# COSEWIC
# Assessment and Status Report

on the

# Williamson's Sapsucker
## *Sphyrapicus thyroideus*

**in Canada**

**ENDANGERED**
**2017**

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

**COSEPAC**
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

COSEWIC. 2017. COSEWIC assessment and status report on the Williamson's Sapsucker *Sphyrapicus thyroideus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 53 pp. (http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

Previous report(s):

COSEWIC 2005. COSEWIC assessment and status report on the Williamson's Sapsucker *Sphyrapicus thyroideus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 45 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Production note:
COSEWIC would like to acknowledge Les W. Gyug for writing the status report on Williamson's Sapsucker, *Sphyrapicus thyroideus,* in Canada, prepared under contract with Environment and Climate Change Canada. This report was overseen and edited by Richard Elliott, Co-chair of the COSEWIC Birds Specialist Subcommittee.

For additional copies contact:

COSEWIC Secretariat
c/o Canadian Wildlife Service
Environment and Climate Change Canada
Ottawa, ON
K1A 0H3

Tel.: 819-938-4125
Fax: 819-938-3984
E-mail: ec.cosepac-cosewic.ec@canada.ca
http://www.cosewic.gc.ca

Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le Pic de Williamson (*Sphyrapicus thyroideus*) au Canada.

Cover illustration/photo:
Williamson's Sapsucker — Photos of male (left) and female (right) Williamson's Sapsucker by Les W. Gyug.


Catalogue No. CW69-14/452-2018E-PDF
ISBN 978-0-660-26755-5

# COSEWIC
# Assessment Summary

**Assessment Summary – November 2017**

**Common name**
Williamson's Sapsucker

**Scientific name**
*Sphyrapicus thyroideus*

**Status**
Endangered

**Reason for designation**
This migratory woodpecker depends on old-growth coniferous and mixed forests in the Southern Interior of British Columbia, with fewer than 1000 individuals breeding in two Canadian subpopulations. Its distribution is largely limited by the availability of large nest-trees, mostly several hundred years old. The main threat to this species is logging and forest harvesting, including removal of dangerous trees for worker safety, forest fires and fire suppression. Lower impact threats are housing and urban development, ranching, and renewable energy development. Despite recent forest harvest regulations in British Columbia intended to protect its nesting habitat, breeding numbers are anticipated to decline further.

**Occurrence**
British Columbia

**Status history**
Designated Endangered in May 2005. Status re-examined and confirmed in November 2017.

**COSEWIC**
**Executive Summary**

## Williamson's Sapsucker
*Sphyrapicus thyroideus*

### Wildlife Species Description and Significance

Williamson's Sapsucker is a medium-sized woodpecker with no recognized subspecies. Unique among woodpeckers, the male Williamson's Sapsucker (mostly black and white) and the female (mostly black and brown) exhibit strikingly different plumage. It is considered a sensitive indicator species because of its specific requirements for habitat with large trees that provide nest cavities and colonial ants on which to forage. It is a primary cavity excavator, making holes in trees that may be used by a variety of secondary cavity-using species.

### Distribution

Williamson's Sapsucker breeds in dry mountain forests of western North America, from southern British Columbia to the southern United States and northern Baja California in Mexico. All Canadian breeding records are from British Columbia. Williamson's Sapsucker is migratory and normally absent from Canada from October-February. It winters in southwest U.S. and northern Mexico.

Williamson's Sapsucker occupies three geographically separated regions In British Columbia: 1) Western: from Manning Provincial Park, near the U.S. border, north to the Cache Creek and Kamloops areas; 2) Okanagan-Boundary: from the Okanagan Valley near Penticton east to Grand Forks; and 3) East Kootenay: within the Rocky Mountain Trench north to Cranbrook and Kimberley, and the Flathead River valley. Birds in the Western and Okanagan-Boundary regions are now considered together as one subpopulation, as the many detections since 2004 within the area between them show that they no longer meet the criteria for separate subpopulations. Birds in the separate East Kootenay region are considered to make up a second subpopulation.

### Habitat

Williamson's Sapsucker breeds in relatively dry coniferous and mixed coniferous-deciduous mountain forests. In Canada, it breeds in Western Larch – Douglas-fir forests in the Okanagan-Boundary and East Kootenay regions, and in Ponderosa Pine – Douglas-fir forests, often mixed with Trembling Aspen in the Western region. It breeds at elevations from 700-1550 m.

