Species at Risk Act
Action Plan Series

Action Plan for the Kirtland's Warbler (*Setophaga kirtlandii*) in Canada

Kirtland's Warbler

2016

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PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of action plans for species listed as Extirpated, Endangered, and Threatened for which recovery has been deemed feasible. They are also required to report on progress within five years after the publication of the final document on the SAR Public Registry.

Under SARA, one or more action plan(s) provides the detailed recovery planning that supports the strategic direction set out in the recovery strategy for the species. The plan outlines what needs to be done to achieve the population and distribution objectives (previously referred to as recovery goals and objectives) identified in the recovery strategy, including the measures to be taken to address the threats and monitor the recovery of the species, as well as the proposed measures to protect the critical habitat that has been identified for the species. The action plan also includes an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. The action plan is considered one in a series of documents that are linked and should be taken into consideration together. Those being the COSEWIC Status Report, the recovery strategy, and one or more action plans.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Kirtland's Warbler and has prepared this action plan to implement the recovery strategy, as per section 47 of SARA. To the extent possible, it has been prepared in cooperation with the Ontario Ministry of Natural Resources and the Department of National Defence.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions and actions set out in this action plan 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 action plan for the benefit of the Kirtland's Warbler and Canadian society as a whole.

Implementation of this action plan 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 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

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A special acknowledgment to Dr. Paul Aird, Professor Emeritus, Faculty of Forestry, University of Toronto, who not only provided valuable information for this action plan, but who also has been contributing to the recovery of the Kirtland's Warbler in Canada for over 40 years. His voluntary contributions include providing advice to guide recovery for the species as a member of the Kirtland's Warbler Recovery Team, extensive surveying and monitoring for the species and its habitat across Ontario and into Quebec and for many years of contributions to the U.S. Kirtland's Warbler Recovery Team.

EXECUTIVE SUMMARY

The Kirtland's Warbler (*Setophaga kirtlandii*) is a globally rare songbird, listed as Endangered under Schedule 1 of the federal *Species at Risk Act* and also under the Ontario's *Endangered Species Act, 2007*. It breeds mainly in the United States, in the Upper and Lower Peninsulas of Michigan, and was recently discovered in Wisconsin. In Canada, the Kirtland's Warbler has, in recent years, been confirmed nesting at one location, near Petawawa, Ontario. The Kirtland's Warbler primarily breeds in large, even-aged stands of young Jack Pine (*Pinus banksiana*). In Canada, it is threatened by a reduction in habitat quality, and also by habitat loss and fragmentation.

The *Recovery Strategy for the Kirtland's Warbler* (Dendroica kirtlandii[2]) *in Canada* (Environment Canada 2006) was posted in 2006 on the *Species at Risk Public Registry*. This action plan addresses the objectives outlined within the recovery strategy, across the entire range of the Kirtland's Warbler in Canada.

Critical habitat for the Kirtland's Warbler is partially identified within this action plan. Critical habitat for the Kirtland's Warbler is based upon the recent occurrence of nesting pairs or singing males, as well as a vegetation community typically dominated by open Jack Pine woodland of a specific age, size, density, and cover. Examples of activities that are likely to destroy critical habitat are also described in this action plan. Environment and Climate Change Canada (ECCC) is working with the Department of National Defence (DND) at Garrison Petawawa to protect critical habitat, all of which is on federal lands.

Measures to be taken for Kirtland's Warbler in Canada are divided into four broad categories: protection and management, monitoring and assessment, outreach and communication, and habitat restoration.

The potential socio-economic costs and benefits of implementing this action plan are also evaluated. Because the species is only known to occur on DND lands, the anticipated costs will largely be incurred by DND. Costs will generally be related to operational impacts of avoiding the destruction of critical habitat, and could be significant for both Garrison Petawawa locally and the Canadian Army nationally. Nonetheless, overall at a national scale, the economic and social costs incurred are expected to be moderate. The social and economic benefits of contributing to the successful recovery of one of the world's rarest birds are difficult to quantify; it is clear, however, that Canada has a conservation responsibility for this species and the benefits of preserving a globally rare species in terms of biodiversity conservation are very high.

[2] The scientific name *Dendroica kirtlandii* was changed to *Setophaga kirtlandii* in January 2013.

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1. RECOVERY ACTIONS

1.1 Context and Scope of the Action Plan

Until 2007, breeding of this globally rare bird had been documented in Canada only near Midhurst (Barrie), Ontario in 1945, although singing males were infrequently reported in suitable habitat at several sites in Ontario and eastern Quebec (COSEWIC 2008). The global breeding range of this species is restricted to the U.S. states of Michigan and Wisconsin, in addition to Ontario. The Kirtland's Warbler (*Setophaga kirtlandii*) breeds primarily in large, even-aged stands of young Jack Pine (*Pinus banksiana*).

In the summer of 2006, three males were observed at Garrison Petawawa as part of a Species at Risk Monitoring Program. In 2007, three birds (two males and one female) were observed at Garrison Petawawa and nesting was confirmed (Richard 2008). This pair fledged two young. In 2008, one pair fledged four young and two single males were also observed. In 2009, two pairs were found at the site and the two nests produced at least three fledglings. In 2010, two pairs and one single male were detected. One pair fledged two young, while the number of young fledged by the second pair is unknown (Richard 2010). In 2011 one pair was confirmed with at least two fledglings. One single male was also found (Richard pers. comm. 2012). Kirtland's Warblers have now been documented breeding at this location for five consecutive years (2007-2011). No singing males in suitable habitat have been documented during the breeding season at other locations in Ontario or Quebec during this period.

