

Recovery Strategy for the Golden-winged Warbler (*Vermivora chrysoptera*) in Canada

Golden-winged Warbler



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

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Golden-winged Warbler and has prepared this strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Provinces of Manitoba (Manitoba Conservation), Ontario (Ministry of Natural Resources and Forestry) and Quebec (Ministère du Développement durable, de l'Environnement et de la Lutte contre les Changements Climatiques).

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 and Climate Change Canada and the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Golden-winged Warbler 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 and Climate Change Canada, the Parks Canada Agency 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.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, there may be future regulatory implications, depending on where the critical habitat is identified. SARA requires that critical habitat identified within a national park named and described in Schedule 1 to the *Canada National Parks Act*, the Rouge National Urban Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* be described in the *Canada Gazette*, after which prohibitions against its destruction will apply. For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies. For any part of critical habitat located on non-federal lands, if the competent minister forms the

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

opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

ACKNOWLEDGMENTS

The recovery strategy was developed by Christian Friis and Kathy St. Laurent (Canadian Wildlife Service (CWS) – Ontario); Christian Artuso (Bird Studies Canada); Ken De Smet (Manitoba Conservation); Paul Goossen (retired, formerly CWS – Prairie and Northern) and Ron Bazin (CWS - Prairie and Northern); Vincent Carignan and Benoît Jobin (CWS – Quebec); Rob Rempel and Fred Pinto (Ontario Ministry of Natural Resources); Chris Robinson (Ontario Ministry of Natural Resources - Ontario Parks); and Rachel Vallender (CWS - National Capital Region). In part, this strategy was based on a draft recovery strategy that was prepared by Allan Harris of Northern Bioscience Ecological Consulting in 2007.

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EXECUTIVE SUMMARY

The Golden-winged Warbler (*Vermivora chrysoptera*) is listed as Threatened on Schedule 1 of the *Species at Risk Act* (SARA). It is a relatively small, migratory songbird distinguished by its grey back, white belly, yellow forehead and a yellow patch on its wings. Golden-winged Warblers are found in early successional habitats (or habitats exhibiting early successional characteristics), usually with dense herbaceous growth mixed with extensive patches of dense shrubby growth along with scattered taller trees adjacent to a forested edge.

The species' range extends from Canada, through the United States to Central and South America, and includes the Greater Antilles and some Caribbean Islands. In Canada, the species is found only during the breeding season in the provinces of Manitoba, Ontario and Quebec, with limited confirmed breeding events in Saskatchewan. Canada is estimated to support 17% of the global breeding population, most of which occurs in Ontario.

Recent analyses of Breeding Bird Survey data indicate that Golden-winged Warbler populations in Canada have remained relatively stable over the long-term (1970-2012). However, trends are variable across the range with declines being noted in the southern portions of its Canadian range while new or larger-than-originally-estimated populations were being found in Manitoba.

Primary threats identified for the Canadian population of the Golden-winged Warbler include: hybridization and competition with the closely related Blue-winged Warbler (*Vermivora cyanoptera*), loss of habitat due to wide-scale maturation of young forest and old fields, breeding and wintering habitat loss or degradation due to human activities, accidental mortality from collisions with man-made structures and nest parasitism by Brown-headed Cowbirds (*Molothrus ater*). Further investigation into breeding habitat requirements and levels of hybridization and parasitism are required to fully understand the extent to which these factors threaten the species.

There are unknowns regarding the feasibility of recovery of the Golden-winged Warbler. Nevertheless, in keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery is determined to be feasible.

The population and distribution objectives in Canada are, to the extent possible, maintain self-sustaining populations in the focal areas in Manitoba, Ontario and Quebec while maintaining, at a minimum, the current abundance of approximately 35,000 pairs. The broad strategies to be taken to address the threats to the survival and recovery of the species are presented in the section on Strategic Direction for Recovery (section 6.2).

Critical habitat for the Golden-winged Warbler in Canada is partially identified in this recovery strategy based on the best available information at this time. Critical habitat in Canada is identified based on habitat occupancy and suitable habitat. Identification of additional critical habitat and/or refinement of existing critical habitat for the Golden-winged Warbler in Canada will occur as additional information becomes available.

One or more action plans will be completed for the Golden-winged Warbler and posted on the Species at Risk Public Registry by December 2022.

RECOVERY FEASIBILITY SUMMARY

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Golden-winged Warbler. In keeping with the precautionary principle, a full recovery strategy has been prepared as would be done when recovery is determined to be feasible.

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

Yes. There are individuals currently available that are capable of reproduction which would be able to sustain the current population or increase its abundance. In Canada, there are an estimated 35,000 breeding pairs. Though most areas within the North American range contain hybrid individuals, genetically pure individuals can be found throughout the Canadian range, particularly in northwestern Manitoba where the highest proportion of genetically pure individuals occur (Vallender et al. 2009).

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

Yes. Sufficient suitable habitat is currently available to support the population of the Golden-winged Warbler in Canada. Habitat management techniques exist to create and improve habitat for Golden-winged Warblers (see Golden-winged Warbler Working Group 2013 and supplement) and thus additional suitable habitat could be made available. The species prefers early-successional habitat in many parts of its range; therefore, to maintain habitat in a suitable state (i.e., delay natural succession to forest), ongoing management or disturbance will be required. Habitat management or restoration techniques require further investigation to ensure that high quality suitable habitat continues to be available.

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

Unknown. Some threats, such as habitat loss or degradation, can be avoided or mitigated through recovery actions. Best management practices (see Golden-winged Warbler Working Group 2013 and Bakermans et al. 2011) exist to guide land owners and land managers in undertaking habitat management for Golden-winged Warblers, including practices relevant to the habitat types most important to the species within its Canadian range. It should be noted that the provision of suitable habitat does not address the threat of hybridization and it is unlikely that the primary threat of genetic introgression³, caused by hybridization with the Blue-winged Warbler, can be avoided. However, a better understanding of the specific habitat characteristics differentiating Golden-winged and

³ The introduction of genes from one species into the gene pool of another species, occurring when matings between the two produce fertile hybrids.

Blue-winged warbler habitat selection could lead to techniques and strategies that could reduce (i.e., mitigate) the rates of hybridization.

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

Unknown. Recovery techniques exist or could be developed within a reasonable timeframe to support the population and distribution objectives outlined in this strategy. For example, stewardship initiatives and habitat management techniques exist (or could be expanded/improved) to ensure sufficient habitat is available to maintain species' abundance. However, habitat management techniques (e.g., controlled burns) that ensure suitable habitat remains available require testing for feasibility and effectiveness. Integration of Golden-winged Warbler habitat needs in land use plans and forestry operating plans could also be pursued. Studies to better understand habitat types that contribute to Golden-winged Warbler reproductive success can lead to the development of additional habitat management techniques to support self-sustaining populations.

TABLE OF CONTENTS

PREFACE	i
ACKNOWLEDGMENTS	iii
EXECUTIVE SUMMARY	iv
RECOVERY FEASIBILITY SUMMARY	iv
1. COSEWIC Species Assessment Information	1
2. Species Status Information	1
3. Species Information	2
3.1 Species Description	2
3.2 Population and Distribution	3
3.3 Needs of the Golden-winged Warbler	6
4. Threats	8
4.1 Threat Assessment	8
4.2 Description of Threats	9
5. Population and Distribution Objectives	12
6. Broad Strategies and General Approaches to Recovery	15
6.1 Actions Already Completed or Currently Underway	15
6.2 Strategic Direction for Recovery	17
6.3 Narrative to Support the Recovery Planning Table	19
7. Critical Habitat	20
7.1 Identification of the Species' Critical Habitat	20
7.2 Habitat Suitability	21
7.3 Habitat Occupancy	23
7.4 Application of the Critical Habitat Criteria	25
7.5 Schedule of Studies to Identify Critical Habitat	27
7.6 Activities Likely to Result in the Destruction of Critical Habitat	27
8. Measuring Progress	32
9. Statement on Action Plans	32
10. References	33
Appendix A: Conservation Ranks of the Golden-winged Warbler in the United States	38
Appendix B: Grid Squares Identified as Containing Critical Habitat for the Golden-winged Warbler (<i>Vermivora chrysoptera</i>) in Manitoba	40
Appendix C: Grid Squares Identified as Containing Critical Habitat for the Golden-winged Warbler (<i>Vermivora chrysoptera</i>) in Ontario	49
Appendix D: Grid Squares Identified as Containing Critical Habitat for the Golden-winged Warbler (<i>Vermivora chrysoptera</i>) in Quebec	54
Appendix E: Detailed Biophysical Attributes of Suitable Breeding Habitat for the Golden-winged Warbler	57
Appendix F: Effects on the Environment and Other Species	59

1. COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2006

Common Name (population): Golden-winged Warbler

Scientific Name: *Vermivora chrysoptera*

COSEWIC Status: Threatened

Reason for Designation: This small songbird has declined by 79% over the last 10 years according to Breeding Bird Survey data from Canada. The main threat appears to be competition and genetic swamping (hybridization) from the closely-related Blue-winged Warbler, which is spreading north because of habitat change and perhaps climate change.

Canadian Occurrence:** Manitoba, Ontario, Quebec

COSEWIC Status History: Designated Threatened in April 2006.

*COSEWIC – Committee on the Status of Endangered Wildlife in Canada

** The breeding range of the Golden-winged Warbler has expanded (and continues to expand) into Saskatchewan though only one confirmed breeding event has been recorded (Buehler et al. 2007; Smith 1996).

2. SPECIES STATUS INFORMATION

The percentage of the global breeding population of the Golden-winged Warbler found in Canada is estimated to be 17% with most of the Canadian population (86%) occurring in Ontario (Partners in Flight 2013). In Canada, the Golden-winged Warbler is listed as Threatened⁴ on Schedule 1 of the federal *Species at Risk Act* (SARA). Under provincial species at risk legislation, the Golden-winged Warbler is listed in Ontario as Special Concern⁵ under the *Endangered Species Act, 2007* (ESA). In Quebec, it is listed on the *Liste des espèces susceptibles d'être désignées menacées ou vulnérables* (list of wildlife species likely to be designated threatened or vulnerable⁶); this list is produced according to the "*Loi sur les espèces menacées ou vulnérables*" (RLRQ, c E-12.01) (Act respecting threatened or vulnerable species) (CQLR, c E-12.01). In Manitoba, the Golden-winged Warbler is listed as Threatened under the *Endangered Species and Ecosystems Act* (ESEA). There is no current designation for the Golden-winged Warbler in Saskatchewan under provincial legislation.

⁴ A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

⁵ A native species that is sensitive to human activities or natural events which may cause it to become endangered or threatened.

⁶ Species on this list receive special consideration for knowledge acquisition and may eventually become listed.

The global status for the Golden-winged Warbler is Apparently Secure (G4) (NatureServe 2014; see Appendix A for definitions). The International Union for Conservation of Nature (IUCN) lists the species as Near-threatened⁷ globally (IUCN 2010).

In the United States (U.S.), the Golden-winged Warbler has a patchy range throughout the Appalachian Mountains of the eastern U.S.; the national conservation status for the breeding population is Apparently Secure (N4B) (NatureServe 2014; see Appendix A for state conservation ranks and definitions). In Canada, the Golden-winged Warbler range extends from Saskatchewan to eastern Ontario and southwestern Quebec; the national conservation rank for the breeding population in Canada is Apparently Secure (N4B) (NatureServe 2014). The subnational (i.e., provincial) conservation ranks for the breeding population are Vulnerable (S3), Apparently Secure (S4) and Imperilled (S2) for Manitoba, Ontario and Quebec, respectively (NatureServe 2014); there is no rank available for Saskatchewan as occurrences are sporadic with limited confirmed breeding events.

3. SPECIES INFORMATION

3.1 Species Description

The Golden-winged Warbler is a small (8 – 11 g) wood warbler. Both sexes are mostly grey with yellow wing patches and crown. The male has a black eye patch and throat, somewhat resembling a Black-capped Chickadee (*Poecile atricapillus*). The female is similar, but less strikingly-coloured than the male (Confer et al. 2011). Hybrids (first generation and back-crosses⁸) of this species with the Blue-winged Warbler (*Vermivora cyanoptera*) can be difficult to differentiate, and recent genetic work suggests that cryptic hybrids⁹ (i.e., phenotypic¹⁰ Golden-winged Warblers with a Blue-winged Warbler genetic component) likely exist in most breeding populations in Ontario, portions of the Quebec breeding population and were recently detected in Manitoba (Van Wilgenburg unpubl. data; Vallender et al. 2009; Vallender unpubl. data) (see section 4.2 for more details). Golden-winged x Blue-winged warbler hybrids were initially believed to represent separate species, Brewster's Warbler and Lawrence's Warbler, with each displaying a mix of characteristics of the parental species (Confer et al. 2011).

⁷ Species or lower taxa that may be considered threatened with extinction in the near future.

⁸ To cross the genes of a first generation hybrid with either of the original parent species.

⁹ Individuals that contain genetic material from both Golden-winged and Blue-winged warblers but only show the visual characteristics of one species. A cryptic hybrid looks like a Golden-winged Warbler but contains genetic material of both Blue-winged and Golden-winged warbler. The Blue-winged Warbler genetic material is not shown in the visual markings of the individual.

¹⁰ Phenotypic characteristics are those that are visible. For example, a phenotypic Golden-winged Warbler displays Golden-winged Warbler markings (black eye patch and throat, yellow wing patches and crown) which are visual characteristics generally used to reliably identify the species.

3.2 Population and Distribution

The North American breeding range of the Golden-winged Warbler extends from Saskatchewan to eastern Ontario and southwestern Quebec, and south through the Appalachian Mountains of the eastern U.S. (Figure 1). Wintering range includes the Caribbean, Central America (Guatemala, Honduras, Nicaragua, Costa Rica and Panama) and northern South America (Colombia, Venezuela) (COSEWIC 2006; Figure 1). Migration occurs in the spring from early April to mid-June and in the fall from early August to mid-October.

The Canadian range includes regions within four provinces (Quebec, Ontario, Manitoba and Saskatchewan) (Figure 1). In Saskatchewan, only one probable breeding record exists; however, there are several additional reports of possible breeding in the southeast along the Saskatchewan-Manitoba border (i.e., Porcupine Hills and Duck Mountain) (Smith 1996). Focal areas known to contain core populations are identified in the *Golden-winged Warbler (Vermivora chrysoptera)* *Status Assessment and Conservation Plan* (Roth et al. 2012) (Figure 2).

Sources suggest that the northern edge of the Golden-winged Warbler breeding range has generally expanded further north since the 1980s with a subsequent contraction along the southern edges in Canada and the U.S. (Cadman et al. 2007; Buehler et al. 2007). However, the northern expansion in Ontario and Quebec is thought to have levelled-off in the mid-1990s though continues to expand northwest into Saskatchewan (COSEWIC 2006; Buehler et al. 2007; Artuso 2009). Range contraction along the southern edge of the range has been linked to various factors including genetic swamping by Blue-winged Warblers, declines in habitat availability and climate change (Hitch and Leberg 2007; Confer et al. 2011).

The Golden-winged Warbler had been declining in areas of its range (i.e., southern Canada and in the United States) for at least 30 years (between 1974 and 2004) (COSEWIC 2006). The best estimate of the global population size in 2013 was 205,000 breeding pairs, of which 35,000 pairs occurred in Canada (Partners in Flight 2013). In Canada, dramatic declines of 79% between 1993 and 2002 were documented, equating to a 14.4% decrease per year (COSEWIC 2006). However, recent analyses of Breeding Bird Survey (BBS) trend estimates for Canada indicate a stable long-term population trend (+0.23% per year between 1970 and 2012) (Environment Canada 2014). The short-term population trend between 2002 and 2012 was -6.78% per year; however, short-term trends are considered to be of low overall reliability¹¹ (Environment Canada 2014).

In Manitoba it is estimated that 2,000 pairs occur, although the population might be higher (Partners in Flight 2013; COSEWIC 2006). Surveys by Artuso (2009) and others have provided a conservative estimate of at least 4,600 males in Manitoba, with potential for additional surveys to discover as-yet-unknown populations (COSEWIC 2006; Artuso 2009). The apparent increase observed in Manitoba does not necessarily indicate an increasing population trend; rather, it reflects that more comprehensive surveys have been conducted. The Ontario population is estimated to be approximately 30,000 pairs (Partners in Flight 2013). In southern Quebec,

¹¹Overall reliability: the minimum category of the three primary credibility measures: geographic coverage, model fit and precision (<http://www.ec.gc.ca/ron-bbs/P004/A002/?lang=e&m=s&r=GWWA&p=S>).

