act* (SARA). It is also listed as Special Concern¹⁰ in Ontario under the provincial *Endangered Species Act, 2007* (ESA). In Quebec, the Woodland Vole has no designated status, but is listed on the *Liste des espèces fauniques susceptibles d'être désignées menacées ou vulnérables* (list of wildlife species likely to be designated threatened or vulnerable); this list is produced according to the "*Loi sur les espèces menacées ou vulnérables*" (*Act Respecting Threatened or Vulnerable Species*).

3. Species Information

3.1. Species Description

The Woodland Vole has three distinguishing characteristics: its fur, size of tail, and size of eyes and ears. Woodland Voles have silky, thick, chestnut brown or slightly reddish fur on the back, with grayish fur underneath (COSEWIC 2010, WDNR 2013). Its tail is very short, ranging from 16 to 24 mm and is usually only 20% of its total length (roughly the size of their hind foot; COSEWIC 2010). Woodland Voles have smaller eyes and ears compared to most voles, an adaptation to underground living, referred to as a semi-fossorial lifestyle (COSEWIC 2010, Naughton 2012, WDNR 2013). They also have slightly larger front claws adapted for digging (COSEWIC 2010). The Woodland Vole is considered a small sized vole compared to other North American vole species, and adults typically range from 107 to 131 mm in length (Banfield 1974, Naughton 2012).

There is potential for confusion between the Woodland Vole and other short-tailed vole or lemming species. The three main species that have a similar appearance to Woodland Voles and have an overlapping distribution in Canada are the Meadow Vole (*Microtus pennsylvanicus*), Southern Red-backed Vole (*Myodes gapperi*) and, in particular, the Southern Bog Lemming (*Synaptomys cooperi*). Both the Meadow Vole and the Southern Red-backed Vole have tails longer than 26 mm (Naughton 2012, WDNR 2013). The Southern Bog Lemming has a tail that is similar in length and fur that is also similar in colour to the Woodland Vole. The main differences are that the Southern Bog Lemming's fur is coarsely textured (compared to silky) and it has a broad grooved upper incisor¹¹ that is absent in the Woodland Vole (Naughton 2012, Fauteux et al. 2014).

3.2. Population and Distribution

⁹ A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

¹⁰ A species that lives in the wild in Ontario and that may become threatened or endangered because of a combination of biological characteristics and identified threats.

¹¹ Front teeth on the upper jaw.

The Woodland Vole is found only in North America, ranging from the southern United States along the Gulf of Mexico to the Great Lakes in southern Ontario and Lake St-Pierre in southern Quebec, and from Nebraska and Texas to the Atlantic Coast (COSEWIC 2010, NatureServe 2013a; Figure 1). Within Ontario and Quebec, the Woodland Vole is restricted to the southern portions of each province in the Mixedwood Plains Ecozone, the Atlantic Highlands Ecozone and one observation was reported north of the St. Lawrence River, Quebec, within the Boreal Shield Ecozone (CCEA 2014; Figure 2). The Quebec and Ontario populations are separated by large distances, however the area in between has not been surveyed but does contain potentially suitable habitat for the species. In Ontario, suitable habitat for the Woodland Vole is fragmented which has likely resulted in the separation of Ontario local populations from low density populations in the United States (extant populations in New York and Michigan do not occur adjacent to the Canada-U.S. border; COSEWIC 2010). Barriers separating populations include large water bodies, busy roads and densely populated urban areas. However, the global (i.e., North American) distribution is thought to be continuous, as the Quebec populations are potentially connected to populations in northern Vermont and New York (COSEWIC 2010).

Woodland Vole home range size and dispersal distances are thought to be small in comparison to other species of voles. A study on Woodland Voles conducted in New York state reported that calculated mean home range values are 41.7 and 44.7 m² for females and males respectively (Fitzgerald and Madison 1983). Female Woodland Voles may disperse up to 300 m (Bowman et al. 2004); however the males may disperse even further during the breeding season to find a suitable mate (Fitzgerald and Madison 1983).