Since active habitat management began in Michigan in the 1970s, the total population of this species has steadily increased. The 2011 U.S. - Canada Kirtland's Warbler census reported 1,825 singing males (Kintigh pers. comm. 2011) with the majority being found in Michigan. Small breeding populations were discovered in 2007 in both Wisconsin and Ontario.

The recovery goals[3] outlined in the Recovery Strategy for the Kirtland's Warbler (*Dendroica kirtlandii*) in Canada (Environment Canada 2006) are:

a) to determine if a breeding population exists in Canada[4]; and
b) to manage habitat at select locations in Canada to encourage the recovery of the species (Environment Canada 2006).

Given the successful breeding of Kirtland's Warblers in eastern Ontario, the context for recovery has changed since the recovery strategy for this species was posted in 2006. Any changes to the recovery goals for Kirtland's Warbler will be incorporated in an updated recovery strategy for the species, however, in the meantime, the approach to recovery will require adjustment within this action plan. Measures are outlined to maintain and, if possible, increase the size of the breeding population in Canada. The discovery of Kirtland's Warbler breeding is a recent occurrence, and information is not yet available to reasonably predict the potential future population size or distribution of this species in Canada.

[3] These recovery goals (2006) were developed before breeding was confirmed in Canada (2007).
[4] This goal has been completed, at least for the confirmed breeding location at Garrison Petawawa. However, more breeding populations may exist, and determining whether this is the case continues to be a recovery goal.

The availability and representation[5] of forest stands dominated by young Jack or Red Pine is integral to the recovery of this species. Efforts have been made in central and northern Ontario to increase the representation of Jack Pine since the posting of the recovery strategy in 2006 by encouraging it through forest management planning. Efforts to create habitat continue to be investigated in conjunction with provincial foresters and biologists and the forest industry in several locations in Ontario. To maintain, and if possible, increase the size of the breeding population in Canada, the creation, maintenance and improvement of forest stands primarily dominated by Jack or Red Pine, particularly in Ontario, must occur.

The measures outlined in this action plan are based on objectives found in the Recovery Strategy for the Kirtland's Warbler. This action plan outlines measures relevant to Ontario and Quebec, where suitable habitat can be found. Protection of wintering grounds will be advocated, largely through the U.S. and Bahamian Kirtland's Warbler recovery programs.

1.2 Critical Habitat

1.2.1 Identification of the species' critical habitat

Critical habitat was not identified in the Recovery Strategy for the Kirtland's Warbler (*Dendroica kirtlandii*) in Canada (Environment Canada 2006).

Critical habitat for the Kirtland's Warbler in Canada is identified in this action plan to the extent possible based on the best available information (current to 2011). Additional critical habitat may be identified across the range as new information becomes available for the Kirtland's Warbler.

Population and distribution objectives were not identified in the 2006 Recovery Strategy and several measures identified in this action plan need to be completed in order to develop population and distribution objectives for Kirtland's Warbler. These measures are outlined in Table 3. Thus it is unknown whether the identified critical habitat is sufficient to recover the species in Canada and therefore critical habitat is considered to be partially identified in this document.

The identification of critical habitat for the Kirtland's Warbler is based on two criteria: occupancy by the Kirtland's Warbler and habitat suitability.

1.2.1.1 Suitable Habitat Occupancy Criterion

Suitable habitat is considered occupied when one or more Kirtland's Warblers has been observed during the breeding season for any single year since 2006.

[5] Retaining a representative sample of all naturally occurring forest types.

Given the rarity of the species, all known observations during the breeding season are considered in the identification of critical habitat which includes observations of confirmed, probable, or possible breeding evidence (presently available information is from the period 2006 to 2011). The definition of confirmed, probable or possible breeders follows standard Breeding Bird Atlas codes in Canada (Appendix B). Confirmed, probable, and possible breeding evidence must be obtained from reliable sources[6] for the site to be considered critical habitat.

1.2.1.2 Suitable Habitat

Suitable habitat is characterized as the areas where individuals of the species carry out essential aspects of their life cycle (courtship, territory defence, feeding, nesting, perching, fledging, post-fledging and dispersal) in Canada. Kirtland's Warbler habitat includes both forested areas and sparsely treed areas in close proximity to suitable forest habitat. Kirtland's Warblers are habitat specialists, preferring extensive tracts of early successional, densely-stocked Jack Pine, growing in a patchy pattern and with frequent small open to lightly-stocked areas (Probst and Weinrich 1993, Coulson 2009). Kirtland's Warbler will select territories within heterogeneous Jack Pine stands; areas where breeding territories will contain a mixture of open to densely stocked areas, while selecting optimal density treed habitat within territories for nest sites (Nelson and Buech 1996, Walker et al. 2003). Based on U.S. research, Kirtland's Warblers first appear in an area about five to six years following fire, when young Jack Pine are 1.5m to 2.0m tall, and will use the area for approximately 15 to 20 years, or until trees reach 3m to 5m in height (Walkinshaw 1983; Probst 1988; Probst and Weinrich 1993). Kirtland's Warblers will initially colonize areas with 20% to 25% Jack Pine cover, although optimal habitat is considered to be 35% to 65% Jack Pine cover (Probst 1988; Kepler 1996). The species will nest in areas with as few as 3,000 trees/ha, although optimal habitat requires a density of 5,000 to 7,500 trees/ha (Probst 1988). The height of the lowest live branch of Jack Pine may also be a factor in the decline of a stand's suitability, as low branches conceal nests on the ground and provide low perches for adults (Probst 1988). Fledglings will move beyond original natal territories but typically will remain within the forest stand. In Michigan, Kirtland's Warbler fledglings have been observed to move 200m from the breeding territory (Mayfield 1960).