Golden-winged Warblers occur along the Ontario border and the U.S. border (near New York and Vermont). The Quebec population is estimated at 105 to 145 breeding males (Regroupement QuébecOiseaux 2015); numbers in Quebec have remained relatively stable over the short-term though range contraction continues in eastern Quebec (Carignan pers. comm. 2014).



Figure 1. Year-round range of the Golden-winged Warbler in North America (adapted from Roth et al. 2012).

3.3 Needs of the Golden-winged Warbler

Breeding Habitat

Habitat selection by the Golden-winged Warbler appears to occur at multiple scales (Thogmartin 2010; Moulton and Artuso unpubl. data). Forest landscapes are initially selected and within these forested areas, Golden-winged Warblers are found nesting in a shifting mosaic of suitable habitat, often created by disturbance (Thogmartin 2010; Roth et al. 2012; Moulton and Artuso unpubl. data). The composition of the landscape may be as important as the composition of the local nesting and foraging habitat itself. Thus, suitable breeding habitat for the Golden-winged Warbler consists of nesting and foraging habitat that is found within a forest landscape. The components of each are described below.

Forest Landscapes

There is mounting evidence that Golden-winged Warblers require large forest landscapes. Thogmartin (2010) found a strong positive association between Golden-winged Warbler presence and total forest cover on the landscape (~28 x 28 km scale). This is further supported by recent survey work that did not find Golden-winged Warblers in locations in Manitoba that were surrounded by non-forest (i.e., agricultural cropland at a 5 x 5 km scale) (Moulton and Artuso unpubl. data). The species will not typically persist in highly fragmented, urbanized or predominantly agricultural landscapes (5 x 5 km scale) (Roth et al. 2012).

There is currently a limited understanding of broad scale habitat selection by Golden-winged Warblers across the Canadian range; however, based on currently available information originating from other parts of the Great Lakes Conservation Region (see Figure 2), the Golden-winged Warbler is associated with landscapes¹² containing a 50-75% forest cover that is composed of at least 50% deciduous (or mixed) forest types and contain less than 30% coniferous forest cover (Bakermans et al. 2011; Roth et al. 2012).

Nesting/Foraging

Breeding Golden-winged Warblers are associated with early successional habitat (or habitats exhibiting early-successional habitat characteristics). At the breeding territory scale (up to 6 ha per pair; average 1-2 ha per pair), Golden-winged Warbler habitat is comprised of a dynamic combination of herbaceous elements (e.g., grasses and forbs), woody shrubs/saplings, and scattered canopy trees and mature forest. The basic requirements – a patchy mixture of shrubs, saplings, herbaceous openings, and widely spaced tall trees – are similar regardless of habitat type (Roth et al. 2012). In most circumstances some forest edge habitat is used (e.g., a combination of early successional habitat alongside a mature forest edge) (Confer and Knapp 1981; Frech and Confer 1987; Confer 1992; Dunn and Garrett 1997). Trees are used primarily for song posts and foraging and transitional edges of forests are often used for nest placement. The basic patch-level configuration is usually set within a landscape of primarily deciduous forest (Roth et al. 2012).

¹² For the purposes of identifying Golden-winged Warbler broad-scale habitat, the landscape refers to the area within a 2.5 km radius (roughly 5 x 5 km) of an occupied site (e.g., nest or territory).

Early successional habitat is often short-lived, existing as optimal nesting and foraging habitat for Golden-winged Warblers generally for one to 15 years (and up to thirty years) post-disturbance (Roth and Lutz 2004; COSEWIC 2006; Bakermans et al. 2011), requiring breeding populations to colonize recently disturbed habitat when previous nesting areas become overgrown with forest. Short-lived early successional habitat can occur in commercially-managed stands such as recently logged areas, along utility and road rights-of-way and regenerating abandoned farmland as well as in naturally-occurring stands such as recently burned areas and natural forest gaps (Confer and Knapp 1981; Dunn and Garrett 1997; Roth and Lutz 2004; COSEWIC 2006; Confer et al. 2011). Early successional habitat characteristics may occur in a relatively stable state such as in alder (*Alnus* spp.) swamps, tamarack (*Larix laricina*) bogs, stunted oak (*Quercus* spp.), open jack pine (*Pinus banksiana*), beaver meadows, shrubby stream borders and areas such as rocky barrens undergoing poor aspen/poplar (*Populus* spp.) regeneration (Confer et al. 2011; see also references in COSEWIC 2006).

In a naturally functioning ecosystem (one with few large and/or intensive human disturbances), the availability of suitable nesting and foraging habitat for the Golden-winged Warbler is a product of the natural frequency and intensity of disturbances such as small-scale agriculture, natural- and human-induced fire, insect infestations, seasonal storms, wind events and beaver-induced flooding. In a highly human-modified ecosystem, the availability of suitable nesting and foraging habitat can be the product of activities such as forestry operations, utility and road right-of-way maintenance and low-density livestock grazing. The Golden-winged Warbler has evolved to capitalise on the dynamic habitat created by periodic disturbances.

Migration and Wintering Habitat

Although limited information exists on habitat use during migration, use of forest edge and tall second-growth, including woodlands, are suggested (Confer 1992; Dunn and Garrett 1997; AOU 1998).

Wintering habitat consists of woodland canopy, partially open or less dense forests and forest borders or gaps (Confer et al. 2011). In Central America and northern South America, wintering habitat consists of high-elevation open pine-oak forest and woodland, especially along forest edges. Lowland, drier habitat is sometimes also used in the wintering range, but there seems to be a greater preference for woodlands, including riparian forests (Confer 1992; Dunn and Garrett 1997; Buehler et al. 2007; Confer et al. 2011).

4. THREATS

4.1 Threat Assessment

Table 1. Threat Assessment Table.

Threat	Level of Concern ^{T1}	Extent	Occurrence	Frequency	Severity ^{T2}	Causal Certainty ^{T3}
Natural Processes or Activities						
Hybridization and competition with Blue-winged Warblers	High	Widespread	Historic, Current	Seasonal	High	High
Nest parasitism by Brown-headed Cowbirds	Low	Widespread	Current	Seasonal	Unknown	Medium
Changes in Ecological Dynamics or Natural Processes						
Wide-scale maturation of young forest and old fields and reduction of shrub/herbaceous layer	Medium	Widespread	Historic, Current	Continuous	Moderate	Medium
Habitat Loss or Degradation						
Loss of wintering habitat through development and other activities	Medium	Widespread	Current	Continuous	Unknown	Medium
Loss of breeding habitat through development and other activities	Medium	Widespread	Historic, Current	Continuous	Moderate	Medium
Accidental Mortality						
Accidental mortality from collisions with man-made structures	Medium	Widespread	Current	Seasonal	Moderate	Medium

^{T1} 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.

^{T2} Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).

^{T3} 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

Threats are presented in order of decreasing level of concern. Hybridization and competition with the Blue-winged Warbler is considered the primary threat to the persistence of the Golden-winged Warbler in Canada.

Hybridization and Competition with Blue-winged Warblers

Blue-winged Warblers pose a double threat to Golden-winged Warblers; firstly because they exhibit similar life history traits thereby creating competition for resources (e.g., territories, food and nesting materials), and secondly because the offspring produced through hybridization (the act of reproduction between different species) are viable thereby allowing for further genetic dilution (Confer et al. 2011). After deglaciation of eastern North America approximately 10,000 years ago, the ranges of these species were largely non-overlapping (Gill 1980). With widespread land clearing for agriculture, Blue-winged Warblers moved into the range of the Golden-winged Warbler, which also had expanded due to similar land-clearing practices and the successional stages that followed (Gill 1980).

Hybridization has occurred with great frequency wherever the two species' ranges are overlapping and has led to the decline of Golden-winged Warbler populations throughout their breeding range. Golden-winged Warblers may be extirpated from these overlapping areas within 50 years after contact (Gill 1997) and possibly as soon as 4 to 5 years (COSEWIC 2006) though the reason for this remains unresolved. Potential refugia for Golden-winged Warblers occur in areas where Blue-winged Warblers do not breed including the northern edge of the Golden-winged Warbler's range, higher elevations and swamps (Confer et al. 2010).

The extent of the Blue-winged Warbler range in Ontario did not expand greatly between the first breeding bird atlas project (1981-1985) and the second (2001-2005) though considerable in-filling occurred (Vallender 2007). Blue-winged Warbler nest records in Quebec were first noted in 1986 (SOS-POP 2015; Regroupement QuébecOiseaux 2015); Golden-winged x Blue-winged hybrids (mainly Brewster's Warbler) occur mainly in the parts of the Quebec breeding range situated south of the St. Lawrence River. Although hybridization with Blue-winged Warblers may not have been the main driving force behind the initial decline of Golden-winged Warblers in Quebec, reports of Blue-winged Warblers and hybrids are increasing along the Quebec-U.S. border and have been found as far north as the Outaouais region (Carignan pers. comm. 2014). The presence of Blue-winged Warblers and hybrids has been reported with some frequency within most of the Ontario range and very rarely (until recently) in Manitoba at the northwestern limit of the range (COSEWIC 2006; Artuso 2009).

Genetic screening on 1,427 Golden-winged Warblers collected from populations throughout the breeding range in North America confirmed the presence of cryptic hybrids in all regions, except those found within Riding Mountain National Park (266 individuals) and the Duck Mountain (14 individuals) in western Manitoba (Vallender et al. 2009). In 2010, additional samples were collected in southeastern Manitoba and western Ontario (i.e., Rainy River and surrounding area). Prior to the analysis of these samples, it was assumed that these two breeding areas also remained unaffected by hybridization. However, two breeding Golden-winged Warblers each in the southeastern area of Manitoba and the Rainy River area were classified as cryptic hybrids.

Moreover, the first phenotypic hybrid (a male “Brewster’s Warbler”) was documented in Riding Mountain National Park in 2010 (Van Wilgenburg unpubl. data). In 2012, approximately 130 additional samples were collected in the southeastern region of Manitoba; results of genetic analysis found that 6% of the birds sampled were hybridized individuals (Moulton et al. unpubl. data).

Wide-scale Maturation of Young Forest and Old Fields and Reduction of Shrub/Herbaceous Layer

While beneficial for some forest species, widespread forest succession has likely contributed to the decline of Golden-winged Warbler populations over much of eastern North America. Maintaining suitable nesting and foraging habitat for Golden-winged Warblers (i.e., early successional forest) requires periodic disturbance from events such as logging, fire, flooding via beaver activities, or wind. Breeding populations will not persist in areas that do not have both the early and late succession components in close proximity; nor will they persist in areas where the forest matures and trees replace the shrubs and herbaceous vegetation (Confer and Knapp 1981; Frech and Confer 1987). Before European contact, natural disturbance caused by fire, flooding, insects and wind, along with slash and burn agriculture by Aboriginal people, probably maintained and created patches of suitable habitat. Wide-scale abandonment of farmland across much of eastern North America, beginning in the early to mid-1800s, led to an increase of suitable nesting and foraging habitat as fields became overgrown with shrubs. As this land reverted to forest, and in conjunction with increased fire suppression, an overall decrease in the availability of early successional scrubby habitats resulted (Confer and Pascoe 2003; Dettmers 2003; Gill 2004; Confer et al. 2011). For example, the population formerly found on the north shore of Lake Erie has all but disappeared as a result of habitat loss due to forest succession (Buehler et al. 2007; Cadman et al. 2007).

Reduction of the herbaceous layer of Golden-winged Warbler nesting and foraging habitat may also occur as the result of invasive species. For example, Common Buckthorn (*Rhamnus cathartica*) and Glossy Buckthorn (*R. frangula*), both invasive species, can shade out hardwood regeneration and exclude herbaceous plants, causing bare soil conditions beneath buckthorn stands (Knight et al. 2007). Declines in native woody and herbaceous cover have been noted in association with the presence of non-native earthworms (Hale et al. 2006; Holdsworth et al. 2007). In addition, non-native earthworms can facilitate invasion by other non-native species through changes in the soil composition and leaf litter (Nuzzo et al. 2009).

Loss of Wintering Habitat through Development and Other Activities

Wintering habitat trends are poorly understood; however, links can be made between deforestation in high-elevation oak forests and conversion to ranch and agricultural use in Central America and South America and subsequent declines in Golden-winged Warbler populations (Buehler et al. 2007). In addition, forests that appear to be important for Golden-winged Warblers during the wintering season are under pressure to be developed for agriculture and urban land uses resulting in deforestation and fragmentation (Confer et al. 2011). Differences in wintering habitat preference and availability between Golden-winged and Blue-winged warblers exist; Golden-winged Warblers are associated more with forested habitat while Blue-winged Warblers are associated more with young second-growth and scrub (Gill et al. 2001; Confer et al. 2011). However, it is unclear if the availability of habitat on the

wintering ground correlates to population-level effects (e.g., differential survival rates); winter ecology for both species is poorly documented.

Loss of Breeding Habitat through Development and Other Activities

Breeding habitat has been lost to ongoing human development in the core areas of the Canadian population and threatens the amount of suitable habitat available to breeding pairs (Confer et al. 2011). For example, rural development in the St. Genevieve area of Manitoba is a current threat to Golden-winged Warbler breeding habitat. Most industrial, commercial and residential developments remove habitat for the Golden-winged Warbler permanently. Agricultural intensification in some areas has resulted in old fields being put back into production or used for intensive livestock grazing, further reducing breeding habitat for Golden-winged Warblers.

Accidental Mortality from Collisions with Man-made Structures

In North America, the total number of birds (all species) killed from collisions with communication towers is estimated at 4 to 5 million individuals per year (Longcore et al. 2013). In addition, the total number of birds (all species) killed by collisions with windows is estimated at 3.5 million to 5 billion individuals per year (Klem 1990; Hager et al. 2008; Banks 1979). In Canada, the number of birds killed annually by human-related activities is approximately 270 million (Calvert et al. 2013), including 23,000 annually from wind turbines, 25 million annually from collisions with windows and 2.5 to 25.6 million annually from collisions with transmission lines (Zimmerling et al. 2013; Machtans et al. 2013; Rioux et al. 2013).

The Golden-winged Warbler has been termed a “super-collider” and appears to suffer exceptionally high mortality from collisions with man-made structures than would be expected by chance based on their population size (Arnold and Zink 2011; Confer et al. 2011). Longcore et al. (2013) determined that collisions with communication towers accounted for 2.5% (range 1.2 to 5.0%) of annual mortality in the Golden-winged Warbler population though Arnold and Zink (2011) found no discernible effect on population trends. Accidental mortality from collisions with man-made structures is an ongoing threat especially considering increasing development of communication towers and wind turbines.

Nest Parasitism by Brown-headed Cowbirds

Nest parasitism by Brown-headed Cowbirds (*Molothrus ater*) has contributed to the Golden-winged Warbler decline in some areas. A survey of several hundred nests from the eastern U.S., including central Michigan, New York and eastern New Jersey, determined that 30% of nests had at least one cowbird egg (Coker and Confer 1990). The rate of parasitism varies greatly; up to 35% of nests were parasitized in New York State compared with 3.8% in one study from Ontario (Confer et al. 2003; Fraser unpubl. data). Confer et al. (2003) found more than one third of Golden-winged Warbler nests within their study population in New York State were parasitized, resulting in a 17% reduction in the number of fledged Golden-winged Warblers as a result of parasitism. The overall effect of cowbird parasitism on Golden-winged Warbler populations in Canada is unknown. Cowbirds are less common and more variably distributed in the extensively forested northern parts of the Golden-winged Warbler’s range where agricultural land is less common, as compared to south of the Canadian Shield (Graham 1987).

5. POPULATION AND DISTRIBUTION OBJECTIVES

Historical (pre-settlement) population levels of the Golden-winged Warbler are unknown and historical suitable habitat availability is speculated to have been lower than current levels; range expansion and population increases during the 1800s and 1900s were likely facilitated by large-scale man-made disturbance (Confer et al. 2011). The Golden-winged Warbler took advantage of habitat created from the abandonment of large-scale land clearing associated with early agricultural practices and the creation of early-successional habitat through forest harvesting. The species has exhibited declines in certain portions of its range partially as a result of reversion of these lands to dense forest. Recent analyses (up to 2012) of BBS data indicate a stable population trend for Canada over the long-term (1970-2012), which may indicate that the Golden-winged Warbler population is leveling off to a more natural state. Given this, and the uncertainty around historical population levels, the population and distribution objective for the Golden-winged Warbler is:

- to the extent possible, maintain self-sustaining populations¹³ in the focal areas (Figure 2) in Manitoba, Ontario and Quebec while maintaining, at a minimum, the current abundance of approximately 35,000 pairs in Canada.