Population and distribution data on this species in Canada are lacking. There have been very few targeted surveys for Woodland Voles in Canada and occurrence data are often gathered only from general small mammal surveys (COSEWIC 2010). Population estimates from the United States are not thought to be representative of the Canadian populations (COSEWIC 2010).

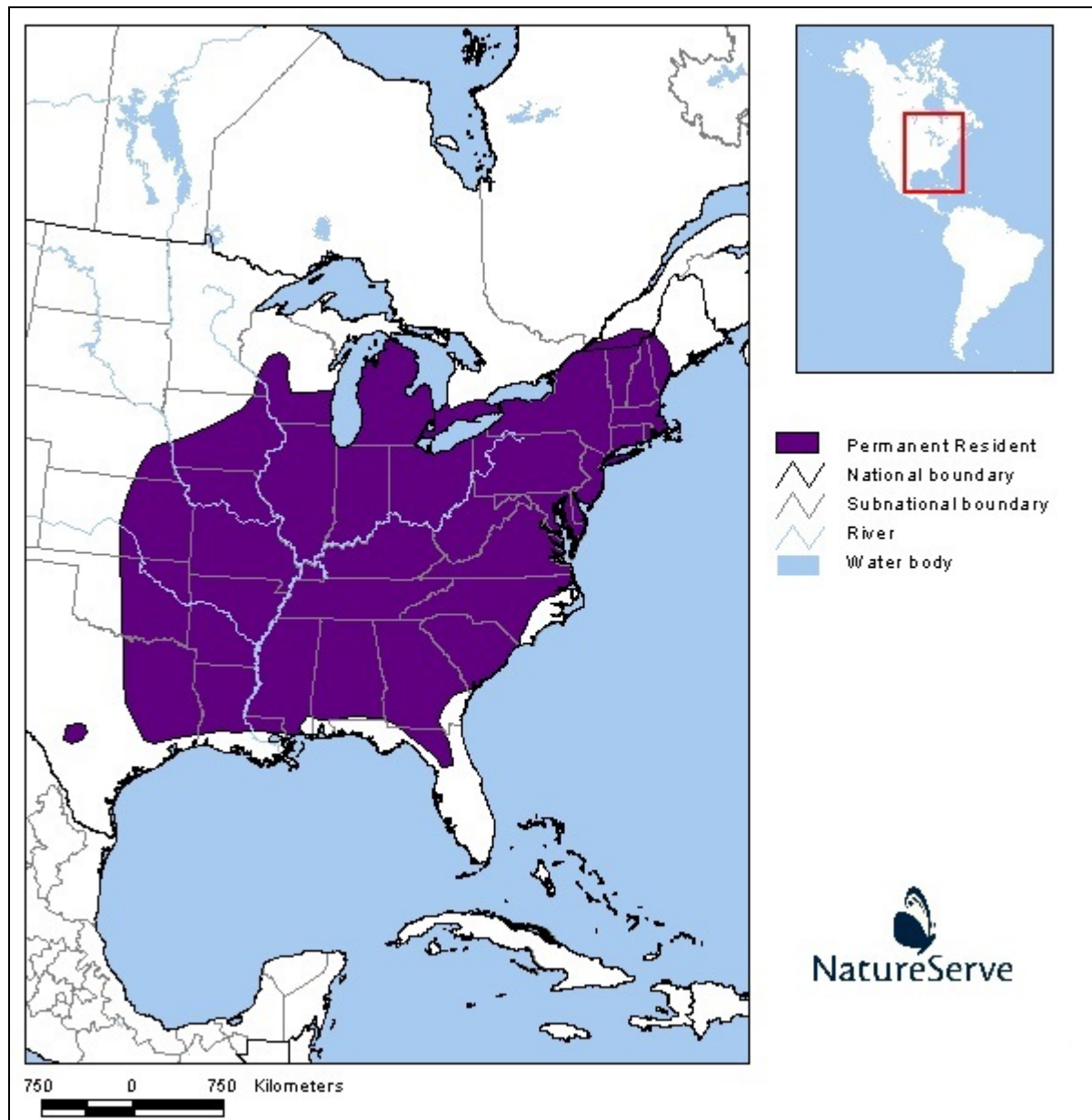


Figure 1. Approximate North American distribution of the Woodland Vole (modified from NatureServe 2013a). Note: This distribution does not include the record north of the St. Lawrence River in Quebec (see Figure 2).