Open to lightly stocked areas of Jack Pine where they occur as small, interspersed patches within a larger stand of trees are important in the selection of nest sites (Walkinshaw 1983). These areas are a refuge for herbaceous flora important to Kirtland's Warbler nest habitat (Houseman and Anderson 2002) and provide essential foraging opportunities (insects, fruits) (COSEWIC 2008). Nests are often built at or near the edges of openings sheltered beneath living pine branches and ground vegetation (Mayfield 1960; Walker et al. 2000). Habitat management efforts in Michigan target the preferred forest stand patchiness of Kirtland's Warbler by creating planting patterns with small openings (<1ha) surrounded by dense patches (preferably >3,900 stems/ha) of Jack Pine (Corace et al. 2010).

[6] Reliable sources may include but are not limited to: records within the Ontario Natural Heritage Information Centre, records in the Ontario Breeding Bird Atlas, observations from acknowledged species experts, observations from recognized birders with photographic evidence, OMNR, ECCC, or Bird Studies Canada (BSC), DND survey reports, etc.

Open to lightly stocked areas of Jack Pine where they occur within the forest landscape are also important dispersal areas for Kirtland's Warbler. Yearlings have shown an innate tendency to disperse to younger habitat from selected nesting habitat (Walkinshaw 1983; Donner et al. 2009). Recruitment into lightly stocked areas (<2,000 trees/ha) by Kirtland's Warbler occurs as the species spatially redistributes from aging suitable habitat into these developing habitat areas (Donner et al. 2008; Donner et al. 2009).

At nest sites in natural settings in Michigan, Jack Pine may also be mixed with Red Maple (*Acer rubrum*) and Trembling Aspen (*Populus tremuloides*) (Mayfield 1992). Although Kirtland's Warblers formerly bred in large, fire-regenerated areas of Jack Pine, most of the Michigan breeding population now occurs within extensive tracts of Jack Pine plantation that was specifically created for the species. The species will also nest in mixed plantations or in Red Pine (*Pinus resinosa*) or Scots Pine (*Pinus sylvestris*) plantations (Weinrich in Sykes 1997; Anich et al. 2011).

Based on the best available information from Michigan and Ontario, the following are the key features of optimal nesting habitat that is suitable habitat for the Kirtland's Warbler in Canada:

- Naturally regenerating forest stand or plantation dominated by Jack Pine or Red Pine
- Stand age of 5-25 years
- Tree height 1.5-5 m
- Stand density of 3,000 trees/ha or greater, and
- Herbaceous ground vegetation such as Low Sweet Blueberry (*Vaccinium angustifolium*), Bearberry (*Arcostaphylos uva-ursi*), Sweet Fern (*Comptonia peregrina*), Bracken Fern (*Pteridium aquilinum*), Canada Mayflower (*Maianthemum canadensis*) and various grass species (Walkinshaw 1983; Deloria-Sheffield et al. 2001; Houseman and Anderson 2002; Richard 2010).

In addition, forest openings and less dense stands where they occur within or alongside habitat areas described above, and up to a maximum distance of 200 m into the open or less dense stands, are also considered suitable habitat for the purposes of maintaining diverse habitat important for Kirtland Warbler nest selection (Probst 1988, Nelson and Buech 1996), foraging, perching, movement and dispersal. The following are the key features of these suitable habitat areas for the Kirtland's Warbler in Canada:

- Stand density of 3,000 trees/ha or less and
- Herbaceous ground vegetation such as Low Sweet Blueberry, Bearberry, Sweet Fern, Bracken Fern, Canada Mayflower and various grass species (Walkinshaw 1983; Deloria-Sheffield et al. 2001; Houseman and Anderson 2002; Richard 2010).

Areas of suitable habitat may be larger than the territories of breeding pairs, as individual Kirtland's Warblers tend to select forest tracts larger than the areas they actually occupy during breeding (Walkinshaw 1983). Juvenile Kirtland's Warbler will also move out of territories and into suitable habitats within the forest stand (Mayfield 1992).

1.2.1.3 Application of Kirtland's Warbler Critical Habitat Criteria

Critical habitat for Kirtland's Warbler is identified as the continuous suitable habitat (see Section 1.2.1.2) known to be occupied by the Kirtland's Warbler according to the Suitable Habitat Occupancy Criterion as described in Section 1.2.1.1. Since suitable habitat is described at a stand level[7], small pockets (i.e. 1 ha or less) of open to less dense trees (< 3,000 trees/ha) are considered as part of the forest stand area; usually described in the field as habitat inclusions or habitat complexes (Lee et al. 1998). The inclusion of small (<1 ha) open to moderately dense patches within a Jack Pine stand is consistent with successful management strategies for Kirtland's Warbler habitat in Michigan (Corace et al. 2010).