It is recognized that hybridization with the Blue-winged Warbler is unlikely to be avoided and the genetic introgression observed to date cannot be reversed. Though genetic introgression can be a means to introducing beneficial genetic diversity into the gene pool, it becomes a concern when one species' genetic make-up is almost entirely replaced (Rheindt and Edwards 2011). Recent and rapid introgression of Blue-winged Warbler genetic material into the Golden-winged Warbler gene pool has been documented, including into areas of Manitoba that were once thought to contain only pure Golden-winged Warbler individuals. The majority of more recent genetic data (Dabrowski et al. 2005; Vallender et al. 2007a, 2007b, 2009) suggest that hybridization is occurring in both directions and thus the reason for the replacement of Golden-winged Warblers with Blue-winged Warbler is largely unresolved. Reducing the rates of hybridization to limit the replacement of Golden-winged Warblers by Blue-winged Warblers will be required to maintain self-sustaining populations of Golden-winged Warblers. Potential refugia for Golden-winged Warblers occur where Blue-winged Warblers do not breed including the north western edge (i.e., north western Manitoba) of the Golden-winged Warbler's range, and higher elevations and swamps in certain areas of the range (e.g., Appalachian Mountains and New York, respectively) (Confer et al. 2010). However, further research is required to clarify the specific habitat characteristics differentiating Golden-winged and Blue-winged warbler habitat selection in Canada to support the development of techniques and strategies that could reduce (i.e., mitigate) the rates of hybridization.

The Golden-winged Warbler distribution is dynamic in response to the short-lived nature of the availability of its preferred breeding habitat and, therefore, their distribution is not expected to be

¹³ Self-sustaining means a population that is: 1) on average stable or growing (i.e., more births than deaths), 2) is large enough to survive random events (severe weather) and human-caused pressures, 3) does not need on-going management (e.g., predator control, captive-breeding), and 4) survives over the long-term (i.e., 50 years) (Environment Canada 2012).

stable at a local scale¹⁴ within the breeding range in Canada. In addition, range expansion and contraction has been documented throughout the species' range in North America. Abundance estimates based on BBS data have high uncertainty. Due to these factors, quantitative abundance objectives are not set for any Canadian province within the range of the Golden-winged Warbler.

The population estimate for the Golden-winged Warbler in Canada is based primarily on BBS data, which have limitations. The current abundance of Golden-winged Warblers in Canada is a rough estimate and obtaining a more accurate estimate would require intensive surveys covering the species' entire range in a wide variety of terrains and locations, including extensive genetic testing due to the presence of cryptic hybrids. In addition, BBS survey techniques do not require visual confirmation of the species' identity. Since hybridized individuals can sing either parental song, detecting the presence of cryptic hybrids in the population or obtaining an accurate population estimate using current survey methods will be challenging. An updated COSEWIC status report is currently in development which may provide additional insight into the Canadian population size of Golden-winged Warbler. Until such information is available, a precautionary approach is being taken to maintain the current abundance of 35,000 pairs. Should new information related to population size become available, the population and distribution objective may be updated in an amended recovery strategy.

The focal areas identified within the *Golden-winged Warbler (Vermivora chrysoptera) Status Assessment and Conservation Plan* (Roth et al. 2012), and adapted¹⁵ within this recovery strategy (Figure 2), will be an important basis for meeting this objective. Focal areas are defined as places:

- where Golden-winged Warblers are consistently present (i.e., persistent breeding);
- that are important for sustaining the current breeding distribution; and,
- that will become particularly important for expanding the population into adjacent areas (Roth et al. 2012).

The focal areas are currently known to contain core populations of breeding Golden-winged Warblers where hybridization and competitive interactions with Blue-winged Warblers are reduced. Within focal areas, a dynamic habitat supply system is able to operate that provides the biophysical attributes needed by Golden-winged Warblers. Areas in Canada where Blue-winged and Golden-winged warblers currently co-exist (e.g., southern Ontario) may not provide the conditions that are beneficial to the long-term recovery of the species and focussing conservation efforts in these areas could further exacerbate the threat of hybridization and competition posed by Blue-winged Warblers. Further research to determine the optimal breeding habitat attributes for the Golden-winged Warbler (i.e., those that do not promote Blue-winged Warbler populations) is required before areas outside of the focal areas can be considered beneficial to recovery.

¹⁴ The local scale is considered the breeding territory scale (i.e., nesting and foraging habitat); up to 6 ha per pair, average 1-2 ha per pair.

¹⁵ Adaptations made within this recovery strategy to the focal areas defined for Canada in the *Golden-winged Warbler (Vermivora chrysoptera) Status Assessment and Conservation Plan* (Roth et al. 2012), to better capture more recent empirical evidence in Quebec, include: the addition of one focal area (GL17) in the Gatineau region of Quebec and a slight alteration of the northern boundary of focal area GL14.

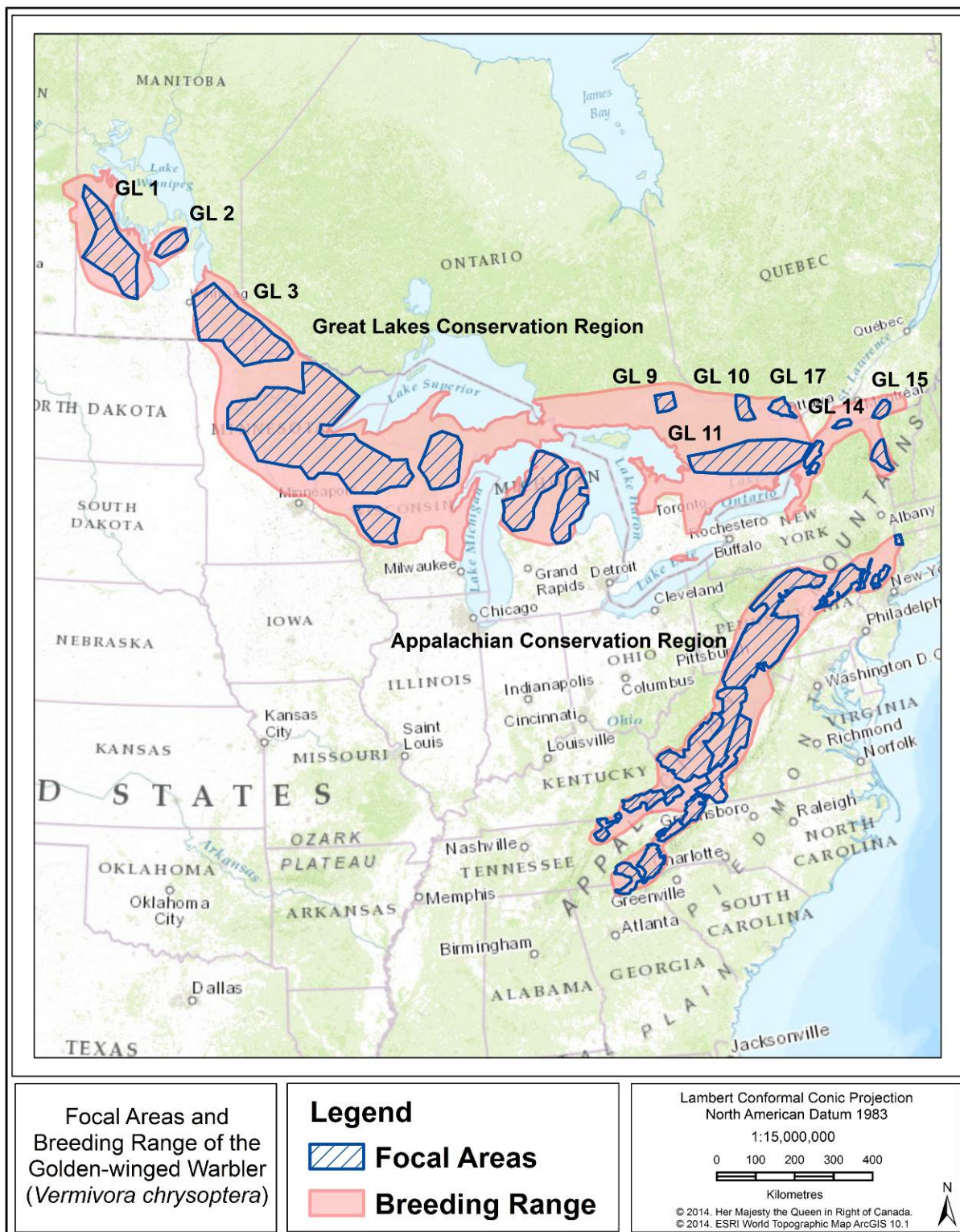


Figure 2. Golden-winged Warbler Focal Areas Identified in the Current Breeding Range (adapted from Roth et al. 2012). Focal areas with portions in Canada labelled; GL=Great Lakes. All Golden-winged Warblers in Canada are considered part of the Great Lakes (vs. Appalachian) Conservation Region as identified in Roth et al. (2012). Focal areas GL 4-8, GL 12-13 and GL 16 occur wholly in the U.S. and are not labelled in this figure.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Targeted Golden-winged Warbler surveys and on-going atlassing efforts in Manitoba are underway to determine the extent of the Golden-winged Warbler range in central Canada. Studies to understand demography, productivity and genetic status are being undertaken (Moulton and Artuso, unpubl. data). Targeted surveys along with habitat assessments were undertaken in Ontario in 2012 with continued efforts in 2013 and 2014, including the use of song recording devices. Surveys for Golden-winged Warblers were conducted predominantly in GL 10 and GL 11 while surveys for Blue-winged Warblers necessitated going outside of focal areas (Bird Studies Canada and Canadian Wildlife Service, unpubl. data).

In Quebec, an assessment of suitable habitat and targeted surveys since 2008, particularly in focal area GL 14, identified new occurrences of the Golden-winged Warbler. Targeted surveys are also being planned in focal area GL 15 (Regroupement QuébecOiseaux 2015). Efforts for the Breeding Bird Atlas are underway in Quebec which will help to gain a better understanding of the species' distribution and make it possible to compare any changes in distribution that have occurred since the 1980s. Since 1994, there has been an on-going monitoring program and the development and maintenance of a database (SOS-POP) for bird species at risk observations in Quebec. In addition, Regroupement QuébecOiseaux is conducting a pilot project in collaboration with over twenty landowners and more than a dozen partners (including Hydro-Québec and forest managers) to develop strategies and techniques to maintain suitable habitat on private land and utility rights-of-way located in focal area GL14.

The genetic status of Golden-winged Warblers in Canada has been the focus of intensive study since 2000. Vallender et al. (2007a, 2007b, 2009, unpubl. data) surveyed numerous sites in Ontario (Long Point, Elgin, Rainy River, Barrie), Manitoba (Riding Mountain National Park, Duck Mountain, Steinbach) and Quebec (Godmanchester, Hinchinbrooke, Outaouais), as part of a range-wide examination of genetic purity in this species (Vallender et al. 2009). Additional assessment of the genetic status of Golden-winged Warbler populations across North America, through mitochondrial DNA assays and nuclear markers using samples collected in 2012, were undertaken in 2013 (Moutlon et al. unpubl. data).

An intensive study combining both genetic and stable isotope analyses is currently being carried out in the mid-western and northwestern portions of the Golden-winged Warbler breeding range (primarily Minnesota, U.S. and Manitoba). Results from this work are expected to improve the understanding of rates of introgression and patterns of dispersal in this species.

A telemetry study was conducted on nine male Golden-winged Warblers in the GL14 focal area of Quebec (Carginan pers. comm. 2013) in 2013. The project aims to provide a better understanding of habitat composition and use of Golden-winged Warbler territories in Quebec. Results to date indicate significant use of the mature forest component of the territory and that overall habitat composition is more varied than previously thought (Carginan pers. comm. 2014).

Environment and Climate Change Canada led the development of all-bird conservation strategies in each of Canada's Bird Conservation Regions (BCRs) by drafting strategies that integrate new and existing plans into an all-bird framework. Canada has 12 BCRs, yet because of the enormous size of the boreal BCRs and to facilitate implementation for certain BCRs, several strategies were prepared based on political sub-units. These integrated all-bird conservation strategies serve as a framework for implementing bird conservation across Canada, as well as in other countries important to Canada's migrant birds. Environment and Climate Change Canada developed national standards for the strategies to ensure a consistent approach. Specific implementation plans can be developed for each BCR, building on the programs currently in place through Joint Ventures or other partnerships. The Golden-winged Warbler is considered a species of Continental Concern¹⁶ within each of the BCRs in Canada in which it occurs (i.e., BCRs 6, 11, 12, 13 and 14) and a species of Regional Concern¹⁷ in BCR 13 (Ontario and Quebec).

The Golden-winged Warbler Working Group¹⁸ is currently developing the *Golden-winged Warbler (Vermivora chrysoptera) Status Assessment and Conservation Plan*. This plan is made up of four chapters: 1) Golden-winged Warbler Status Review, 2) Golden-winged Warbler Full Life Cycle Conservation Strategy, 3) Golden-winged Warbler Breeding Season Conservation Plan, and 4) Golden-winged Warbler Non-breeding Season Conservation Plan (chapters 2 and 3 were published as Roth et al. 2012; chapters 1 and 4 are still in development). The plan aims to cover both breeding and non-breeding season issues and threats including strategies for conservation and plan implementation internationally. The plan provides the most recent scientific information available about Golden-winged Warbler distribution, habitat selection at multiple scales and management effects on the species. The goal of the plan is to develop a long-term conservation and implementation strategy to halt the decline of populations range-wide and eventually increase populations, especially in areas with small populations where extirpation is imminent. This recovery strategy includes components (e.g., focal areas, habitat multiplier and landscape context) of the *Golden-winged Warbler (Vermivora chrysoptera) Status Assessment and Conservation Plan* and integrates these components with the objectives identified in this document.

The Ontario Ministry of Natural Resources has developed forest management standards and guidelines for the Golden-winged Warbler in the *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (OMNR 2010). For example, new roads, landings and aggregate pits are not permitted within suitable wetland habitats occupied by Golden-winged Warblers. In addition, water drawdown or other activities that may alter water levels/water regimes of the suitable occupied wetland habitat are not permitted (OMNR 2010).

¹⁶ Species of Continental Concern are those listed on the Partners in Flight (PIF) Watch List and which are considered the most vulnerable at the continental scale due to a combination of small and declining populations, limited distributions and high threats throughout their ranges.

¹⁷ Species of Regional Concern are those for which combined factors such as high threats, population decline and limited distributions make the species vulnerable within a BCR. These factors may or may not be evident at a continental scale for a particular species.

¹⁸ The Golden-winged Warbler Working Group is comprised of over 75 representatives/members from the United States, Canada and Latin America including ornithologists, conservationists, and managers from academia, federal and state agencies, international non-governmental organizations, and industry.

6.2 Strategic Direction for Recovery

Table 2. Recovery Planning Table.