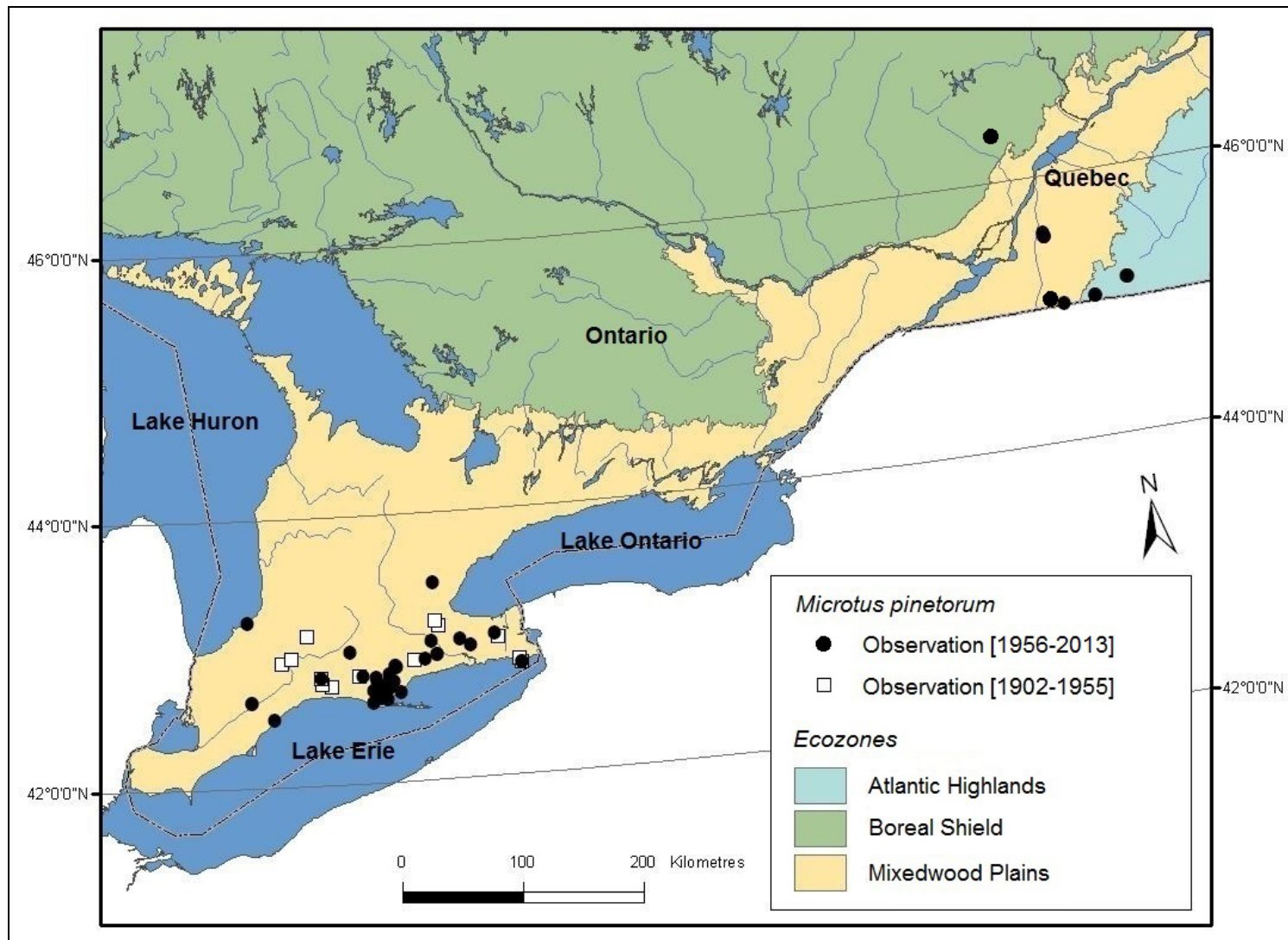


Figure 2. Observations of the Woodland Vole (*Microtus pinetorum*) in Canada by Ecozones during two time spans (1902-1955; 1956-2013) (modified from COSEWIC 2010).

3.3. Needs of the Woodland Vole

Like many short-lived species, Woodland Voles are prolific breeders, having multiple litters per year (average lifespan is 3-6 months; COSEWIC 2010). It is thought that breeding is more likely to occur in the warmer months (May to October in the Canadian range; Sutherland pers. comm. 2014). Depending on location this could mean 1 to 4 litters in a year, with more litters in the southern extent of the Woodland Vole's global range. Gestation¹² time is fairly typical compared to other species of voles (20 to 25 days; Golley 1961) with approximately 1 to 6 young in each litter (COSEWIC 2010).

Woodland Voles are terrestrial species that spend a large portion of their time below ground (COSEWIC 2010). Due to this semi-fossorial lifestyle, soil type and moisture are important habitat requirements for the Woodland Vole (Bowman et al. 2004). Woodland Voles prefer relatively light, friable¹³ soils that allow for easy digging (Fisher and Anthony 1980, Rhodes and Richmond 1985, Bowman et al. 2004). Soil moisture was also found to be important, as Woodland Voles are most often associated with well-drained soils (COSEWIC 2010). However, the species may disperse into swampy habitats with moist soils when at high densities (Hamilton 1938; Miller and Getz 1969; Rhodes and Richmond 1985; WDNR 2013). Underground nests are often associated with the base of trees or coarse woody debris (WDNR 2013).