Critical habitat includes an additional 200m around the edge of optimal breeding habitat, where it meets the suitable habitat criteria, to protect the critical functions of suitable nesting areas. Including up to 200m of open to less dense stands of suitable habitat where they occur contiguous with dense stands of optimal nesting habitat provides essential edge habitat important to Kirtland's Warbler for foraging, perching, and dispersal. Nests are often built at or near the edges of openings sheltered beneath living pine branches and ground vegetation (Mayfield 1960; Walker et al. 2000). The thickets of Jack Pine provide cover for Kirtland's Warbler early in the life of a stand, while the presence of openings maintain ground vegetation and lower live limbs around their periphery (or edge), extending the useful life of the stand as breeding habitat (Buech 1980). This 200m area also considers the fact that fledglings have been observed to move 200m beyond breeding territories into adjacent suitable habitats (Mayfield 1992) and that adjacent developing habitats are essential for species recruitment. Yearling Kirtland's Warblers typically disperse into younger habitat from selected nesting habitat (Walkinshaw 1983; Donner et al. 2009).

Gravel or single lane paved roads as well as small pockets of bare ground (in areas that are predominantly vegetated) do not constitute a break in continuous suitable habitat as the habitats remain functionally connected for the species. For additional clarity, unsuitable habitat features such as existing anthropogenic features (e.g. existing infrastructure, including roads, trails, and buildings) within a site are not necessary for the survival or recovery of the species and are therefore not critical habitat. Continuous suitable habitat is broken by major roads (e.g. multi-laned paved roads) or the end of suitable habitat as described in Section 1.2.1.2.

Application of critical habitat criteria to available information identifies sites in Renfrew County on Garrison Petawawa as critical habitat. The area containing critical habitat for Kirtland's Warbler is presented in Table 1. Critical habitat for Kirland's Warbler in Canada occurs within the 10 x 10 km standardized UTM grid squares where the critical habitat criteria described in section 1.2 are met. As new information becomes available (see section 1.2.3, Schedule of Studies), additional critical habitat sites may be identified where they meet the critical habitat criteria across the range of the Canadian Kirtland's Warbler population.

[7] The Ecological Land Classification for Southern Ontario (Lee et al. 1998) identifies the appropriate scale for site or stand level research e.g. habitat inventory or mapping to be approximately 1:10,000.This identifies a minimum mapping unit of 1 hectare or less, depending on the resolution of available data. In other words, at this resolution patches within the forest stand that are less than 1 ha will be considered part of the homogeneous stand area.

Table 1. Grid squares identified as containing critical habitat for Kirtland's Warbler in Canada.
Critical habitat for Kirtland's Warbler in Renfew County occurs within the 10 x 10 km UTM grid squares, where the criteria described in section 1.2 are met.

10 x 10 km Standardized UTM grid square ID[1]	UTM Grid Square Coordinates[2]		Land tenure[3]
	Easting	Northing	
18TR98	290000	5080000	Federal
18TR99	290000	5090000	Federal
18UR08	300000	5080000	Federal
18UR09	300000	5090000	Federal
18UR18	310000	5080000	Federal
18UR19	310000	5090000	Federal
18UR28	320000	5080000	Federal
18UR29	320000	5090000	Federal
18US10	310000	5100000	Federal

[1]Based 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 two digits represent the UTM Zone, the following two letters indicate the 100 x 100 km standardized UTM grid followed by two digits to represent the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. 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).
[2]The 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 squares containing Garrison Petawawa. The coordinates may not fall within critical habitat and are provided as a general location only.
[3]Land tenure is provided as an approximation of the types of land ownership that exist where critical habitat has been identified and should be used for guidance purposes only.

1.2.2 Examples of activities likely to result in 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 were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time.

Below is a list of activities that would likely destroy critical habitat based on where the activity takes place and the component of critical habitat it affects. It is not an exhaustive list of all activities likely to destroy crtical habitat:

- Activities that result in forest clearing or large-scale/extensive removal that reduce overall forest size or density such that a large portion of the species' suitable habitat features are eliminated. For example through construction of roads, buildings or similar structures which result in removing large numbers of trees that could provide cover for birds, shelter for nests, perches and food sources.

  Forest harvesting that follows management guidelines, including the creation of one to five well-dispersed small openings for every 4,000 m^2 (1 acre) of forest, which are desirable to Kirtland's Warblers for nesting and having a total openness of approximately 25% or 1,000 m^2 for every 4,000 m^2 (Huber 2001; Spaulding and Rothstein 2009) in dense stands of trees, is not likely to result in the destruction of critical habitat. Some forest management is generally required to maintain sufficient areas of suitable habitat for this species over time.

- Activities that result in fragmentation of suitable habitat (e.g., the construction of roads, buildings, hydro towers, wind turbines and lines and other similar structures) such that forest stand size is reduced leaving the remaining forest areas in stands of sizes that would no longer be sufficient for the Kirtland's Warbler to fulfil its life cycle (e.g. a reduction in stand size such that the species will not utilize habitats it formerly used following the completion of the activity).