Threat or Limitation	Broad Strategy to Recovery	General Description of Research and Management Approaches	Priority ¹
Hybridization and competition with Blue-winged Warblers; Wide-scale maturation of young forest and old fields and reduction of shrub/herbaceous layer; Loss of breeding habitat through development and other activities	Management and Stewardship of the Species' Habitat	<ul style="list-style-type: none"> Develop habitat management techniques, or identify existing practices, that reduce the threats associated with hybridization and genetic swamping. 	High
		<ul style="list-style-type: none"> Investigate techniques and develop guidelines and/or identify existing practices, to create and maintain suitable habitat (including control of invasive species, where necessary) through, for example, commercial forestry and management of old fields and rights-of-way. 	High
		<ul style="list-style-type: none"> Develop and implement techniques to measure and track the amount of critical habitat available over time to ensure a sufficient amount of critical habitat is being maintained in Canada. 	High
		<ul style="list-style-type: none"> Ensure a constant supply of suitable habitat within focal areas by integrating Golden-winged Warbler habitat needs in, for example, land-use plans and forestry operating plans. 	High
		<ul style="list-style-type: none"> Establish stewardship agreements and working relationships and investigate opportunities to secure habitat, particularly in areas where suitable habitat occurs in a more stable state (e.g., stunted oak and rock barrens). 	High
Knowledge gaps concerning population size and distribution; Hybridization and competition with Blue-winged Warblers	Inventory and Monitoring	<ul style="list-style-type: none"> Implement the existing standard protocol to monitor Golden-winged Warbler and Blue-winged Warbler populations (Golden-winged Warbler Working Group 2010) and determine extent of range in Canada. 	High
		<ul style="list-style-type: none"> Determine suitable nesting and fledgling habitat requirements and availability at the regional level (e.g., provincial scale, Bird Conservation Region scale). 	High
		<ul style="list-style-type: none"> Determine habitat types that are most productive to the species' reproductive success. 	High

Hybridization and competition with Blue-winged Warblers; Accidental mortality from collisions with man-made structures; Nest parasitism by Brown-headed Cowbirds	Research	<ul style="list-style-type: none"> Continue to assess the significance of hybridization with Blue-winged Warblers and effects on Golden-winged Warbler populations across the Canadian range. 	High
		<ul style="list-style-type: none"> Determine the significance of accidental mortality from collisions with man-made structures considering other sources of human-caused mortality when those other sources are additive. If determined to limit the species' ability to maintain self-sustaining populations, implement available mitigation techniques. 	Medium
		<ul style="list-style-type: none"> Determine the significance of cowbird parasitism on Golden-winged Warbler nesting success across the Canadian range. If determined to limit the species' productivity and recruitment, investigate and develop mitigation techniques. 	Low
Knowledge gaps concerning wintering range, wintering habitat requirements and threats to wintering areas; All threats	Communication and Partnerships	<ul style="list-style-type: none"> Collaborate and develop partnerships with agencies and organizations that are working on recovery efforts in the United States, the Caribbean, Central America and South America to share information and approaches and to better understand wintering and migration habitat requirements and availability, wintering ground distribution and migratory patterns. 	Medium

¹ "Priority" reflects the degree to which the broad strategy 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

The main threat to the species is hybridization with the Blue-winged Warbler. Continued assessment of the significance of hybridization with Blue-winged Warblers (e.g., through DNA analysis) and the impacts on Golden-winged Warbler populations across the Canadian range is required to support recovery. A better understanding on the current rates of hybridization is needed to obtain accurate estimates of population size and trends of genetically pure Golden-winged Warblers to allow for measuring progress towards recovery objectives. Habitat management techniques aimed at creating and maintaining Golden-winged Warbler habitat in a way that minimizes the suitability for Blue-winged Warblers, and thus reduces the threat of hybridization, need to be developed and implemented.

For the time being, in Canada, habitat management techniques used to create and maintain suitable habitat for the Golden-winged Warbler should occur in the focal areas identified in Figure 2 and specifically within the grid squares containing critical habitat (Appendices B, C and D). However, not all areas within a focal area may be appropriate for habitat management. Management recommendations should be based on producing favourable demographic parameters, particularly nest productivity and minimizing hybridization with the Blue-winged Warbler (Roth et al. 2012). Organizations and land managers wanting to conduct habitat management or habitat improvement for the Golden-winged Warbler are encouraged to consult the best management practices currently available for the species (see Bakermans et al. 2011, Roth et al. 2012 and Golden-winged Warbler Working Group 2013). Habitat management outside of focal areas will become increasingly important as populations increase outside of the current focal areas to ensure suitable habitat is available for the expanding population.

Habitat management will be successful through integration with other management plans and existing practices that focus on early successional forest and shrub habitats and species associated with the Golden-winged Warbler, particularly through integration with commercial forestry activities and rights-of way and old field management. In addition, exploring opportunities for securing habitat and establishing stewardship agreements are high priorities. These tools will be particularly important in areas where suitable habitat exists as a more stable resource (e.g., stunted oak and rock barrens) as these habitats have a longer life span and do not require the same level of management to maintain their suitability (as compared to early-successional habitat originating from disturbance). It will be important to develop a system to measure and track the amount of available suitable habitat in the focal areas over time to ensure that critical habitat targets are being met and to ensure that the amount of critical habitat for the Golden-winged Warbler does not fall below that identified (see section 7) as a result of both natural (e.g., forest maturation) and human-caused (e.g., development) pressures.

Population inventories and monitoring to gain a better understanding of Golden-winged Warbler and Blue-winged Warbler distribution in Canada will help to focus recovery actions, including monitoring range expansion and contraction. Other knowledge gaps that could be filled (or are currently being filled) through population inventories and monitoring include: determination of suitable nesting and fledgling habitat, fecundity and survivorship in different habitat types, especially a comparison between habitats originating from man-made (e.g., rights-of-way, logging, agriculture) versus natural (e.g., fire, beaver activity, wind throw and tree fall gaps)

disturbance; determination of habitat types that are most productive to the species' reproductive success and whether any particular habitat or human activity is associated with an ecological trap or population sink; and landscape ecology and habitat preference uncertainties (Artuso 2009). Research pertaining to the effects of Brown-headed Cowbird nest parasitism, Blue-winged Warbler competition and mortality from collisions with man-made structures on the Golden-winged Warbler population is also recommended.

Developing and fostering new and existing stewardship and working relationships, particularly with industry, corporations, and non-governmental organizations, will ensure the successful implementation of recovery activities defined above. Sharing of knowledge and collaboration with U.S. partners working on conservation and recovery initiatives within the Golden-winged Warbler breeding range in the U.S. is fundamental to successful recovery of the species across its North American range. International partnerships will be beneficial to understanding migration and wintering habitat needs and threats, and conserving these habitats where they exist.

7. CRITICAL HABITAT

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Under SARA, critical habitat is "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". This federal recovery strategy identifies critical habitat to the extent possible, based on the best available information for the Golden-winged Warbler as of August 2013; more precise boundaries may be mapped, and additional critical habitat may be added in the future if additional research supports the inclusion of areas beyond those currently identified.

7.1 Identification of the Species' Critical Habitat

The key to the identification of critical habitat for the Golden-winged Warbler is achieving and maintaining processes within the focal areas that allow for the on-going availability of habitat preferred by the species to carry out its life processes. Critical habitat for the Golden-winged Warbler is the habitat that meets the breeding habitat needs of the species (i.e., nesting/foraging habitat within forest landscapes; see section 3.3) currently available within known occupied areas of the focal areas in Canada. Critical habitat for the Golden-winged Warbler in Canada is partially identified in this recovery strategy. To be confident that the critical habitat amounts and configuration will support recovery of the species in the long-term, further study is required to confirm the presence of breeding Golden-winged Warblers in insufficiently sampled areas and to understand the factors influencing Golden-winged Warbler habitat selection at multiple scales.

Although there is habitat supporting Golden-winged Warbler breeding outside of identified focal areas (e.g., southern Ontario), these habitats contribute considerably less to population persistence due to their low relative abundance of Golden-winged Warblers. These areas also have experienced range contraction owing primarily to past (and current) genetic pressure from Blue-winged Warbler. The threat of hybridization reduces the overall quality of these areas and

thus the contribution to Golden-winged Warbler recovery in Canada. There is currently limited information available relating to the co-existence of the two species and/or management techniques to minimize hybridization. As such, the critical habitat for the Golden-winged Warbler is identified in the focal areas where recovery efforts should be concentrated at this point in time (Figure 2).

An evaluation of the critical habitat criteria identifies 304 10 x 10 km Standardized UTM grid squares that contain critical habitat for the Golden-winged Warbler in Canada within eight of the nine focal areas (or portions of) in Canada (section 7.4; Appendices B, C and D). Within these grid squares, suitable habitat used by the Golden-winged Warbler is dynamic and its location may change annually as affected by the natural and human disturbance mechanisms that create and maintain it.

The identification of critical habitat for the Golden-winged Warbler is based on two criteria: habitat suitability and habitat occupancy.

7.2 Habitat Suitability

This criterion refers to the biophysical attributes necessary for Golden-winged Warblers to breed in Canada. Suitable habitat for the Golden-winged Warbler in Canada consists of nesting and foraging habitat patches within forest landscapes (Table 3, with more detailed biophysical attributes of breeding habitat provided in Appendix E).

Nesting and foraging habitat for the Golden-winged Warbler throughout their Canadian range includes a variety of early successional forest types (or habitats that exhibit early successional characteristics) that include extensive patches of dense shrubby growth, interspersed with dense herbaceous growth and are adjacent to a forested edge (Confer and Knapp 1981; Frech and Confer 1987; Confer 1992; Dunn and Garrett 1997). It is the shared edge component between the forest and open/shrub habitat that is particularly important habitat for Golden-winged Warblers.

Edges can be along roads, trails, transition zones along timber harvests, margins of old fields or shrublands, or other places where young forest transitions into adjacent habitats. Nests are often located within 200 m on either side of a forest edge (Van Wilgenburg unpubl. data). Though Golden-winged Warblers are often considered an 'edge' species, recent telemetry work has shown that they use the forested portion of their territory much more extensively than previously thought (Streby et al. 2012); daily use (i.e., for foraging, singing, territorial defence, raising young, collecting nesting material, constructing nests, etc.) of the mature forest component averaged 40 - 200 m into the forest (Streby pers. comm. 2012; Carignan unpubl. data 2014).

The use of the open/shrub side of the shared edge appears to be partly related to the structure contained within the habitat. Completely open habitat types (e.g., open grasslands that contain no trees or shrubs) may be used less extensively than other open habitat types that contain scattered trees and/or patches of shrubby growth. In these habitat types, Golden-winged Warblers use the open side of the edge less extensively (up to 50 m) because the necessary structure (shrubs and/or scattered trees) is lacking (Streby pers. comm. 2012).

The composition of the broader landscape appears to play an important role in habitat selection by Golden-winged Warblers (Thogmartin 2010; Moulton and Artuso unpubl. data). Although the details of broad-scale habitat selection by Golden-winged Warblers are lacking in Canada, to be precautionous, forest cover amounts based on best management practices found in Bakermans et al. (2011), Golden-winged Warbler Working Group (2013) and Roth et al. (2012), are used to represent suitable forest landscapes where nesting and foraging habitat patches are found. Forest landscapes that include 50-75% forest cover that is composed of at least 50% deciduous (or mixed) forest types and contain less than 30% coniferous forest cover (Roth et al. 2012) are considered appropriate. Thus, suitable habitat for the Golden-winged Warbler is the nesting and foraging habitat (as described above) that resides within appropriate forest landscapes (Figure 3).

Table 3. Biophysical Attributes of Golden-winged Warbler Suitable Habitat. See Appendix E for detailed biophysical attributes.

Use	Habitat Types ¹⁹	Biophysical Attributes
Nesting and Foraging Habitat	Open/Shrub & Forest	The entire length of an open/shrub habitat and forest habitat interface AND a width that extends from that interface 200 m into the suitable forest habitat types and 200 m into the suitable open/shrub habitat types OR if the suitable open/shrub habitat is open grassland the width extends 50 m into the open grassland.
Forest Landscape	Forest	50-75% forest cover within a 5 x 5 km area consisting of: <ul style="list-style-type: none"> • primarily (≥50%) deciduous or mixed forest types, and • <30% coniferous forest cover

¹⁹ See Appendix E for the detailed biophysical attributes of suitable breeding habitat for the Golden-winged Warbler.

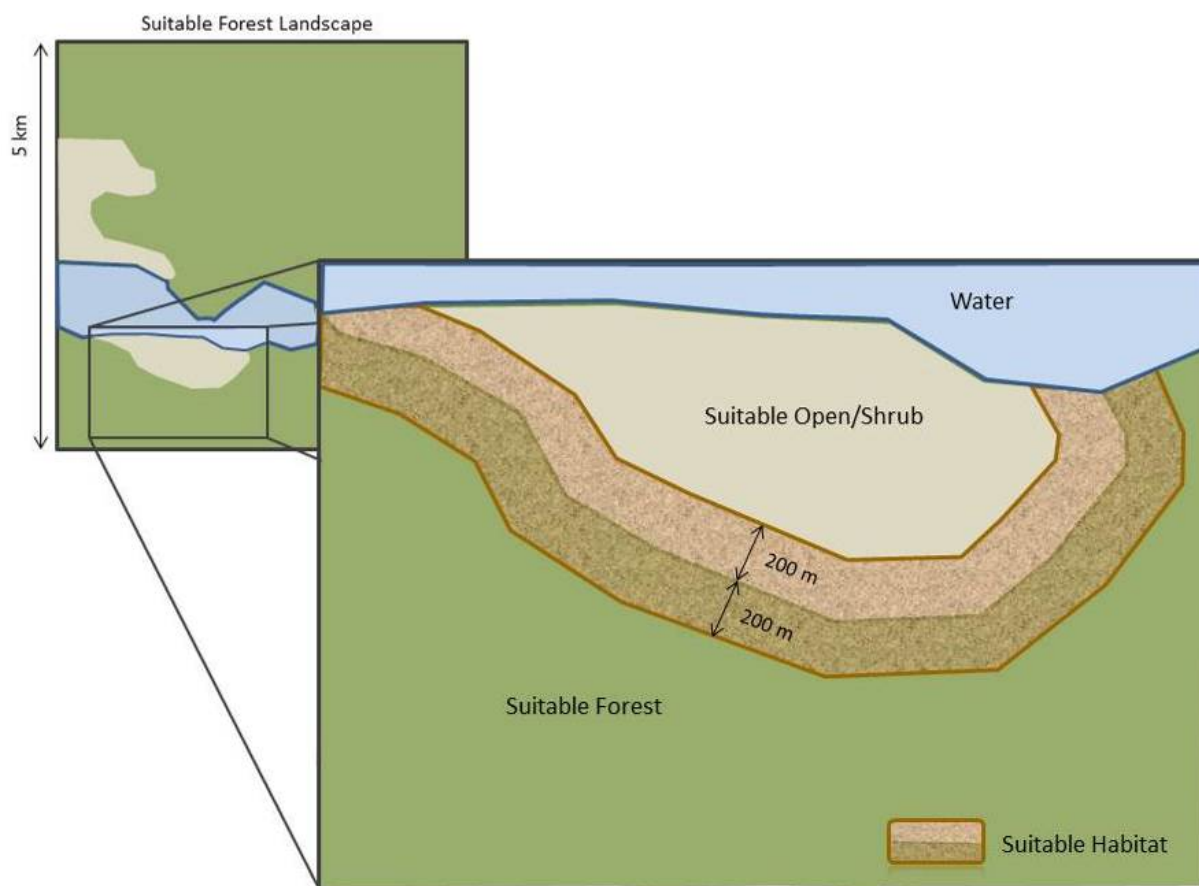


Figure 3. Schematic of Suitable Habitat for the Golden-winged Warbler. Suitable habitat for the Golden-winged Warbler is the nesting and foraging habitat (200 + 200 m interface between forest and open habitat types) within a forest landscape (note: schematic not to scale). Detailed biophysical attributes of suitable habitat are provided in Table 3 and Appendix E.

The biophysical attributes of suitable habitat types will most commonly be defined based on available thematic land cover data. Land cover datasets differ among provincial databases as do habitat associations of the species across its range with some cover types not necessarily available or used by the species in all provinces (e.g., alvar habitat in Ontario). It is recognized that, due to the scale of available thematic mapping, not all habitat within a particular land cover type will be of the composition required to form breeding territories. Therefore, within the identified forest-open edge habitat, only areas large enough to contain a Golden-winged Warbler territory (>1 ha) are considered to be suitable habitat.

7.3 Habitat Occupancy

This criterion refers to areas where there is evidence of recurrent use by the species for breeding (possible, probable or confirmed; as per Ontario Breeding Bird Atlas codes²⁰). Habitat

²⁰ Standard breeding evidence definitions used in Canadian breeding bird atlases can be found here: <http://www.birdsontario.org/atlas/codes.jsp?lang=en>

occupancy is based on documented nest locations, incidental observations and individual occurrences of Golden-winged Warbler, and standardized survey data within the focal areas. The best available information varies among the geographic areas that Golden-winged Warblers occur (e.g., provincial datasets and availability of breeding bird atlases), and the occupancy criteria for each province is adjusted accordingly. The following criteria were used to define occupancy in Manitoba, Ontario and Quebec.

Manitoba Habitat Occupancy Criteria

- Records of confirmed, probable or possible breeding since 2007 in areas within which there is a high probability (i.e., 95%) that Golden-winged Warblers will be observed²¹.