Woodland Voles are habitat generalist species with an affinity towards forests with nearby open habitat (i.e., edge habitat). Vegetation type and cover are both influential to species distribution. Woodland Voles are most common in habitat with dense herbaceous vegetation, which is used for food and cover (Getz 1985). Dense vegetation acts to moderate the microclimate, reducing temperature and moisture stress on the species (Getz 1965, 1971). Based on capture records, Ross (1998) predicted they would regularly use marginal habitats adjacent to forests, particularly hedgerows in agricultural areas. Most of the habitat information available for Woodland Voles is from the United States where they seem to be a habitat generalist, occupying a range of habitats including heavy woods, damp bogs, and cultivated lawns (COSEWIC 2010). Similarly, in southwestern Ontario they have been found in most available habitats, including marginal lands such as hedgerows, but were most common in mesic mixed¹⁴ or dry deciduous forests (COSEWIC 2010). The areas where Woodland Voles have been observed in southwestern Ontario (St. Thomas and Niagara eco-districts) have a higher than average forest cover for this region of Ontario (COSEWIC 2010).

Although active year-round, low temperatures seem to be a limiting factor for the Woodland Vole (COSEWIC 2010, WDNR 2013). This may be due to the increased energy demand in low temperatures, despite behavioural changes to conserve heat and energy such as limiting above ground exposure and communal huddling (Bowman et al. 2004). There is no known research documenting temperatures in tunnel networks

¹² Internal carrying of the embryo or fetus by the female Woodland Vole.

¹³ Loose soil with a crumbly texture.

¹⁴ Deciduous forests with moist soils and coniferous trees as part of the canopy.

or in communal areas to determine lower temperature tolerances of the Woodland Vole at the northern extent of the species' range (Bowman et al. 2004).