- Activities that remove or kill ground vegetation (e.g., spraying of herbicides and/or pesticides, trampling and off-road vehicle use), creating easily discernible open areas of four square metres or larger and/or trails 0.3 metres or greater in width and four square metres or larger in total area[8]. This creates areas devoid of native ground vegetation that typically provides cover/shelter, food etc. for Kirtland's Warblers. These activities, or the removal of trees when performed along road sides and on ground vegetation that is encroaching on the road, may not destroy critical habitat when conducted outside of the breeding season. Numerous studies cite the importance of ground cover to the Kirtland's Warbler (Smith 1979; Buech 1980; Zou et al. 1992; Houseman and Anderson 2002).

1.2.3 Schedule of studies to identify critical habitat

A schedule of studies was provided in the Recovery Strategy for the Kirtland's Warbler in Canada (Environment Canada 2006) (Table 2). Activities within this schedule of studies have either been completed or are currently underway.

The critical habitat identified in this action plan is considered partial. As Kirtland's Warbler surveys continue in Ontario and Quebec, additional areas of critical habitat may be identified. It will be important to collect the relevant information needed to determine which areas meet the criteria for further identification of Kirtland's Warbler critical habitat. Therefore, a supplement to the schedule of studies is included in this action plan (Table 3) to update the activities described

[8] Until more information becomes available for this globally rare species, found at only one location in Canada, this size area will be used to describe "easily discernible".

in the 2006 schedule of studies. The schedule of studies supplement will be incorporated in any updated recovery strategy for the species.

Table 2. Schedule of studies (Environment Canada 2006).
*****All activities not yet completed are currently underway and have been incorporated into Table 3.

Targeted completion date*	Research required	Anticipated benefit
2006-2009	Complete surveys and ground-truth wherever suitable habitat is found, including Thessalon, Chapleau/Gowganda, Cartier/Lake Wanapitei, Petawawa, Manitoulin Island, the Bruce Peninsula, and Barrie/Orillia	Provide focus for survey and monitoring efforts, coordinate data
2007-2011	Select high-potential sites and monitor annually	Locate breeding populations
2006-2011	Continue to undertake surveys and document suitable habitat in other areas of Ontario	Locate breeding populations
Within one season of breeding confirmation **[Completed]**	Determine a method to locate and identify critical habitat and complete mapping	Map critical habitat for known breeding occurrences
Within one season of breeding confirmation **[Completed]**	Describe habitat in Canadian breeding locations: vegetation communities, density and cover, other habitat features, etc.	Obtain site-specific habitat information; inform management
Annually upon breeding confirmation	Complete annual census of Canadian population	Set population targets for recovery in Canada
Upon breeding confirmation	Completely identify potential critical habitat	Critical habitat identified

Table 3. Schedule of studies supplement.

Activity	Timeline
Assess population and distribution of Kirtland's Warbler in Canada	
▪ Complete annual census of known Canadian occurrence(s); and ▪ When possible, continue to monitor and survey annually in high-potential sites in Ontario and Quebec, including the Chapleau area, Renfrew County, western Quebec, eastern Algonquin Provincial Park, Manitoulin Island, the Bruce Peninsula, eastern Georgian Bay, and North Bay areas	Underway / 2016-2021
Assess quantity, attributes, and location of known and potential suitable habitat	
▪ Map areas of suitable habitat based on survey results; ▪ Describe suitable habitat using Forest Ecosystem Classification and Ecosystem Land Classification communities for all past, current and future nest sites and territories; and ▪ Use this and additional site characteristics (density, cover) to refine the description of key habitat attributes for Canadian sites.	Underway / 2016-2021

Fully identify critical habitat for the Kirtland's Warbler in Canada	
▪ Develop numerical population and distribution objectives for the persistence of the current breeding population of Kirtland's Warbler in Canada; ▪ Use habitat mapping together with population and distribution objectives to calculate and refine critical habitat area required to meet recovery targets; and ▪ Revise critical habitat identification based on results.	2021

1.3 Proposed Measures to Protect Critical Habitat

In Canada, critical habitat for Kirtland's Warbler occurs only on federal land owned by the Department of National Defence. In the event that the critical habitat identified in this action plan is determined to be legally protected, a statement to that effect will be made available on the SAR Public Registry. In the event that it is determined that any portions remain unprotected, steps will be taken to ensure that they are protected in accordance with SARA s. 58.

Measures to be taken to protect critical habitat include working with the Department of National Defence on an order or other suitable mechanism for any portion of critical habitat that is not already legally protected by provisions in or measures under SARA or any other Act of Parliament.

1.4 Measures to be Taken and Implementation Schedule

The measures to be taken and implementation schedule proposed to meet the broad strategies outlined in section 2.4 of the *Recovery Strategy for the Kirtland's Warbler in Canada* (Environment Canada 2006) are presented in Table 4.

1.4.1 Measures completed or underway

Since confirmation of breeding by Kirtland's Warbler in 2007, many actions have been undertaken. Below is a brief description of measures completed or in progress.

Habitat was created on Garrison Petawawa through forest fires caused by military training and through regeneration of Jack Pine between 1999 and 2005 through aerial seeding and hand-planting (Richard pers. comm. 2012). Surveys were conducted for Kirtland's Warbler at Garrison Petawawa in 2002, 2004 and 2005 and a survey and monitoring program has been implemented annually since 2006. Garrison Petawawa has also conducted annual habitat assessments since 2006 (Richard 2010). Birds were colour banded from 2006 – 2009.