Ontario Habitat Occupancy Criteria

- Ontario Breeding Bird Atlas squares where:
 - Golden-winged Warblers were found in both the first and second atlases²²; OR
 - One or more records of confirmed or probable breeding have been observed since 2001.

Quebec Habitat Occupancy Criteria

- One or more records of confirmed breeding since 1994; OR
- A minimum of two records of probable breeding in any single year since 1994; OR
- At least one record of probable breeding in each of two separate years within a 5-year floating window²³ since 1994.

For the Golden-winged Warbler in Canada, habitat occupancy is based on 10 x 10 km Standardized UTM grid squares which is considered appropriate to capture the species needs (Thogmartin 2010; Moulton and Artuso unpubl. data), and is consistent with available data (e.g., breeding bird atlas projects, land cover datasets and standardized national grid systems). It is at this scale that disturbance regimes (both natural and man-made) are able to operate to provide the suitable forest landscapes, and nesting and foraging habitat within, to support self-sustaining populations of Golden-winged Warbler, all other pressures on the species notwithstanding (e.g., hybridization with the Blue-winged Warbler).

Confirmed breeding records constitute the highest indication of habitat occupancy and therefore indicate the presence of suitable habitat. However, because breeding is difficult to confirm for this species, records of possible or probable breeding can also be used as indicators of habitat suitability. Continued presence (e.g., observed in both Ontario atlases) implies processes are maintaining suitable habitat in these locations. Alternatively, a twenty year window is considered where atlas data does not exist or where more than 20 years have passed between atlas projects

²¹ Based on a 95% contour of a modeled Golden-winged Warbler density surface. The density surface was created from available breeding observations of Golden-winged Warblers in Manitoba.

²² The first breeding bird atlas in Ontario covers the period 1981-1985 (Cadman et al. 1987) and the second breeding bird atlas in Ontario covers the period 2001-2005 (Cadman et al. 2007).

²³ This criterion is used by the Quebec Conservation Data Center as the minimal condition required to indicate site fidelity. Furthermore, records older than 20 years are considered historical.

(i.e., Manitoba and Quebec); records older than 20 years require validation to determine continued occupancy and presence of suitable habitat.

7.4 Application of the Critical Habitat Criteria

Critical habitat for the Golden-winged Warbler in Canada is identified within focal areas as the areas containing the biophysical attributes of suitable habitat (nesting and foraging habitat within a forest landscape) that meet the habitat occupancy criteria. The 10 x 10 km Standardized UTM grid squares that meet the occupancy criteria bound the maximum extent of the area that contains critical habitat. As focal areas were delineated at a broad scale, if a grid square falls partially outside of the focal area boundary, critical habitat may still occur within the portion outside of the focal area boundary.

Application of the critical habitat criteria identifies 304 10 x 10 km Standardized UTM grid squares of critical habitat in eight of the nine focal areas in Canada: 182 grid squares in Manitoba, 108 grid squares in Ontario and 14 grid squares in Quebec (Table 4; Appendices B, C and D). The identified grid squares bound an area of 2,987,500 ha. Within these 10 x 10 km Standardized UTM grid squares, habitat models estimate that approximately 1,074,700 ha of forest landscapes²⁴ for the Golden-winged Warbler exist: 499,100 ha in Manitoba, 517,800 ha in Ontario and 57,800 ha in Quebec (Table 4). Within these forest landscapes, habitat models estimate that approximately 353,500 ha of critical habitat (i.e., nesting and foraging habitat within appropriate forest landscapes) exist: 184,900 ha in Manitoba, 165,600 ha in Ontario and 3,000 ha in Quebec (Table 4).

Any human-made structures and any area that does not correspond to the biophysical attributes of suitable habitat for the Golden-winged Warbler (see section 7.3) are not considered critical habitat. More detailed information on the location of critical habitat, to support protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment and Climate Change Canada's Recovery Planning section at: ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

This is considered a partial identification of critical habitat due to insufficient survey effort²⁵ leading to a limited knowledge on the current distribution and abundance of Golden-winged Warblers in some focal areas (i.e., GL 9, the Ontario portion of GL 3 and the Quebec portion of GL 10) and portions of most others. Further study is required to confirm the presence of breeding Golden-winged Warblers in these areas. In addition, further study is required to understand the scale, configuration and amount of cover types influencing Golden-winged Warbler habitat selection at alternate scales to ensure the proper elements of the species' critical habitat are being identified and protected. A schedule of studies (section 7.5) has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient to

²⁴ Forest landscapes include 50-75% forest cover that is composed of at least 50% deciduous (or mixed) forest types and contain less than 30% coniferous forest cover.

²⁵ Insufficient survey effort is evaluated as 10 x 10 km grid squares that have had: 1) no survey effort for Golden-winged Warbler (including other bird surveys that would detect Golden-winged Warblers) in the past; 2) no survey effort since 1994 (data is historical); or 3) atlas squares that have had less than 20 hours of sampling.

meet the population and distribution objective. The identification of critical habitat will be updated when this information becomes available, either in a revised recovery strategy or action plan(s).

Table 4. Estimated Critical Habitat Amounts in Canada

Province	Focal Area	Area of Focal Area (ha)	Total Forest Cover in Focal Area (%)	Number of 10 x 10 km Standardized UTM Grid Squares	Area of 10 x 10 km Standardized UTM Grid Squares in Hectares (Proportion of Focal Area in %)	Estimated Area of Forest Landscapes in Hectares (Proportion of Grid Squares in %)	Estimated Area of Critical Habitat ²⁶ in Hectares (Proportion of Grid Squares in %)
Manitoba	GL1	2,060,300	35	98	980,000 (48)	301,200 (31)	96,300 (10)
	GL 2	351,100	25	19	190,000 (54)	39,600 (21)	16,400 (9)
	GL 3 (MB portion)	1,505,900	33	65	600,200 (40)	158,300 (26)	72,200 (12)
		~3,917,300	Total	182	~1,770,200 (45)	~499,100 (28)	~184,900 (10)
Ontario	GL 3 (ON portion)	664,700	50	N/A (insufficient survey effort)	Unknown	Unknown	Unknown
	GL 9	222,200	73	N/A (insufficient survey effort)	Unknown	Unknown	Unknown
	GL 10 (ON portion)	178,400	79	6	60,000 (34)	12,500 (21)	3,000 (5)
	GL 11	2,300,000	62	102	1,017,300 (44)	505,300 (50)	162,600 (16)
		~3,365,300	Total	108	~1,077,300 (32)	~517,800 (48)	~165,600 (15)
Quebec	GL 10 (QC portion)	63,400	83	N/A (insufficient survey effort)	Unknown	Unknown	Unknown
	GL 14	51,000	33	3	30,000 (59)	2,800 (9)	860 (3)
	GL 15	118,600	51	4	40,000 (34)	25,000 (63)	600 (2)
	GL 17	196,800	81	7	70,000 (36)	30,000 (43)	1,540 (2)
		~429,800	Total	14	~140,000 (38)	~57,800 (41)	~3,000 (2)
		~7,712,400	Grand Total	304	~2,987,500 (39)	~1,074,700 (36)	~353,500 (12)

²⁶ Based on crude habitat models; an area sum of nesting and foraging habitat (patches), residing within an appropriate forest landscape, as per the critical habitat criteria described in this document.

7.5 Schedule of Studies to Identify Critical Habitat

Table 5. Schedule of Studies

Description of Activity	Rationale	Timeline
Confirm species' presence, including breeding status, in focal areas and portions of focal areas that have received insufficient survey effort.	Information on the recent presence (including breeding status) is required to support the identification of critical habitat (i.e., determination of habitat occupancy).	2016-2020
If Golden-winged Warblers are present and breeding in the aforementioned areas, determine habitat characteristics and extent of biophysical attributes; identify additional critical habitat.	Determination of the extent of suitable habitat and identification of additional critical habitat.	2016-2023
Determine habitat attributes (e.g., spatial scale, composition and configuration) that influence the selection and quality of nesting and foraging habitat for Golden-winged Warblers in Canada.	Identify additional biophysical attributes of critical habitat, as necessary.	2016-2023

7.6 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case-by-case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Government of Canada 2009). Activities described in Table 6 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Due to the dynamic nature of Golden-winged Warbler habitat, it is recognized that some activities listed in Table 6 can both destroy and promote suitable habitat characteristics. The likelihood that critical habitat will be destroyed is increased if any one of these activities, or combination thereof, was to occur in such a manner, place and time, that any one of the following three situations were to occur:

- Remove or alter biophysical attributes necessary for the Golden-winged Warbler (without replacement);
- Cumulatively, or individually, reduce the amount of critical habitat available within the focal areas below the amounts identified for each province (i.e., ~184,900 ha in Manitoba, ~165,600 ha in Ontario and ~3,000 ha in Quebec) and/or compromise the ability of the focal areas to provide the amounts of critical habitat identified (e.g., reduce the suitability or availability of forest landscapes);

- Compromise the ability of a focal area to be restored to the minimum amount of critical habitat, if required (e.g., large-scale permanent removal of habitat).

Given the dynamic nature of much of the Golden-winged Warbler critical habitat in Canada, removal of some areas of critical habitat can be replaced or offset with other areas that meet the critical habitat criteria in the same focal area. Although an individual/pair may have some fidelity to a particular patch over the course of their lifespan, it may not be necessary or feasible (without intense management) for suitable breeding habitat to remain in the same location over time. The exact patch boundaries of critical habitat are not delineated; rather, as described, the focus is on providing an on-going supply of habitat by allowing the processes that maintain habitat to occur. While some habitat may become unsuitable due to succession or is removed, other habitat may become suitable due to succession, disturbance (natural or man-made) or management. Therefore, destruction of critical habitat will occur when the estimated amount of critical habitat drops below the identified target levels for a focal area (Table 4). However, this does not preclude the activities listed below in Table 6 from occurring if destroyed critical habitat is replaced or offset by additional critical habitat within the same or other 10 x 10 km grid squares containing critical habitat in a particular focal area, such that it is able to serve its function when required by the species (i.e., habitat is made available prior to the destructive activity). As such, activities that result in permanent removal of critical habitat may have more effect on the availability of critical habitat than activities that result in a temporary removal of critical habitat because the former activities can contribute to any and all three of the situations described above. Activities that result in a temporary removal of critical habitat have the potential to contribute to the future supply of critical habitat, given proper management.

Table 6: Activities Likely to Result in the Destruction of Critical Habitat

Description of Activity	Description of effect	Details of effect
Permanent Habitat Loss or Conversion		
Activities such as residential development and industrial development (e.g., large open-pit mines) that result in the permanent removal of critical habitat	<ul style="list-style-type: none"> • Results in the direct loss of critical habitat, or conversion to other land uses. • Results in the destruction of critical habitat by reducing or eliminating habitat or habitat features required to fulfill the species' life cycle (e.g., herbaceous layer, dense shrub, forest component, perching structures). • Some of these activities can result in modifications to the forest landscape that favour Brown-headed Cowbirds, or other nest predators, and could potentially increase levels of brood parasitism and nest predation rates. 	<p>Activities listed may remove or convert critical habitat. The likelihood that critical habitat will be destroyed is increased if any one of these activities, or combination thereof, was to occur in such a manner, place and time, that any one of the three aforementioned situations (section 7.6) were to occur.</p> <p>Removal/conversion of habitat during the breeding season would be particularly detrimental in the short-term (i.e., current breeding season) though long-term effects could also be considered detrimental because the activity results in permanent removal of suitable habitat. The activities causing destruction can be both direct and cumulative.</p> <p>If this activity were to occur outside the</p>

		bounds of critical habitat, it could result in destruction of critical habitat if the forest landscape characteristics that contribute to the suitability of nesting and foraging habitat are not maintained (i.e., 50-75% primarily deciduous forest cover and <30% coniferous forest at a 5 x 5 km scale).
Temporary Habitat Loss		
Activities, such as forest harvesting and maintenance of infrastructure (e.g., right-of-way/utility corridor), that result in the temporary removal of critical habitat	<ul style="list-style-type: none"> • Results in the direct loss of critical habitat if not concurrently replaced by suitable habitat in the same, or another, 10 x 10 km grid square containing critical habitat within the same focal area. • Results in the destruction of critical habitat by reducing or eliminating habitat or habitat features required to fulfill the species' life cycle (e.g., herbaceous layer, dense shrub, forest component, perching structures). • Some of these activities can result in modifications to the forest landscape that favour Brown-headed Cowbirds, or other nest predators, and could potentially increase levels of brood parasitism and nest predation rates. 	<p>Activities listed may remove critical habitat temporarily. The likelihood that critical habitat will be destroyed is increased if any one of these activities, or combination thereof, was to occur in such a manner, place and time, that any one of the three aforementioned situations (section 7.6) were to occur. The amount of critical habitat lost within a 10 x 10 km grid square may be replaced by the same amount of critical habitat in the same or in another 10 x 10 km grid square(s) identified as critical habitat within the same focal area, provided the replacement habitat is available when the species requires it (i.e., habitat is made available prior to the destructive activity).</p> <p>Removal/conversion of habitat during the breeding season would be particularly detrimental in the short-term (i.e., current breeding season). The activities causing destruction can be both direct and cumulative. If conducted outside of the breeding season, these activities may not cause habitat destruction. If these activities were to occur outside the bounds of critical habitat, it could result in destruction of critical habitat if the forest landscape characteristics that contribute to the suitability of nesting and foraging habitat are not maintained (i.e., 50-75% primarily deciduous forest cover and <30% coniferous forest at a 5 x 5 km scale).</p>
Habitat Degradation (Temporary or Permanent)		
Herbicide application, pesticide application	<ul style="list-style-type: none"> • Degradation of habitat and habitat features (e.g., herbaceous cover and shrubby component) required by the species to fulfill its life cycle. • Reduction/elimination of herbaceous layer required for nest site placement and prey/foraging opportunities. • Reduction/elimination of 	<p>Activities listed may degrade critical habitat. The likelihood that critical habitat will be destroyed is increased if any one of these activities, or combination thereof, was to occur in such a manner, place and time, that any one of the three aforementioned situations (section 7.6) were to occur. The likelihood that critical habitat would be destroyed would depend on the time of year the activity is conducted, and the frequency and intensity (e.g., whether herbaceous and</p>

	<p>herbaceous cover for nesting, potentially leading to increased susceptibility to predation.</p> <ul style="list-style-type: none"> • Reduction/elimination of local insect/food resource base. 	<p>shrubby vegetation is able to grow back) of the activity.</p> <p>Destruction of critical habitat in relation to these activities would occur if the level of degradation progressed to the point that the habitat is no longer suitable and no longer provides its function to the species (e.g., nest cover, foraging opportunities). This could include reducing the insect/food resource base to a level that affected nesting success and survival of adults and nestlings.</p> <p>Degradation of habitat during the breeding season would be particularly detrimental in the short-term (i.e., current breeding season) though long-term impacts may also be considered detrimental in some cases (e.g., repeated application). The activities causing degradation can be both direct and cumulative. If conducted outside of the breeding season, these activities may not cause habitat destruction.</p>
Inappropriate livestock grazing	<ul style="list-style-type: none"> • Reduction/elimination of herbaceous layer and shrubby component required for nest site placement and foraging opportunities (including post-fledging use). • Reduction/elimination of herbaceous cover for the nest potentially leading to increased susceptibility to predation. 	<p>The likelihood that critical habitat will be destroyed is increased if this activity was to occur in such a manner, place and time, that any one of the three aforementioned situations (section 7.6) were to occur. The likelihood that critical habitat would be destroyed would depend on the intensity, frequency, duration and timing of the grazing activity.</p> <p>Destruction of critical habitat in relation to this activity would occur if the level of degradation to the biophysical attributes of critical habitat (e.g., shrub and herbaceous vegetation) progressed to the point that the habitat is no longer suitable and no longer provides its function (e.g., cover and nest placement opportunities) to the species.</p> <p>Degradation of habitat during the breeding season would be particularly detrimental in the short-term (i.e., current breeding season) though long-term impacts may also be considered detrimental in some cases (e.g., over-grazing for a repeated period of time without sufficient regeneration). The activities causing degradation can be both direct and cumulative. If conducted outside of the breeding season, these activities may not cause habitat destruction.</p>

<p>Introduction of exotic species, especially plants or invertebrates.</p> <p>Examples of activities that can introduce exotic species include: the deliberate introduction of non-native plant seeds or plants; depositing foreign soil, gravel, compost or garden waste; operation of all-terrain vehicles; and livestock grazing)</p>	<ul style="list-style-type: none"> • Exotic species result in physical and chemical changes to habitat, particularly to the herbaceous layer used for nesting sites, such that it is no longer suitable for the species. 	<p>The likelihood that critical habitat will be destroyed is increased if this activity was to occur in such a manner, place and time, that any one of the three aforementioned situations (section 7.6) were to occur.</p> <p>Destruction of critical habitat in relation to this activity would occur if the level of degradation to the biophysical attributes of critical habitat (e.g., shrub and herbaceous vegetation) progressed to the point that the habitat is no longer suitable and no longer provides its function (e.g., cover and nest placement opportunities) to the species.</p> <p>The activities causing degradation can be both direct and cumulative. Degradation of habitat would be particularly detrimental in the long-term as invasive species are able to establish and expand.</p>
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It is important to note that many of the activities noted in Table 6, depending on how they are conducted, can also *contribute* to future habitat supply or help to maintain habitat in a state that is suitable for Golden-winged Warblers. For example, forest harvesting can contribute both to future habitat supply and to maintaining the forest landscape. Forest harvesting may in fact provide the primary tool to ensure a steady supply of suitable habitat on the landscape. Herbicide application, livestock grazing and right-of-way maintenance may help to maintain early-successional habitat characteristics preferred by the species or contribute to future habitat supply, if undertaken at appropriate times of the year, frequency and intensity (e.g., allows for herbaceous and shrubby vegetation to grow back). Following recommendations for avoiding incidental take of migratory birds or their nests is an important step in project planning. See Environment and Climate Change Canada's guidance on the Incidental Take of Migratory Birds in Canada at <http://www.ec.gc.ca/paom-itmb/> for more information.