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 or degradation						
Urban development, agricultural intensification, and forest harvesting	Medium	Widespread	Historic/ Current	Continuous	Unknown	Medium

¹ *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the conservation of the species, consistent with the management 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

In addition to the threats listed below, there are other possible threats to the Woodland Vole and its habitat that remain largely unknown including the impacts of forest insects and disease, and roads and trails. In the United States, Woodland Voles are considered an orchard pest. There is no evidence to suggest that Woodland Voles have invaded orchards and cultivated areas, or that poison is used to control them in Canada (COSEWIC 2010).

Urban development, agricultural intensification and forest harvesting

Habitat loss and degradation is considered the greatest threat to the Woodland Vole (COSEWIC 2010, WDNR 2013) and has occurred in all areas of the Woodland Vole's Canadian range (COSEWIC 2010). Habitat loss and degradation has been mainly attributed to urban development, agricultural expansion and forest conversion (Bélanger et al. 1999, Larson et al. 1999, COSEWIC 2010). Most of the landscape conversion happened in 1920's in southern Ontario and 1970's in southeastern Quebec with losses quantified as 90 and 70% respectively (Bélanger et al. 1999, Larson et al. 1999).

The Woodland Vole may occur on agricultural lands; however, agricultural intensification may reduce the habitat features required by the species through a change in the density of herbaceous vegetation.

The conversion of forest habitat results in the loss of two main habitat features required by the Woodland Vole: habitat connectivity and suitable soils (relatively dry, light, friable soils that promote easy digging). Suitable habitats can be connected through hedgerows and small remnant forests. The loss of forests and connecting features not only reduces available suitable habitat, but also the Woodland Vole's dispersal ability (COSEWIC 2010).

Forest harvesting can also result in alterations to the species' habitat. Short-term alterations may have a direct impact on this short-lived species. Clear-cut logging will result in an increase in light penetration and a reduction in soil moisture. Increased soil compaction through the use of heavy machinery or hardening of landscapes can also make the soils unsuitable for burrowing, thus reducing habitat availability (WDNR 2013). In addition, forest harvesting may increase the probability of propagules of invasive species being introduced on forestry equipment. These effects may result in habitat that is no longer suitable for the species.

Potential Threats

Invasive non-native earthworms

Non-native earthworms may reduce the availability of suitable habitat by reducing leaf litter to nearly bare soil (Alban and Berry 1994, Hale et al. 2005), altering plant and soil composition (Bohlen et al. 2004, Wironen and Moore 2006, Holdsworth et al. 2007), and decreasing diversity and abundance of tree seedlings and herbaceous plants (WDNR 2013, Sackett et al. 2012). This reduces food availability as well as ground cover that Woodland Voles are highly dependent on to conceal surface runways¹⁵ (Byman 2011, WDNR 2013). Invasive non-native earthworms have been identified as threats to forest ecosystems in southern Quebec and central Ontario (Wironen and Moore 2006, Sackett et al. 2012). Invasive non-native earthworms are considered a significant threat to Woodland Voles in the state of Wisconsin (WDNR 2013), but their impacts on Woodland Voles in Ontario and Quebec are not known.

Deer over-browsing

Over-browsing as a result of hyper-abundant populations of White-tailed Deer (*Odocoileus virginianus*) is thought to negatively impact small mammals through habitat loss, reduced food availability and increased direct competition for resources (Flowerdew and Ellwood 2001, Byman 2011). The extent of this threat is dependent on White-tailed Deer population abundance at specific locations and the deer management techniques applied at those locations. Results from a study conducted in Pennsylvania (Byman 2011) suggested that deer management techniques, such as exclosure fencing,

¹⁵ Paths created by Vole species when traveling above ground.

may significantly increase the number of Woodland Voles within a given area (Byman 2011). The impact of over-browsing by deer on the Woodland Vole in Canada is not known.