Garrison Petawawa has also developed a species at risk identification field guide that includes Kirtland's Warbler, which is distributed to personnel utilizing the range and training area to

facilitate the reporting of sightings (Richard 2010). In 2013 a Master's thesis was completed characterizing Kirtland's Warbler habitat on Garrison Petawawa (Richard 2013).

The process of identifying and surveying suitable habitat elsewhere in Ontario has occurred annually since 2006. Potentially suitable, large areas of Jack Pine have been identified by recovery team members with the assistance of Ontario Forest Resources Inventory (FRI) databases, and the expertise of OMNR staff, forest industry representatives and volunteers. Ground-truthing and searches, using standard methods i.e. the *Searching and Monitoring Protocol for Kirtland's Warbler in Canada* (Kirtland's Warbler Recovery Team 2010) and *Search Protocol for Kirtland's Warbler* (Kirtland's Warbler Recovery Team 2012) have been undertaken in the following areas:

- Bancroft area,
- Bruce Peninsula,
- Chapleau area,
- Eastern Algonquin Provincial Park,
- Eastern shoreline of Georgian Bay,
- Manitoulin Island,
- North Bay area,
- OMNR Sault Ste. Marie District, and
- Renfrew County.

Forest management prescriptions have been developed through the Forest Management Planning process and are being used in OMNR's Pembroke District. A habitat suitability model for Kirtland's Warbler in the Great Lakes – St. Lawrence forest of Ontario (Coulson 2009) has been developed and provided to other Forest Management Units in Ontario where Kirtland's Warbler may occur.

The OMNR has prepared a guide for the Ontario forest industry, showing Areas of Concern (AOCs) in the forest management planning process, which will help to identify and protect suitable habitat for Kirtland's Warbler. Field identification sheets have also been prepared for OMNR forestry technicians in Renfrew County, and these are being revised for wider audiences (Coulson pers. comm. 2008).

In Algonquin Provincial Park, suitable habitat is monitored annually and surveys for additional habitat have been undertaken in the eastern section of the park. Forest management targets have been developed to ensure areas of suitable habitat (age and density etc.) are available in the future. This includes several areas where the selective removal of other tree species and planting and aerial seeding of Jack Pine is undertaken by forest management personnel (Steinberg pers. comm. 2010).

Potential habitat for Kirtland's Warbler has also been identified in Quebec using forest stand attributes from digital forestry maps (COSEWIC 2008). Targeted surveys have occurred within potential habitat at locations including Kazabazua, Ile aux Allumettes, Ile du Grand Calumet, and Parc de la Vérendrye. No targeted surveys have been conducted in Quebec since 2007.

1.4.2 Measures to be taken and implementation schedule

The measures identified are divided into four broad categories: protection and management, monitoring and assessment, outreach and communication, and habitat restoration. They are described in Table 4, together with the implementation schedule for their completion.

Table 4. Measures to be Taken and Implementation Schedule.

Recovery Measures	Priority	Threats or concerns addressed	Timeline
1. Protection and Management			
1.1 Protect known site(s) from immediate threats and restrict access under existing legislation, policies, guidelines, work plans and management plans.	High	Reduced habitat quality ; habitat loss and fragmentation	Ongoing
1.2 Develop and/or implement site-specific habitat work plan(s)/management plan(s) for Kirtland's Warbler at Garrison Petawawa and adjacent areas, and other sites as required.	High	Reduced habitat quality; habitat loss and fragmentation	2015 and ongoing
1.3 Characterize occupied habitat and compare to Michigan studies to determine differences and inform management.	High	Lack of species information	2016
1.4 Evaluate threats to Kirtland's Warblers at any new breeding locations.	Medium	Lack of species information	Within one year of confirmation of breeding
2. Monitoring and Assessment			
2.1 Work with provincial foresters, biologists and the forest industry to assess quantity, attributes and location of known and other suitable habitat in Ontario and Quebec, using forestry mapping and Geographical Information Systems (GIS): ▪ Characterize occupied habitat ▪ Describe vegetation communities for all past and current nest sites ▪ Map areas of suitable habitat ▪ Identify opportunities for habitat creation	High	Lack of species information	Ongoing
2.2 Conduct annual population census at breeding site(s), and banding where appropriate, and report results annually to recovery teams in Canada and U.S.	High	Lack of species information	2015 and ongoing
2.3 Investigate incidental reports of singing males in suitable habitat	High	Lack of species information	As opportunities arise
2.4 Maintain and update the National Survey and Monitoring Protocol for Kirtland's Warbler.	Medium	Lack of species information	As required

Recovery Measures	Priority	Threats or concerns addressed	Timeline
3. Outreach and Communication			
3.1 Encourage communication among ECCC, DND, OMNR (including Ontario Parks) and other partners, including the forest industry, especially at the management/forestry technician level to achieve recovery.	High	Multi-agency co-operation	Ongoing
3.2 Encourage birding groups and naturalist clubs to seek landowner permission and then search for Kirtland's Warblers and their habitat to increase survey coverage (and report sightings to ECCC and OMNR).	High	Lack of public awareness; Lack of species information	Ongoing
3.3 Produce and deliver communications materials to increase awareness of Kirtland's Warbler and its habitat to Ontario Crown forest licensees, OMNR district foresters and technical staff in priority areas	High	Lack of species awareness; All threats	2015 and Ongoing
3.4 Work co-operatively with the U.S. recovery team and agencies on measures of mutual importance.	Medium	All threats; Lack of information	Ongoing as required
3.5 Educate the public (local and province-wide) about Kirtland's Warbler conservation through field naturalists and media.	Low	Lack of public awareness	2015 and ongoing
4. Habitat Restoration			
4.0 Work with OMNR to strongly encourage Forest Management Planning (FMP) teams in target areas of Ontario to develop and attain specific targets to manage and provide suitable Kirtland's Warbler habitat within planning unit(s).	High	Reduced habitat quantity and quality; habitat loss and fragmentation	2015 and ongoing, according to FMP timelines
4.1 Determine areas suitable for habitat management/creation in Ontario, and create and manage habitat through partnerships with landowners or land managers.	High	Reduced habitat quality; habitat loss and fragmentation	Ongoing