Environment and Climate Change Canada recognizes three broad approaches in identifying critical habitat: site-level (small/localized geographic range, narrow habitat specificity), area-level (intermediate geographic range, wide or narrow habitat specificity) and landscape-level (large geographic range, wide habitat specificity). These three conceptual scales are used to help provide context for the critical habitat identification, its presentation, and description of activities likely to destroy critical habitat. In adopting an area-level approach for the identification of critical habitat for the Golden-winged Warbler, it is important to note that the maintenance and management of the critical habitat will be achieved through coordinated recovery actions, policy and land-use management plans that also operate at this scale. Mitigation of adverse effects from individual projects/activities will require a coordinated approach, as will management of cumulative effects within and among focal areas.

8. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. To measure progress, every five years, success of recovery strategy implementation will be measured against the following performance indicators:

- to the extent possible, self-sustaining populations in the focal areas in Manitoba, Ontario and Quebec are maintained,
- to the extent possible, the current abundance of approximately 35,000 pairs is maintained.

9. STATEMENT ON ACTION PLANS

One or more action plans will be completed for the Golden-winged Warbler and posted on the Species at Risk Public Registry by December 2022.

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APPENDIX A: CONSERVATION RANKS OF THE GOLDEN-WINGED WARBLER IN THE UNITED STATES

Table A-1. Conservation Status Ranks for the Golden-winged Warbler in the United States (from NatureServe 2014).

	Global (G) Rank	National (N) Rank (United States)	Sub-national (S) Rank
Golden-winged Warbler (<i>Vermivora chrysoptera</i>)	G4	N4B	Alabama (SNRM) Arkansas (S2N) Colorado (SNA) Connecticut (S2B) Delaware (SNA) District of Columbia (S3N) Florida (SNA) Georgia (S1) Illinois (S1S2) Indiana (S1B) Iowa (S1N) Kansas (SNA) Kentucky (S2B) Louisiana (SNA) Maryland (S3B) Massachusetts (S1B) Michigan (S5) Minnesota (SNRB) Mississippi (SNA) Missouri (SNA) Nebraska (SNRN) New Hampshire (S2B) New Jersey (S3B,S3N) New York (S3B) North Carolina (S3B) North Dakota (S3) Ohio (S1) Oklahoma (SU) Pennsylvania (S4B) Rhode Island (SXB,S2N) South Carolina (SNA) South Dakota (SNA) Tennessee (S3B) Texas (S3) Vermont (S2S3B) Virginia (S3B) West Virginia (S2B) Wisconsin (S3S4B)

Rank Definitions (NatureServe 2014)

- **S1:** Critically Imperilled - At very high risk of extirpation in the jurisdiction (i.e., S -state/province) due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
- **S2:** Imperilled - 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.
- **G4/N4/S4:** Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines 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.
- **SNR:** Unranked - National or subnational conservation status not yet assessed.
- **SNA:** Not Applicable - A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.
- **SU:** Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
- **SX:** Presumed Extirpated - Species or ecosystem is believed to be extirpated from the jurisdiction. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. [Equivalent to “Regionally Extinct” in IUCN Red List terminology]

Breeding Status Qualifiers

- **B:** Breeding - Conservation status refers to the breeding population of the species in the nation or state/province.
- **N:** Non-breeding - Conservation status refers to the non-breeding population of the species in the nation or state/province.
- **M:** Migrant - Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province.

APPENDIX B: GRID SQUARES IDENTIFIED AS CONTAINING CRITICAL HABITAT FOR THE GOLDEN-WINGED WARBLER (*VERMIVORA CHRYSOPTERA*) IN MANITOBA

Table B-1. Critical Habitat for the Golden-winged Warbler in Manitoba occurs within these 10 x 10 km Standardized UTM grid squares where criteria described in section 7 are met.

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
GL 1				
14ULB53	Manitoba	350000	5630000	Federal Protected Area and Non-federal Land
14ULB54	Manitoba	350000	5640000	Federal Protected Area and Non-federal Land
14ULB55	Manitoba	350000	5650000	Federal Protected Area and Non-federal Land
14ULB63	Manitoba	360000	5630000	Federal Protected Area and Non-federal Land
14ULB64	Manitoba	360000	5640000	Federal Protected Area and Non-federal Land
14ULB65	Manitoba	360000	5650000	Federal Protected Area and Non-federal Land
14ULB72	Manitoba	370000	5620000	Non-federal Land
14ULB73	Manitoba	370000	5630000	Federal Protected Area and Non-federal Land
14ULB74	Manitoba	370000	5640000	Federal Protected Area and Non-federal Land
14ULB75	Manitoba	370000	5650000	Federal Protected Area and Non-federal Land
14ULB82	Manitoba	380000	5620000	Federal Protected Area and Non-federal Land
14ULB83	Manitoba	380000	5630000	Federal Protected Area and Non-federal Land
14ULB84	Manitoba	380000	5640000	Federal Protected Area and Non-federal Land
14ULB85	Manitoba	380000	5650000	Federal Protected Area and Non-federal Land
14ULB92	Manitoba	390000	5620000	Federal Protected Area and Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
14ULB93	Manitoba	390000	5630000	Federal Protected Area and Non-federal Land
14ULB94	Manitoba	390000	5640000	Federal Protected Area and Non-federal Land
14ULB95	Manitoba	390000	5650000	Non-federal Land
14ULC66	Manitoba	360000	5760000	Non-federal Land
14ULC74	Manitoba	370000	5740000	Other Federal Land and Non-federal Land
14ULC76	Manitoba	370000	5760000	Non-federal Land
14ULC83	Manitoba	380000	5730000	Other Federal Land and Non-federal Land
14ULC84	Manitoba	380000	5740000	Other Federal Land and Non-federal Land
14ULC85	Manitoba	380000	5750000	Non-federal Land
14ULC86	Manitoba	380000	5760000	Other Federal Land and Non-federal Land
14ULC87	Manitoba	380000	5770000	Non-federal Land
14ULC93	Manitoba	390000	5730000	Non-federal Land
14ULC94	Manitoba	390000	5740000	Non-federal Land
14ULC95	Manitoba	390000	5750000	Non-federal Land
14ULC96	Manitoba	390000	5760000	Non-federal Land
14ULC97	Manitoba	390000	5770000	Non-federal Land
14ULD30	Manitoba	330000	5800000	Non-federal Land
14ULD31	Manitoba	330000	5810000	Non-federal Land
14ULD40	Manitoba	340000	5800000	Non-federal Land
14ULD41	Manitoba	340000	5810000	Non-federal Land
14ULD42	Manitoba	340000	5820000	Non-federal Land
14ULD50	Manitoba	350000	5800000	Non-federal Land
14UMA49	Manitoba	440000	5590000	Other Federal Land and Non-federal Land
14UMA58	Manitoba	450000	5580000	Non-federal Land
14UMA59	Manitoba	450000	5590000	Federal Protected Area and Non-federal Land
14UMA68	Manitoba	460000	5580000	Non-federal Land
14UMA69	Manitoba	460000	5590000	Federal Protected Area and Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
14UMB02	Manitoba	400000	5620000	Federal Protected Area and Non-federal Land
14UMB03	Manitoba	400000	5630000	Federal Protected Area and Non-federal Land
14UMB04	Manitoba	400000	5640000	Federal Protected Area and Non-federal Land
14UMB05	Manitoba	400000	5650000	Federal Protected Area and Non-federal Land
14UMB12	Manitoba	410000	5620000	Federal Protected Area and Non-federal Land
14UMB13	Manitoba	410000	5630000	Federal Protected Area and Non-federal Land
14UMB14	Manitoba	410000	5640000	Federal Protected Area and Non-federal Land
14UMB22	Manitoba	420000	5620000	Federal Protected Area and Non-federal Land
14UMB23	Manitoba	420000	5630000	Federal Protected Area and Non-federal Land
14UMB24	Manitoba	420000	5640000	Federal Protected Area and Non-federal Land
14UMB25	Manitoba	420000	5650000	Federal Protected Area and Non-federal Land
14UMB31	Manitoba	430000	5610000	Federal Protected Area and Non-federal Land
14UMB32	Manitoba	430000	5620000	Federal Protected Area and Non-federal Land
14UMB35	Manitoba	430000	5650000	Federal Protected Area and Non-federal Land
14UMB40	Manitoba	440000	5600000	Federal Protected Area and Non-federal Land
14UMB41	Manitoba	440000	5610000	Federal Protected Area and Non-federal Land
14UMB42	Manitoba	440000	5620000	Federal Protected Area and Non-federal Land
14UMB43	Manitoba	440000	5630000	Federal Protected Area and Non-federal Land
14UMB44	Manitoba	440000	5640000	Federal Protected Area and Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
14UMB45	Manitoba	440000	5650000	Non-federal Land
14UMB50	Manitoba	450000	5600000	Federal Protected Area and Non-federal Land
14UMB51	Manitoba	450000	5610000	Federal Protected Area and Non-federal Land
14UMB52	Manitoba	450000	5620000	Federal Protected Area and Non-federal Land
14UMB53	Manitoba	450000	5630000	Federal Protected Area and Non-federal Land
14UMB54	Manitoba	450000	5640000	Non-federal Land
14UMB55	Manitoba	450000	5650000	Non-federal Land
14UMB60	Manitoba	460000	5600000	Federal Protected Area and Non-federal Land
14UMB61	Manitoba	460000	5610000	Non-federal Land
14UMB62	Manitoba	460000	5620000	Non-federal Land
14UMB72	Manitoba	470000	5620000	Other Federal Land and Non-federal Land
14UMB73	Manitoba	470000	5630000	Other Federal Land and Non-federal Land
14UMB74	Manitoba	470000	5640000	Other Federal Land and Non-federal Land
14UMB75	Manitoba	470000	5650000	Other Federal Land and Non-federal Land
14UMB76	Manitoba	470000	5660000	Non-federal Land
14UMB82	Manitoba	480000	5620000	Other Federal Land and Non-federal Land
14UMB83	Manitoba	480000	5630000	Other Federal Land and Non-federal Land
14UMB84	Manitoba	480000	5640000	Other Federal Land and Non-federal Land
14UMB85	Manitoba	480000	5650000	Other Federal Land and Non-federal Land
14UMB86	Manitoba	480000	5660000	Non-federal Land
14UMB92	Manitoba	490000	5620000	Other Federal Land and Non-federal Land
14UMB93	Manitoba	490000	5630000	Other Federal Land and Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
14UMB94	Manitoba	490000	5640000	Non-federal Land
14UMB95	Manitoba	490000	5650000	Non-federal Land
14UMC02	Manitoba	400000	5720000	Other Federal Land and Non-federal Land
14UMC03	Manitoba	400000	5730000	Non-federal Land
14UMC04	Manitoba	400000	5740000	Non-federal Land
14UMC05	Manitoba	400000	5750000	Non-federal Land
14UMC06	Manitoba	400000	5760000	Non-federal Land
14UMC11	Manitoba	410000	5710000	Non-federal Land
14UMC12	Manitoba	410000	5720000	Non-federal Land
14UMC13	Manitoba	410000	5730000	Non-federal Land
14UMC14	Manitoba	410000	5740000	Non-federal Land
14UMC15	Manitoba	410000	5750000	Non-federal Land
14UMC22	Manitoba	420000	5720000	Non-federal Land
14UMC23	Manitoba	420000	5730000	Non-federal Land
14UMC24	Manitoba	420000	5740000	Non-federal Land
No. of grid squares = 98; Total Area = 980,000 ha; Estimated Amount of Critical Habitat = 96,300 ha				
GL 2				
14UNB46	Manitoba	540000	5660000	Non-federal Land
14UNB55	Manitoba	550000	5650000	Other Federal Land and Non-federal Land
14UNB56	Manitoba	550000	5660000	Other Federal Land and Non-federal Land
14UNB57	Manitoba	550000	5670000	Other Federal Land and Non-federal Land
14UNB65	Manitoba	560000	5650000	Other Federal Land and Non-federal Land
14UNB66	Manitoba	560000	5660000	Other Federal Land and Non-federal Land
14UNB67	Manitoba	560000	5670000	Other Federal Land and Non-federal Land
14UNB76	Manitoba	570000	5660000	Other Federal Land and Non-federal Land
14UNB77	Manitoba	570000	5670000	Other Federal Land and Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
14UNB86	Manitoba	580000	5660000	Other Federal Land and Non-federal Land
14UNB87	Manitoba	580000	5670000	Other Federal Land and Non-federal Land
14UPB07	Manitoba	600000	5670000	Non-federal Land
14UPB08	Manitoba	600000	5680000	Non-federal Land
14UPB09	Manitoba	600000	5690000	Non-federal Land
14UPB17	Manitoba	610000	5670000	Non-federal Land
14UPB18	Manitoba	610000	5680000	Non-federal Land
14UPB19	Manitoba	610000	5690000	Non-federal Land
14UPB29	Manitoba	620000	5690000	Non-federal Land
14UPC10	Manitoba	610000	5700000	Non-federal Land
No. of grid squares = 19; Total Area = 190,000 ha; Estimated Amount of Critical Habitat = 16,400 ha				
GL 3				
14UPA70	Manitoba	670000	5500000	Non-federal Land
14UPA71	Manitoba	670000	5510000	Non-federal Land
14UPA72	Manitoba	670000	5520000	Non-federal Land
14UPA73	Manitoba	670000	5530000	Non-federal Land
14UPA80	Manitoba	680000	5500000	Non-federal Land
14UPA81	Manitoba	680000	5510000	Non-federal Land
14UPA82	Manitoba	680000	5520000	Non-federal Land
14UPA83	Manitoba	680000	5530000	Non-federal Land
14UPA84	Manitoba	680000	5540000	Non-federal Land
14UPA90	Manitoba	690000	5500000	Non-federal Land
14UPA91	Manitoba	690000	5510000	Non-federal Land
14UPA92	Manitoba	690000	5520000	Non-federal Land
14UPA93	Manitoba	690000	5530000	Non-federal Land
14UPA94	Manitoba	690000	5540000	Non-federal Land
14UPA95	Manitoba	690000	5550000	Non-federal Land
14UPA96	Manitoba	690000	5560000	Non-federal Land
14UPV89	Manitoba	680000	5490000	Non-federal Land
14UPV99	Manitoba	690000	5490000	Non-federal Land
14UQA00	Manitoba	700000	5500000	Non-federal Land
14UQA01	Manitoba	700000	5510000	Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
14UQA02	Manitoba	700000	5520000	Non-federal Land
14UQA03	Manitoba	700000	5530000	Non-federal Land
14UQA04	Manitoba	700000	5540000	Non-federal Land
14UQA05	Manitoba	700000	5550000	Non-federal Land
14UQA06	Manitoba	700000	5560000	Non-federal Land
14UQA10	Manitoba	710000	5500000	Non-federal Land
14UQA11	Manitoba	710000	5510000	Non-federal Land
14UQA12	Manitoba	710000	5520000	Non-federal Land
14UQA13	Manitoba	710000	5530000	Non-federal Land
14UQA14	Manitoba	710000	5540000	Non-federal Land
14UQV06	Manitoba	700000	5460000	Non-federal Land
14UQV07	Manitoba	700000	5470000	Non-federal Land
14UQV08	Manitoba	700000	5480000	Non-federal Land
14UQV09	Manitoba	700000	5490000	Non-federal Land
14UQV16	Manitoba	710000	5459999	Non-federal Land
14UQV17	Manitoba	710000	5469998	Non-federal Land
14UQV18	Manitoba	710000	5479998	Non-federal Land
14UQV19	Manitoba	710000	5490000	Non-federal Land
15UTQ89	Manitoba	282896	5490000	Non-federal Land
15UTQ94	Manitoba	290000	5440000	Non-federal Land
15UTQ95	Manitoba	290000	5450000	Non-federal Land
15UTQ99	Manitoba	290000	5490000	Non-federal Land
15UTR80	Manitoba	283295	5500000	Non-federal Land
15UTR81	Manitoba	283694	5510000	Non-federal Land
15UTR82	Manitoba	284094	5520000	Non-federal Land
15UTR83	Manitoba	284498	5530000	Non-federal Land
15UTR90	Manitoba	290000	5500000	Non-federal Land
15UTR91	Manitoba	290000	5510000	Non-federal Land
15UTR92	Manitoba	290000	5520000	Non-federal Land
15UTR93	Manitoba	290000	5530000	Non-federal Land
15UUQ04	Manitoba	300000	5440000	Non-federal Land
15UUQ05	Manitoba	300000	5450000	Non-federal Land
15UUQ09	Manitoba	300000	5490000	Non-federal Land
15UUQ14	Manitoba	310000	5440000	Non-federal Land
15UUQ15	Manitoba	310000	5450000	Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
15UUQ16	Manitoba	310000	5460000	Non-federal Land
15UUQ19	Manitoba	310000	5490000	Non-federal Land
15UUQ23	Manitoba	320000	5430000	Non-federal Land
15UUQ24	Manitoba	320000	5440000	Non-federal Land
15UUQ25	Manitoba	320000	5450000	Non-federal Land
15UUQ26	Manitoba	320000	5460000	Non-federal Land
15UUQ35	Manitoba	330000	5450000	Non-federal Land
15UUQ36	Manitoba	330000	5460000	Non-federal Land
15UUR00	Manitoba	300000	5500000	Non-federal Land
15UUR10	Manitoba	310000	5500000	Non-federal Land
No. of grid squares = 65; Total Area = 600,200 ha; Estimated Amount of Critical Habitat = 72,200 ha				