5. Management Objective

The management objective for the Woodland Vole is to maintain, and where feasible increase, its current distribution in Canada through the maintenance of habitat and reduction of threats and, where possible improve knowledge on distribution and biological needs (i.e. habitat requirements) of the species in Canada.

6. Broad Strategies and Conservation Measures

6.1. Actions Already Completed or Currently Underway

To date, only a few management initiatives specific to Woodland Vole have been undertaken; however, there are other broad scale habitat conservation initiatives that would also address habitats appropriate for the Woodland Vole.

Habitat suitability model

Bowman et al. (2004) created a habitat suitability model for Ontario. This model uses habitat preferences and limitations of Woodland Voles (e.g. soil type, vegetation community classification and temperature limitations) and compares this against spatial datasets. The result is a map of potential habitat for the Woodland Vole. Validation of this model (i.e. verifying whether the habitat mapping matches with habitat on the ground and determining if the species occurs at the indicated locations) has not been undertaken.

Targeted species surveys

The most recent comprehensive surveys for the Woodland Vole were completed as part of the Haldimand-Norfolk Inventory (Gartshore 1987). This survey data is housed in Ontario's Conservation Data Centre (Ontario Natural Heritage Information Centre, Ontario Ministry of Natural Resources and Forestry), however all records but one are considered historic by NatureServe standards (historic records are older than 20 years, indicating a need for sites to be revisited). While other surveys have been completed in areas in which voles are suspected to occur, none have yielded any confirmed Woodland Vole observations. Other surveyed areas include: Ganaraska (Bowman pers. comm. 2014), the Ruthven Park Lower Grand River Land Trust property, and the Ruigrok Tract Niagara Peninsula Conservation Authority property (Buck pers. comm. 2014).

The most recent Woodland Vole records include a capture in Quebec that was part of a general small mammal survey at the Phillipsburg Migratory Bird Sanctuary in 2006 (COSEWIC 2010), and in 2013 the first Woodland Vole was observed north of the St. Lawrence River during a survey carried out by the *Organisme des Bassins Versants de la Zone Bayonne* near Lac Mondor in the administrative region of Lanaudière

(Brouillette 2013; confirmed by Desrosiers pers. comm. 2014). The other six observations for this species in Quebec were recorded between 1956 and 1976 (COSEWIC 2010). The *Small mammals and bats database*, developed by the Ministère des Forêts, de la Faune et des Parcs (MFFP), includes occurrence records of small mammals, including the Woodland Vole, in an effort to collect information on small mammals and expand the knowledge of the distribution of Woodland Voles and other small mammal species in Quebec. This database led to the publication of the *Atlas des micromammifères du Québec* (Atlas of the Small Mammals of Quebec; Desrosiers et al. 2002), and is also a data source for the *Centre de données sur le patrimoine naturel du Québec* (Quebec CDPNQ).

There is only one record of the species in Ontario since 1998 (COSEWIC 2010).

Land conservation

There are a number of conservation organizations and land trusts operating in the known range of the Woodland Vole that have identified its habitat in their plans. For example, the Carolinian Canada Coalition has identified the Woodland Vole as an indirect target in the majority of their Conservation Action Plans (Jalava pers. comm. 2014). These plans outline targets for woodland stewardship, restoration and land protection activities, which would benefit both Woodland Voles and their habitat. The Nature Conservancy of Canada has identified the Woodland Vole in many Natural Area Conservation Plans across the known range in Ontario and Quebec. These plans have large land acquisition (habitat protection) goals for forest and woodland habitats (Kraus pers. comm. 2014).

A number of regulations and policies may also protect the habitat of the Woodland Vole in southern Ontario and Quebec. For example, within the provincial crown lands which are Ontario Parks and Conservation Areas the *Provincial Parks and Conservation Reserves Act* would apply. The *Niagara Escarpment Planning and Development Act*¹⁶ and the *Greenbelt Act, 2005*¹⁷ protect certain private lands. Other land use planning tools may also apply including the Ontario Natural Heritage Reference Manual (OMNR 2010) and the Best Practices Guide to Natural Heritage Systems Planning (Ontario Nature 2014). The Woodland Vole's habitat in Quebec receives some protection from *An Act Respecting the Lands in the Domain of the State* (R.S.Q., c. T-8.1) and the *Sustainable Forest Development Act* (R.S.Q., c. A-18.1).