ECCC – Environment and Climate Change Canada; OMNR – Ontario Ministry of Natural Resources; DND – Department of National Defence.

2. SOCIO-ECONOMIC EVALUATION

The *Species at Risk Act* requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation (SARA 49(1)(e)). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety, recognizing that not all aspects of its implementation are under the jurisdiction of the federal government. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis.

Its intent is to inform the public and to guide decision making on implementation of the action plan by partners.

The protection and recovery of species at risk can result in both benefits and costs. The Act recognizes that "*wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons*" (SARA). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996; Fisheries and Oceans Canada 2008). Furthermore, the conservation of species at risk is an important component of the Government of Canada's commitment to conserving biological diversity under the *International Convention on Biological Diversity*. The Government of Canada has also made a commitment to protect and recover species at risk through the Accord for the Protection of Species at Risk. The specific costs and benefits associated with this action plan are described below.

The primary measures to implement Kirtland's Warbler action plan activities in Ontario have been and will continue to be through federal and provincial government cooperation along with the implementation of stewardship initiatives with land managers.

The only known breeding occurrence of Kirtland's Warbler in Canada occurs at Garrison Petawawa, an active military base administered by the federal Department of National Defence. Public access is not permitted. The anticipated socio-economic costs and benefits associated with implementing this action plan, including the protection of critical habitat at Garrison Petawawa, are presented below.

It is possible that the population and geographic extent of breeding Kirtland's Warblers may increase over time, especially if habitat management is undertaken in suitable locations in Ontario and Quebec. This may result in the need for additional measures not identified in this plan, and may significantly change the costs associated with implementing this action plan. Should the population and geographic extent of breeding Kirtland's Warbler increase, such that additional activities are required and additional benefits are realized, the socio-economic evaluation will be updated. The socio-economic evaluation presented below deals only with the current situation.

2.1 Costs

All of the critical habitat in Canada is currently located on an active federal military base with no public access. Therefore most costs of its protection will be borne by the Department of National Defence. The social and economic costs incurred by the Department of National Defence as a result of the implementation of this action plan, particularly costs to avoid the destruction of critical habitat, could be significant for both Garrison Petawawa locally and the Canadian Army nationally. As one of six major force generation bases with the Canadian Army, any local

reductions in training opportunities at Garrison Petawawa to protect critical habitat could adversely impact land force readiness.

Management of Kirtland's Warbler and its habitat may have several socio-economic costs to operations at Garrison Petawawa and elsewhere in Canada.

1. Critical habitat for Kirtland's Warbler is identified in an area of Garrison Petawawa that is used for military training purposes. The peak training period on Garrison Petawawa is March through October. The protection of critical habitat through personnel access restrictions to portions of the Range and Training Area at Garrison Petawawa could impact the quality of training and limit the number of training opportunities for military and other federal and provincial enforcement personnel. It may be necessary to limit or cease military training in some areas within critical habitat which have unique military training features, as many training exercises cannot be re-located outside of critical habitat within the Garrison Petawawa Range and Training Area. These areas are booked far more frequently than other areas of the property that are not critical habitat. Over 3,800 personnel could be affected annually if all training planned within critical habitat for an entire year was affected (Department of National Defence 2011). The monetary costs associated with reducing land use and loss of training opportunities could be significant to Garrison Petawawa. It is, however, difficult to attribute a monetary value to the loss of training opportunities.

There are also costs associated with planning and altering military training. Large expenditures for food, water, fuel, ammunitions and other consumables are ear-marked at the planning stage, well in advance of the activity that is to possibly occur in critical habitat. Costs of cancelling or relocating major exercises can be as high as several hundred thousand dollars (Department of National Defence 2011). Additional planning costs to shift dates, relocate or alter training are also anticipated since training exercises are often booked a year in advance. Revisions to incorporate changes to training and infrastructure into Garrison Petawawa's three-year plan and budget would also increase planning costs.

Although commercial forestry is conducted at Garrison Petawawa, it is minimal in extent and income generation and does not occur in Jack Pine forest; therefore commercial forest harvesting will not be affected by the action plan (Department of National Defence 2011).

2. Due to the restricted public access to Garrison Petawawa, the enforcement of legal protection of critical habitat and management of the only current nesting location (e.g. habitat assessments, surveying, monitoring, etc.) is likely to be completed mainly by the Department of National Defence, with technical and limited financial support from Environment and Climate Change Canada.