¹Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098>), where the first 2 digits and letter represent the UTM Zone, the following 2 letters indicate the 100 x 100 km Standardized UTM grid, followed by 2 digits to represent the 10 x 10 km Standardized UTM grid containing all or a portion of critical habitat. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See <http://www.bsc-eoc.org/> for more information on breeding bird atlases).

²The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 10 x 10 km Standardized UTM grid square containing all or a portion of critical habitat. The coordinates may not fall within critical habitat and are provided as a general location only. UTM Standardized grid squares at the intersection of UTM zones are merged with their adjacent grid squares.

³Land tenure is provided as an approximation of the types of land ownership that exist where critical habitat may be found and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

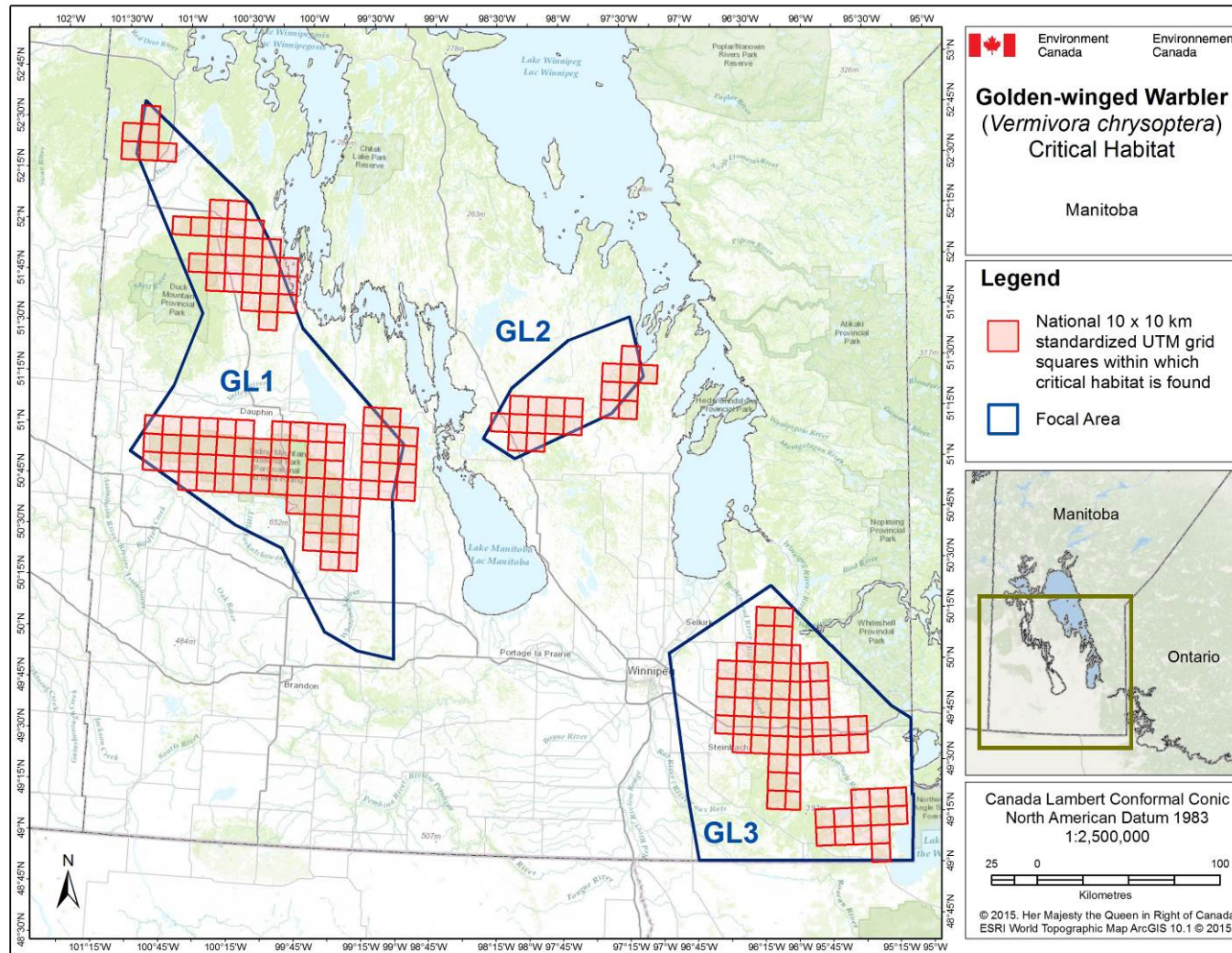


Figure B-1. Grid Squares Identified as Containing Critical Habitat for the Golden-winged Warbler in Manitoba.

Critical habitat for Golden-winged Warbler in Manitoba occurs within these 10 x 10 km Standardized UTM grid squares where the criteria described in section 7 are met. The grid squares represent 45% of the focal areas in Manitoba. Habitat models estimate ~184,900 ha of critical habitat are available for the Golden-winged Warbler within the identified grid squares and should be managed proportionately within each focal area.

APPENDIX C: GRID SQUARES IDENTIFIED AS CONTAINING CRITICAL HABITAT FOR THE GOLDEN-WINGED WARBLER (*VERMIVORA CHRYSOPTERA*) IN ONTARIO

Table C-1. Critical Habitat for the Golden-winged Warbler in Ontario occurs within these 10 x 10 km Standardized UTM grid squares where the criteria described in section 7 are met.

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
GL 11				
17TPK15	Ontario	610000	4950000	Non-federal Land
17TPK16	Ontario	610000	4960000	Non-federal Land
17TPK17	Ontario	610000	4970000	Non-federal Land
17TPK18	Ontario	610000	4980000	Non-federal Land
17TPK25	Ontario	620000	4950000	Non-federal Land
17TPK26	Ontario	620000	4960000	Non-federal Land
17TPK27	Ontario	620000	4970000	Non-federal Land
17TPK34	Ontario	630000	4940000	Non-federal Land
17TPK35	Ontario	630000	4950000	Other Federal Land and Non-federal Land
17TPK36	Ontario	630000	4960000	Non-federal Land
17TPK37	Ontario	630000	4970000	Other Federal Land and Non-federal Land
17TPK38	Ontario	630000	4980000	Non-federal Land
17TPK44	Ontario	640000	4940000	Non-federal Land
17TPK45	Ontario	640000	4950000	Non-federal Land
17TPK46	Ontario	640000	4960000	Non-federal Land
17TPK48	Ontario	640000	4980000	Non-federal Land
17TPK54	Ontario	650000	4940000	Non-federal Land
17TPK55	Ontario	650000	4950000	Non-federal Land
17TPK56	Ontario	650000	4960000	Non-federal Land
17TPK64	Ontario	660000	4940000	Non-federal Land
17TPK65	Ontario	660000	4950000	Non-federal Land
17TPK78	Ontario	670000	4980000	Non-federal Land
17TPK87	Ontario	680000	4970000	Non-federal Land
17TPK88	Ontario	680000	4980000	Non-federal Land
17TPK95	Ontario	690000	4950000	Non-federal Land
17TPK97	Ontario	690000	4970000	Non-federal Land
17TPK98	Ontario	690000	4980000	Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
17TQK04	Ontario	700000	4940000	Non-federal Land
17TQK05	Ontario	700000	4950000	Non-federal Land
17TQK13	Ontario	710000	4930000	Other Federal Land and Non-federal Land
17TQK14	Ontario	710000	4940000	Other Federal Land and Non-federal Land
17TQK16	Ontario	710000	4960000	Non-federal Land
17TQK23	Ontario	720000	4930000	Federal and Non-federal Land
17TQK33	Ontario	730000	4930000	Other Federal Land and Non-federal Land
18TTQ63	Ontario	261440	4930000	Non-federal Land
18TTQ72	Ontario	270000	4920000	Other Federal Land and Non-federal Land
18TTQ73	Ontario	270000	4930000	Non-federal Land
18TTQ74	Ontario	270000	4940000	Non-federal Land
18TTQ78	Ontario	270000	4980000	Non-federal Land
18TTQ79	Ontario	270000	4990000	Non-federal Land
18TTQ82	Ontario	280000	4920000	Non-federal Land
18TTQ83	Ontario	280000	4930000	Non-federal Land
18TTQ84	Ontario	280000	4940000	Non-federal Land
18TTQ92	Ontario	290000	4920000	Non-federal Land
18TTQ93	Ontario	290000	4930000	Non-federal Land
18TTQ94	Ontario	290000	4940000	Non-federal Land
18TTQ95	Ontario	290000	4950000	Non-federal Land
18TUQ02	Ontario	300000	4920000	Non-federal Land
18TUQ04	Ontario	300000	4940000	Non-federal Land
18TUQ13	Ontario	310000	4930000	Non-federal Land
18TUQ14	Ontario	310000	4940000	Non-federal Land
18TUQ22	Ontario	320000	4920000	Non-federal Land
18TUQ23	Ontario	320000	4930000	Non-federal Land
18TUQ24	Ontario	320000	4940000	Non-federal Land
18TUQ25	Ontario	320000	4950000	Non-federal Land
18TUQ33	Ontario	330000	4930000	Non-federal Land
18TUQ34	Ontario	330000	4940000	Non-federal Land
18TUQ35	Ontario	330000	4950000	Non-federal Land
18TUQ42	Ontario	340000	4920000	Non-federal Land
18TUQ43	Ontario	340000	4930000	Non-federal Land
18TUQ44	Ontario	340000	4940000	Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
18TUQ45	Ontario	340000	4950000	Non-federal Land
18TUQ52	Ontario	350000	4920000	Non-federal Land
18TUQ53	Ontario	350000	4930000	Non-federal Land
18TUQ54	Ontario	350000	4940000	Non-federal Land
18TUQ55	Ontario	350000	4950000	Non-federal Land
18TUQ56	Ontario	350000	4960000	Non-federal Land
18TUQ62	Ontario	360000	4920000	Non-federal Land
18TUQ63	Ontario	360000	4930000	Non-federal Land
18TUQ64	Ontario	360000	4940000	Non-federal Land
18TUQ65	Ontario	360000	4950000	Non-federal Land
18TUQ66	Ontario	360000	4960000	Non-federal Land
18TUQ67	Ontario	360000	4970000	Non-federal Land
18TUQ72	Ontario	370000	4920000	Non-federal Land
18TUQ73	Ontario	370000	4930000	Non-federal Land
18TUQ74	Ontario	370000	4940000	Non-federal Land
18TUQ75	Ontario	370000	4950000	Non-federal Land
18TUQ76	Ontario	370000	4960000	Non-federal Land
18TUQ77	Ontario	370000	4970000	Non-federal Land
18TUQ82	Ontario	380000	4920000	Other Federal Land and Non-federal Land
18TUQ83	Ontario	380000	4930000	Other Federal Land and Non-federal Land
18TUQ84	Ontario	380000	4940000	Other Federal Land and Non-federal Land
18TUQ85	Ontario	380000	4950000	Non-federal Land
18TUQ86	Ontario	380000	4960000	Non-federal Land
18TUQ87	Ontario	380000	4970000	Non-federal Land
18TUQ92	Ontario	390000	4920000	Other Federal Land and Non-federal Land
18TUQ93	Ontario	390000	4930000	Other Federal Land and Non-federal Land
18TUQ94	Ontario	390000	4940000	Other Federal Land and Non-federal Land
18TUQ96	Ontario	390000	4960000	Non-federal Land
18TUQ97	Ontario	390000	4970000	Non-federal Land
18TVQ02	Ontario	400000	4920000	Other Federal Land and Non-federal Land

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
18TVQ03	Ontario	400000	4930000	Other Federal Land and Non-federal Land
18TVQ05	Ontario	400000	4950000	Other Federal Land and Non-federal Land
18TVQ12	Ontario	410000	4920000	Non-federal Land
18TVQ13	Ontario	410000	4930000	Non-federal Land
18TVQ14	Ontario	410000	4940000	Non-federal Land
18TVQ15	Ontario	410000	4950000	Other Federal Land and Non-federal Land
18TVQ22	Ontario	420000	4920000	Non-federal Land
18TVQ23	Ontario	420000	4930000	Non-federal Land
18TVQ34	Ontario	430000	4940000	Non-federal Land
18TVQ35	Ontario	430000	4950000	Non-federal Land
18TVQ44	Ontario	440000	4940000	Non-federal Land
No. of grid squares = 102; Total Area = 1,017,300 ha; Estimated Amount of Critical Habitat = 162,600 ha				
GL 10				
18TUR07	Ontario	300000	5070000	Non-federal Land
18TUR08	Ontario	300000	5080000	Other Federal Land and Non-federal Land
18TUR09	Ontario	300000	5090000	Other Federal Land and Non-federal Land
18TUR16	Ontario	310000	5060000	Non-federal Land
18TUR17	Ontario	310000	5070000	Non-federal Land
18TUR26	Ontario	320000	5060000	Non-federal Land
No. of grid squares = 6; Total Area = 60,000 ha; Estimated Amount of Critical Habitat = 3,000 ha				

¹Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098>), where the first 2 digits and letter represent the UTM Zone, the following 2 letters indicate the 100 x 100 km Standardized UTM grid, followed by 2 digits to represent the 10 x 10 km Standardized UTM grid containing all or a portion of critical habitat. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See <http://www.bsc-eoc.org/> for more information on breeding bird atlases).

²The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 10 x 10 km Standardized UTM grid square containing all or a portion of critical habitat. The coordinates may not fall within critical habitat and are provided as a general location only. UTM Standardized grid squares at the intersection of UTM zones are merged with their adjacent grid squares.