6.2. Broad Strategies

The broad strategies to manage the Woodland Vole in Canada are as follows:

1. Determine the current distribution and, where possible, abundance of the Woodland Vole in Canada;

¹⁶ http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90n02_e.htm

¹⁷ http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_05g01_e.htm

2. Address ecological and biological knowledge gaps that benefit Woodland Vole conservation;
3. Investigate and quantify threats to the Woodland Vole and their habitat;
4. Support stewardship activities and outreach programs that mitigate threats and conserve suitable habitat.

6.3. Conservation Measures

Table 2. Conservation Measures and Implementation Schedule

Conservation Measure	Priority ¹⁸	Threats or Concerns Addressed	Timeline
1. Determine the current distribution			
1.1 Research, field test, and implement a monitoring protocol for the Woodland Vole to determine distribution (and where possible, abundance) for each population and look for evidence of recruitment and/or breeding.	High	Knowledge gaps	2015-2020
1.2 Consolidate information for all search efforts conducted for the Woodland Vole through various organizations and submit to appropriate Conservation Data Centres in Ontario and Quebec. Revisit all observations in Canada to determine if they are extant or historical and if appropriate habitat still exists in those areas.	High	Habitat loss or degradation	Ongoing
1.3 Validate the existing habitat suitability model for Ontario (Bowman et al. 2004) through ground truth methods and targeted trapping.	High	Knowledge gaps	2015-2020
1.4 Create a habitat suitability model for Quebec based on the Ontario model, if validation of Ontario model shows it to be effective.	High	Knowledge gaps	2015-2020
1.5 Support monitoring activities in existing conservation properties with Woodland Vole occurrences and/or habitat. Promote targeted surveys for the Woodland Vole in suitable unsurveyed habitat.	Medium	Knowledge gaps	2015-2025
2. Address knowledge gaps			
2.1 Investigate and describe habitat use by Woodland Voles in Canada including ecosystem type, minimum patch size, home	Medium	Knowledge gaps	2015-2025

¹⁸ 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 species. Medium priority measures may have a less immediate or less direct influence on reaching the management population and distribution objectives, but are still important for management of the population. Low priority recovery 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 species.

range size, temperature tolerance, and soil types.			
3. Investigate and quantify threats			
3.1 Encourage studies that determine the home range size and the use of various habitats within the home ranges of the Woodland Vole to help mitigate the effects of forest fragmentation on the species.	Medium	Habitat loss or degradation	Ongoing
3.2 Investigate the severity and impacts of existing and potential threats (e.g., non-native invasive earthworms, deer over-browsing, targeted pest control, forest insects and disease, and roads and trails) on both Woodland Voles and their available habitat.	High	Habitat loss or degradation	2015-2020
4. Support stewardship activities and outreach programs			
4.1 Promote awareness and stewardship to increase conservation and restoration of the Woodland Vole's habitat (forests and other areas with dense herbaceous cover and adjacent open areas); encourage landowners and land trusts to implement effective conservation tools and stewardship options.	High	Habitat loss or degradation	Ongoing
4.2 Improve communications with municipalities, provinces, and individuals (specifically forest managers, woodlot owners and orchard owners) about the Woodland Vole, its habitat needs and management options.	Medium	Habitat loss or degradation	Ongoing

7. Measuring Progress

Every five years, success of the implementation of this management plan will be measured against the following performance indicators:

- Efforts to conserve the habitat and reduce threats to the Woodland Vole in Canada have been implemented;
- Known populations of Woodland Vole and the habitat where it is currently known to occur have been maintained;
- Number of targeted surveys has increased; and
- Research has been implemented and has increased knowledge of distribution, biological requirements, habitat use, potential threats and needs of the Woodland Vole in Canada.