3. Measures in this action plan aim to increase suitable Jack Pine habitat through the Ontario FMP process, and increase the use of partnerships with the forestry sector. This is likely to be a key factor in increasing the Kirtland's Warbler populations in Canada, because much of the potentially suitable Jack Pine habitat in Ontario is approaching an age well beyond what is suitable for nesting and is in need of renewal. Setting minimum area targets for suitable Jack Pine habitat will require additional time and effort by foresters and biologists to become familiar with Kirtland's Warbler habitat management guidelines. Existing guidelines developed in the

United States clearly take into account commercial concerns, such as economic timber values and harvest potential and will be a useful resource (Huber et al. 2001). Management of Jack or Red Pine to provide suitable Kirtland's Warbler habitat is likely to require additional planning and some changes to current management, but significant financial impacts on the forestry sector are not anticipated.

4. Other actions described in this plan, including surveys, habitat management, and developing forest management prescriptions have been recommended for areas throughout Ontario and Quebec. The costs of implementing these activities will largely be borne by existing staff and programs and do not add to existing resources through this action plan.

2.2 Benefits

Many of the benefits derived from biodiversity conservation, including the protection of species at risk, are non-market commodities that are difficult to quantify. Wildlife, in all its forms, has value in and of itself, and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological, and scientific reasons. For Canada, biodiversity is important to its current and future economy and natural wealth. A self-sustaining healthy ecosystem with its various elements in place, including species at risk, contributes positively to landowner and public livelihoods.

With effective management of suitable habitat, the potential for an increase in the Kirtland's Warbler population in Canada is high. In the United States, where effective management and expansion of Kirtland's Warbler habitat has resulted in substantial population increases, significant socio-economic benefits have occurred. The recovery of this globally endangered songbird has become a well-known conservation success story, and a source of pride for the state of Michigan. The success has been the result of unprecedented co-operation among federal and state agencies and the forestry sector. Kirtland's Warbler continues to be one of the world's rarest birds, and in Michigan is a highly desirable destination for a growing population of avid birders. Nature-based tourism contributes seasonal income to local economies, and several non-profit organizations contribute to conservation efforts.

Because the only currently known breeding occurrence in Canada is not publicly accessible, there are no opportunities at present for nature viewing or wildlife tourism, and future potential cannot be estimated at this time. The main socio-economic benefits to implementing this plan in Canada are expected to be indirect. For example, increased interaction among staff from federal and provincial agencies and the forest sector (e.g. in the development of forest management plans) may result in stronger working relationships that could also assist in the recovery of Kirtland's Warblers, many other species at risk and other wildlife. Similarly, communication with American agencies would benefit the program and strengthen inter-jurisdictional relationships between Canada and the United States.

The main benefits of implementing this plan are difficult to quantify socio-economically. However, from a biodiversity and population conservation perspective, the main benefit is that the global population and range of this endangered songbird may be increased, preventing it from becoming extirpated in Canada.

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APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[9]. 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[10] (FSDS) goals and targets.

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

At least two other species at risk (the Whip-poor-will (*Caprimulgus vociferus*) and Common Nighthawk (*Chordeiles minor*)) are known to occur in the Jack Pine forest area which has been identified as Kirtland's Warbler critical habitat (Coulson pers. comm. 2010; Richard pers. comm. 2012). A floristic inventory of Garrison Petawawa (Brunton 1999) documented one provincially rare plant, Houghton's Umbrella-sedge (*Cyperus houghtonii*, S3?), which was located on the edge of Kirtland's Warbler habitat. Any management actions within critical habitat, such as stand maintenance in order to maintain suitable age-classes of Jack Pine, should consider the needs of these species.

The effects of potential management actions (e.g. forest harvest, replanting, and prescribed burning) can be managed so that they have minimal negative effects for most species, and have beneficial effects for some. In the United States, the positive effects of Kirtland's Warbler habitat management on other native species have been well documented (e.g. Huber et al. 2001). In Michigan forests that are managed for Kirtland's Warbler, rather than for Jack Pine alone, the openings created have been shown to provide important refugia for the flora native to Jack Pine barrens, now a critically imperiled plant community (Houseman and Anderson 2002). Although cowbird control is not believed to be required in Canada currently, any reduction in the cowbird population would likely also benefit other native songbirds.

Surveys for Kirtland's Warbler in suitable habitat are not expected to have any effect on other species and may provide a benefit by locating other rare species.

[9] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[10] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

APPENDIX B: STANDARD ONTARIO BREEDING BIRD ATLAS CODES

DESCRIPTION
POSSIBLE breeder
Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season
Species observed in its breeding season in suitable nesting habitat
PROBABLE breeder
Pair observed in their breeding season in suitable nesting habitat
Permanent territory presumed through registration of territorial behaviour (song, etc.) or the occurrence of an adult bird, on at least 2 days, a week or more apart, at the same place, in suitable nesting habitat during the breeding season
Courtship or display between a male and a female or 2 males including courtship feeding or copulation
Visiting probable nest site
Agitated behaviour or anxiety calls of an adult indicating nest-site or young in the vicinity
Brood patch on adult female or cloacal protuberance on adult male
CONFIRMED breeder
Nest building or carrying nest materials.
Distraction display or injury feigning
Used nest or egg shells found (occupied or laid within the period of the survey). Use only for unique and unmistakable nests or shells
Recently fledged young or downy young
Adults leaving or entering nest sites in circumstances indicating occupied nest (including nests which content cannot be seen)
Adult carrying fecal sac
Adult carrying food for young during its breeding season.
Nest containing eggs
Nest containing young seen or heard