³Land tenure is provided as an approximation of the types of land ownership that exist where critical habitat may be found and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

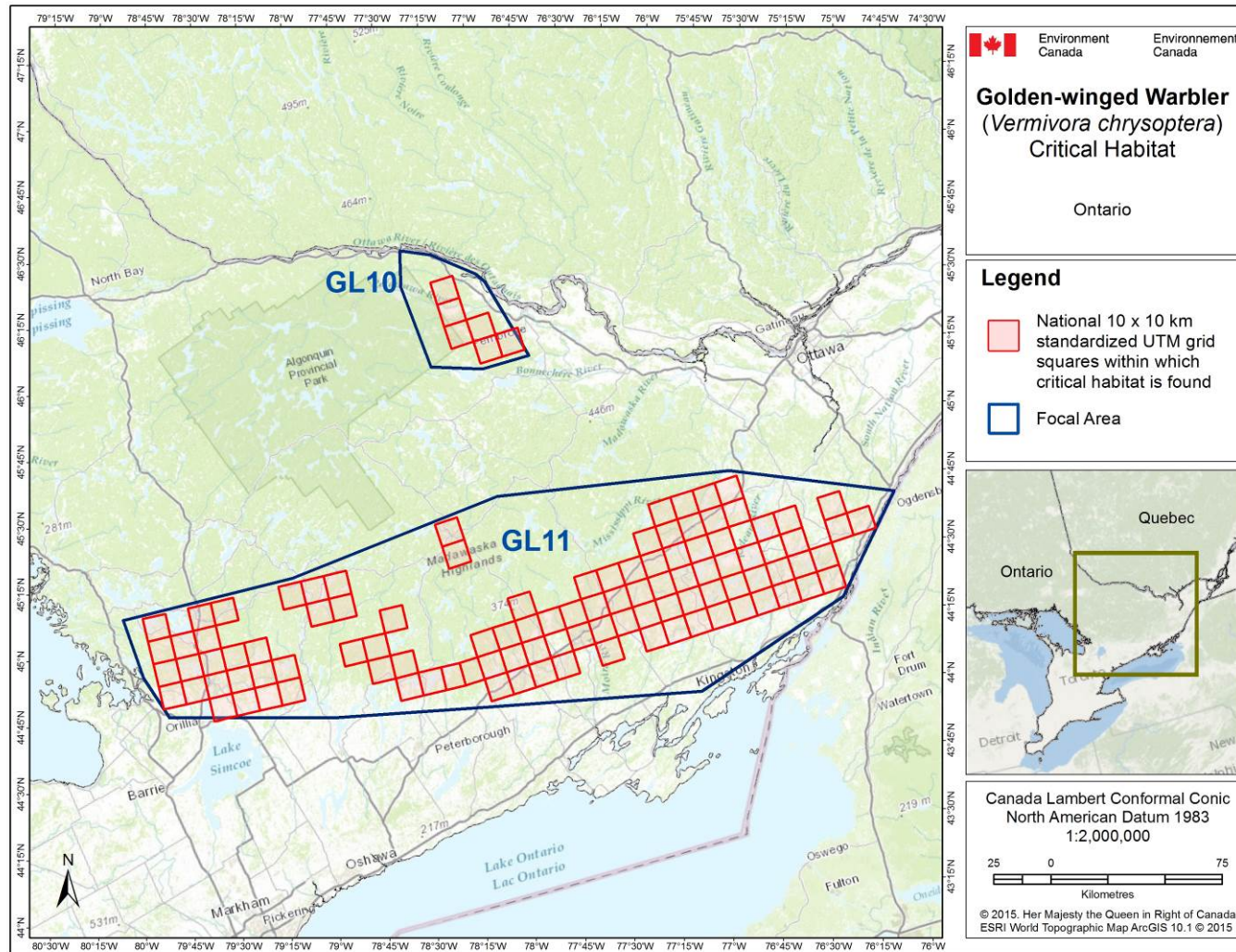


Figure C-1. Grid Squares Identified as Containing Critical Habitat for the Golden-winged Warbler in Ontario.

Critical habitat for Golden-winged Warbler in Ontario occurs within these 10 x 10 km Standardized UTM grid squares where the criteria described in section 7 are met. The grid squares represent 32% of the focal areas in Ontario. Habitat models estimate 165,600 ha of critical habitat are available for the Golden-winged Warbler within the identified grid squares and should be managed proportionately within each focal area.

APPENDIX D: GRID SQUARES IDENTIFIED AS CONTAINING CRITICAL HABITAT FOR THE GOLDEN-WINGED WARBLER (*VERMIVORA CHRYSOPTERA*) IN QUEBEC

Table D-1. Critical Habitat for the Golden-winged Warbler in Quebec occurs within these 10 x 10 km Standardized UTM grid squares where criteria described in section 7 are met.

10 x 10 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
GL 14				
18TWQ59	Quebec	550000	4990000	Non-federal Land
18TWQ69	Quebec	560000	4990000	Non-federal Land
18TWQ78	Quebec	570000	4980000	Non-federal Land
No. of grid squares = 3; Total Area = 30,000 ha; Estimated Amount of Critical Habitat = 860 ha				
GL 15				
18TXQ78	Quebec	670000	4980000	Non-federal Land
18TXQ79	Quebec	670000	4990000	Non-federal Land
18TXR70	Quebec	670000	5000000	Non-federal Land
18TXR81	Quebec	680000	5010000	Non-federal Land
No. of grid squares = 4; Total Area = 40,000 ha; Estimated Amount of Critical Habitat = 600 ha				
GL 17				
18TUR77	Quebec	370000	5070000	Other Federal Land and Non-federal Land
18TVR15	Quebec	410000	5050000	Non-federal Land
18TVR18	Quebec	410000	5080000	Non-federal Land
18TVR24	Quebec	420000	5040000	Other Federal Land and Non-federal Land
18TVR25	Quebec	420000	5050000	Other Federal Land and Non-federal Land
18TVR28	Quebec	420000	5080000	Other Federal Land and Non-federal Land
18TVR34	Quebec	430000	5040000	Other Federal Land and Non-federal Land
No. of grid squares = 7; Total Area = 70,000 ha; Estimated Amount of Critical Habitat = 1,540 ha				

¹Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098>), where the first 2 digits and letter represent the UTM Zone, the following 2 letters indicate the 100 x 100 km Standardized UTM grid, followed by 2 digits to represent the 10 x 10 km Standardized UTM grid containing all or a portion of critical habitat. This unique

alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See <http://www.bsc-eoc.org/> for more information on breeding bird atlases).

²The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 10 x 10 km Standardized UTM grid square containing all or a portion of critical habitat. The coordinates may not fall within critical habitat and are provided as a general location only. UTM Standardized grid squares at the intersection of UTM zones are merged with their adjacent grid squares.

³Land tenure is provided as an approximation of the types of land ownership that exist where critical habitat may be found and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

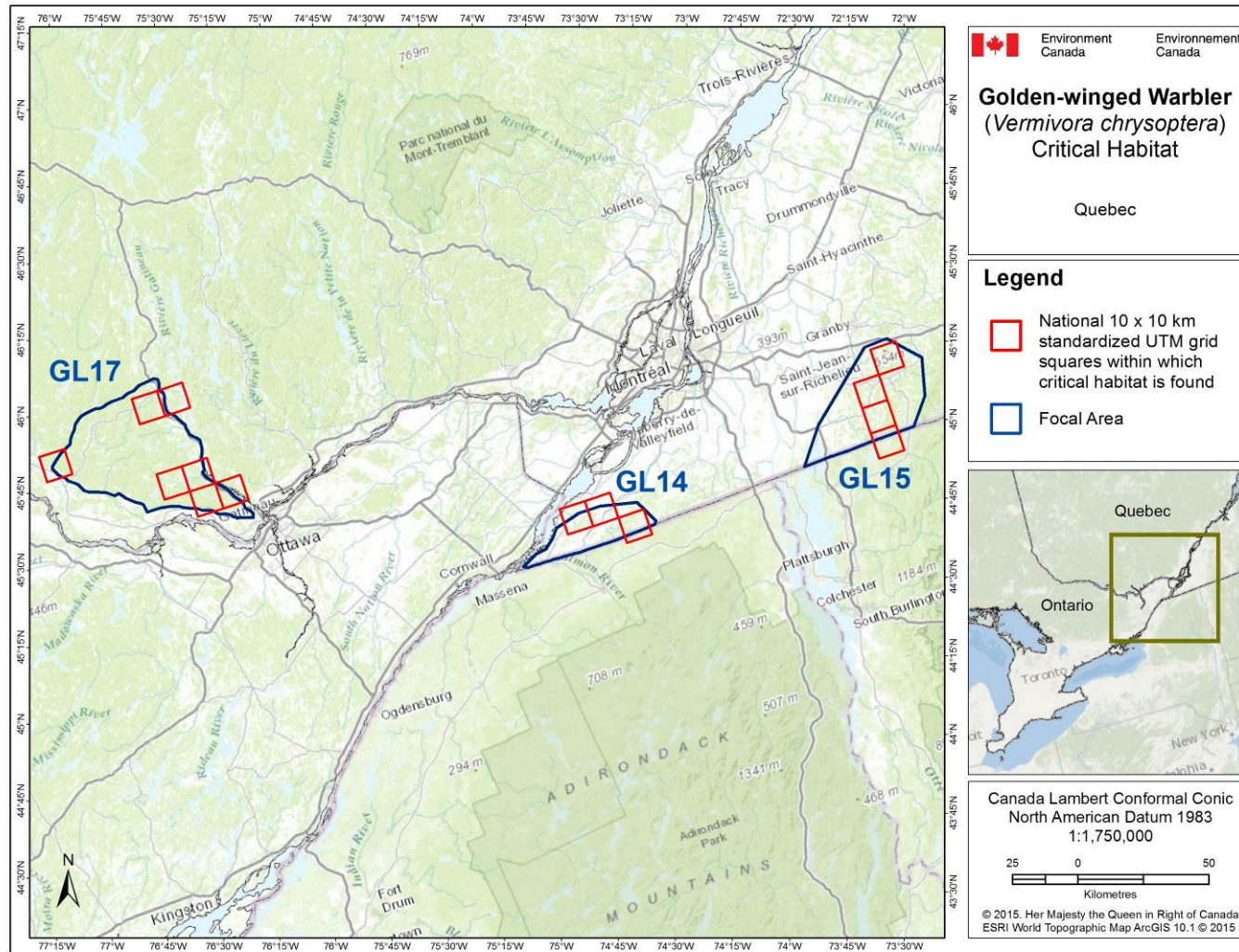


Figure D-1. Grid Squares Identified as Containing Critical Habitat for the Golden-winged Warbler in Quebec.

Critical habitat for Golden-winged Warbler in Quebec occurs within these 10 x 10 km Standardized UTM grid squares where the criteria described in section 7 are met. The grid squares represent 38% of the focal areas in Quebec. Habitat models estimate ~3000 ha of critical habitat are available for the Golden-winged Warbler within the identified grid squares and should be managed proportionately within each focal area.

APPENDIX E: DETAILED BIOPHYSICAL ATTRIBUTES OF SUITABLE BREEDING HABITAT FOR THE GOLDEN-WINGED WARBLER

Table E-1. Detailed Biophysical Attributes of Breeding Habitat for the Golden-winged Warbler

Open/Shrub		
<i>Habitat Type</i>	<i>Characteristics</i>	<i>Species/Components, as examples²⁷</i>
<ul style="list-style-type: none"> • Regenerating forest (e.g., cut or burned) • Grassland • Alvar • Bog • Fen • Meadow (wet or dry) • Pasture • Abandoned field • Thicket • Any other thematic mapping polygon²⁸ that contains more than 50% representation of the habitat characteristics listed here 	>10% herbaceous ground cover	<ul style="list-style-type: none"> • Goldenrod (<i>Solidago</i> spp.) • Bracken Fern (<i>Pteridium aquilinum</i>) • Common Milkweed (<i>Asclepias syriaca</i>) • Wild Strawberry (<i>Fragaria virginiana</i>) • Nettle (<i>Urtica</i> spp.) • Yarrow (<i>Achillea millefolium</i>) • Timothy Grass (<i>Phleum pratense</i>) • Panic Grass (<i>Panicum virgatum</i>) • Canada Wild Rye (<i>Elymus canadensis</i>)
	>15% sapling and shrub cover	<ul style="list-style-type: none"> • Raspberry (<i>Rubus</i> spp.) • <i>Viburnum</i> spp. • Dogwood (<i>Cornus</i> spp.) • Rose (<i>Rosa</i> spp.) • Willow (<i>Salix</i> spp.) • Alder (<i>Alnus</i> spp.) • Aspen or maple (<i>Populus</i> spp. or <i>Acer</i> spp.)
	<30% bare ground	<ul style="list-style-type: none"> • Exposed soils • Mudflats • Rocky outcrops (i.e., bedrock) • Cutbacks • Railway surfaces • Burned areas
	Presence of natural levels of prey items	<ul style="list-style-type: none"> • Tortricid moths (leaf-rollers) and their larvae • Other moths and their pupae • Winged insects • Spiders
Forest		
<i>Habitat Type</i>	<i>Characteristics</i>	<i>Species/Components, as examples²⁵</i>
<ul style="list-style-type: none"> • Deciduous forest • Mixed forest • Woodland • Savannah • Any other thematic mapping polygon that contains more than 50% representation of the habitat characteristics listed 	Forest cover primarily (>50%) deciduous (or mixed) and less than 30% coniferous. Tree cover may be sparse, dense or open with canopy closure ranging between 10 and 100%. When canopy	<ul style="list-style-type: none"> • Poplar/aspen • Oak (<i>Quercus</i> spp.) • Maple • American Beech (<i>Fagus grandifolia</i>) • Birch (<i>Betula</i> spp.) • Tamarack (<i>Larix laricina</i>) • Balsam Fir (<i>Abies balsamea</i>) • Pine (<i>Pinus</i> spp.)

²⁷ Species are provided as examples, based on habitats known to be occupied by Golden-winged Warblers in Canada. As limited habitat inventories are available, this is not an exhaustive list.

²⁸ A thematic mapping polygon is a representation of a group features with similar values (e.g., deciduous forest).

here	closure is <100%, interspersing areas may contain a combination of the open/shrub suitable habitat types described above.	
	Presence of song perches. Presence of natural levels of prey items	<ul style="list-style-type: none">• Tortricid moths (leaf-rollers) and their larvae• Other moths and their pupae• Winged insects• Spiders

APPENDIX F: 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](#)²⁹. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy's](#)³⁰ (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.

The recovery strategy for the Golden-winged Warbler could be implemented in conjunction with those of other species at risk and could benefit other species requiring early successional scrub habitat. Some of the species anticipated to benefit from the implementation of the Golden-winged Warbler recovery strategy include the Eastern Towhee (*Pipilo erythrophthalmus*), Field Sparrow (*Spizella pusilla*) and American Woodcock (*Scolopax minor*) as well as other species at risk such as Loggerhead Shrike (*Lanius ludovicianus*), Eastern Whip-poor-will (*Antrostomus vociferus*) and Common Nighthawk (*Chordeiles minor*). See Schlossberg and King (2007) for additional species that would benefit from the implementation of this recovery strategy.

The approaches identified in the Recovery Planning Table (Table 2) highlight management actions that are designed to benefit Golden-winged Warbler populations; however, it is recognized that some of these actions may be detrimental to other species. Habitat management approaches that favour Golden-winged Warblers do not favour species that require contiguous mature forest or grasslands. Thus, for example, promoting successional habitat in contiguous grassland habitat may reduce the available habitat for an entire guild of other declining grassland species (e.g., Bobolink [*Dolichonyx oryzivorus*] and Eastern Meadowlark [*Sturnella magna*]). Brown-headed Cowbird population control, if determined to be required, will reduce the numbers of that species but would benefit any host³¹ species. An ecosystem approach should be considered for each management opportunity, on a case-by-case basis, in order to consider multiple species needs and ensure an adequate supply of suitable habitat is available for the Golden-winged Warbler and other species. The implementation of the recovery strategy and any future action plan(s) should follow an adaptive management approach, whereby new information feeds back into planning on a regular basis to take advantage of new tools, knowledge, challenges and opportunities.

²⁹ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

³⁰ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

³¹ The Brown-headed Cowbird is a nest parasite that lays its eggs in the nests of other species. The other species which may incubate and raise the young of the cowbird are termed 'host species'.