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Appendix A: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [*Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*](#)¹⁹. 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 achievement of any of the [*Federal Sustainable Development Strategy*](#)'s²⁰ (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans may 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.

It is anticipated that conservation measures for the Woodland Vole should lead to the conservation of additional species that use forest and edge habitats, as well as species that prey on the Woodland Vole. Promoting outreach and stewardship practices to forest and woodland managers will help species using forest habitats. Inventory and monitoring activities will have little or no negative effect on other species and may support surveys for other small mammal species and incidental sightings of non-target species. Addressing knowledge gaps and investigating threats will also benefit other species facing similar threats and with similar biology or ecology. Some examples of species at risk that will benefit from these conservation measures are listed below in Table 3.

¹⁹ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

²⁰ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

Table 3. Species at risk that may benefit from conservation measures directed at the Woodland Vole.

Common Name	Scientific Name	SARA Status	Province
Acadian Flycatcher	<i>Empidonax virescens</i>	Endangered	Ontario
American Columbo	<i>Frasera caroliniensis</i>	Endangered	Ontario
Barn Owl	<i>Tyto alba</i>	Endangered	Ontario
Cerulean Warbler	<i>Setophaga cerulea</i>	Special Concern	Ontario, Quebec
Cucumber Tree	<i>Magnolia acuminata</i>	Endangered	Ontario
Eastern Flowering Dogwood	<i>Cornus florida</i>	Endangered	Ontario
Eastern Foxsnake (Carolinian population)	<i>Pantherophis gloydi</i>	Endangered	Ontario
Eastern Milksnake	<i>Lampropeltis triangulum</i>	Special Concern	Ontario, Quebec
Gray Ratsnake (Carolinian population)	<i>Pantherophis spiloides</i>	Endangered	Ontario
Prothonotary Warbler	<i>Protonotaria citrea</i>	Endangered	Ontario
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Threatened	Ontario, Quebec
Red Mulberry	<i>Morus rubra</i>	Endangered	Ontario
Round-leaved Greenbrier	<i>Smilax rotundifolia</i>	Threatened	Ontario
Short-eared Owl	<i>Asio flammeus</i>	Special Concern	Ontario, Quebec
Small Whorled Pogonia	<i>Isotria medeoloides</i>	Endangered	Ontario

Appendix B: Subnational conservation ranks for the Woodland Vole

Table 4. Subnational Conservation Status Ranks (S-Ranks) for the Woodland Vole (*Microtus pinetorum*) in Canada and the United States of America (NatureServe 2013a).

Subnational Rank	State/Province
SNR	Florida, Missouri, Ohio, South Carolina
S1	Maine, Nebraska,
S2	Wisconsin
S3	Iowa, Minnesota, Quebec, Texas, Vermont
S3?	Ontario
S3S4	Michigan
S4	Delaware, District of Columbia, Indiana, Louisiana, New Hampshire, New Jersey, West Virginia
S5	Alabama, Arkansas, Connecticut, Georgia, Illinois, Kansas, Kentucky, Maryland, Massachusetts, Mississippi, New York, North Carolina, Oklahoma, Pennsylvania, Tennessee, Virginia
SU	Rhode Island

Rank Definitions (NatureServe 2013b)

SNR: Unranked - National or subnational conservation status not yet assessed.

S1: Critically Imperiled – At very high risk of extinction in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

S2: Imperiled - At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

S3: Vulnerable - At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

S4: Apparently Secure - At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

S5: Secure - At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

SU: Unrankable – Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

S#S#: **Range Rank** – a numeric range rank (e.g. S4S5) is used to indicate the range of uncertainty about the exact status of a taxon or ecosystem type. Ranges cannot skip more than one rank (e.g. SU should be used rather than S1S4).

S#?: Inexact Numeric Rank – Denotes inexact numeric rank (e.g. S3?).