Essential habitat elements for Williamson's Sapsucker in Canada appear to be: large live or dead trees for excavating nest cavities; live coniferous trees for sap-well creation; colonies of aphid-tending ants at sufficient densities for foraging; and live trees for gleaning ants from the bark surface to feed nestlings. Prior to feeding nestlings, and particularly early in the season before ants are active, Williamson's Sapsucker may peck for insects in the wood or under the bark of a tree in the manner of other woodpeckers.

**Biology**

Williamson's Sapsucker returns to Canada in late winter and early spring, and pairs typically establish breeding territories in late March or early April. Eggs usually hatch by early June, and young fledge by late June-early July. Average number of fledglings per nest is 3.1 in Canada. Breeding territory size ranges from 28 to 53 ha. The highest breeding density found in Canada is 3.1 nests/$km^2$.

Williamson's Sapsucker adults and fledged young feed by licking sap from the sapwells that they drill in the bark of live trees, consuming ants they glean from tree trunks, and eating other insects found by pecking at tree trunks. Nestlings are fed ants gleaned by adults from tree trunks.

**Population Sizes and Trends**

The population size of Williamson's Sapsucker in Canada is estimated at 960 mature individuals (95% confidence interval 520-1440). Population size appears to be limited by the amount of appropriate mature forest habitat, containing suitable nesting trees in the presence of appropriate densities of foraging trees from which to glean ants. Suitable habitat has been decreasing at an average rate of just < 1% per year in the past decade, due to commercial harvesting of mature forests.

The Canadian breeding range may have increased during the 1940s, when the Western region appears to have expanded, with sightings in the Princeton area where they had not been previously observed. However, there have been no recent range expansions and habitat has since declined in amount and suitability. Long-term monitoring surveys were only established in 2012, so trend estimates are not yet available. However, since habitat suitability mapping was initiated in 2009, habitat has changed at 24% of survey points, primarily due to pine-beetle induced mortality, fire salvage logging and land clearing for other reasons, such as quarrying.

## Threats and Limiting Factors

The primary threat to Williamson's Sapsucker is habitat loss due to commercial timber harvesting of mature forests. Although Best Management Practices in British Columbia are intended to allow timber harvesting to continue without reducing habitat suitability, recent assessments show continuing habitat loss. Additional threats include salvage logging of pine-beetle-infested Ponderosa Pine stands, salvage logging of lower-elevation Lodgepole Pine stands where these overlap with Williamson's Sapsucker habitat, salvage logging of burned stands, and removal of suitable nesting trees (large trees or snags with advanced decay) in work areas to meet workers' safety requirements.

## Protection, Status and Ranks

Williamson's Sapsucker was assessed by COSEWIC as Endangered in 2005 and in 2017 and is listed as Endangered on Schedule 1 of the *Species at Risk Act*. It is considered not-at-risk globally and in the U.S.A. At the subnational level, it is considered imperilled in Nevada and Wyoming where there are very small populations, vulnerable in B.C. and Utah, vulnerable/apparently secure in Washington state, apparently secure in Arizona, Colorado, Idaho, Montana, New Mexico, Oregon, and not ranked in California.

Williamson's Sapsucker is protected under the *Migratory Birds Convention Act* and the *British Columbia Wildlife Act.* The species' nests are protected under the same acts, but as timber harvesting is conducted during the breeding season in B.C., little protection exists from incidental destruction of occupied nests in much of its range. Some protection from timber harvesting is provided within 147 Wildlife Habitat Areas established under the *British Columbia Forest and Range Practices Act* that protect 171 known nesting territories. Because only about 40% of these are used in any given year, Wildlife Habitat Areas are presumed to protect about 14% of the breeding population.

# TECHNICAL SUMMARY

*Sphyrapicus thyroideus*

Williamson's Sapsucker

Pic de Williamson

Range of occurrence in Canada: British Columbia

### Demographic Information

| | |
|---|---|
| Generation time (usually average age of parents in the population). | Assumed to be about 3 years; average age of parents and survivorship are unknown. |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? | Yes, inferred decline in number of mature individuals from long-term habitat loss due to land clearing and timber harvesting. |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]. | Projected ~5% reduction in total numbers within 5 years, based on inferred and projected habitat loss of just < 1% per year. (see **Habitat Trends** section) |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations]. | Inferred 9% reduction in total number of mature individuals over last 10 years, based on observed 9% reduction in habitat over that period. |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. | Inferred projection of 9% decline in number of mature individuals over next 10 years, based on projected 9% decline in habitat from timber harvesting over that period. |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future. | Inferred projection of 9% decline, based on projected continuing decline in habitat from timber harvesting. |
| Are the causes of the decline a. clearly reversible and b. understood and c. ceased? | a. Yes, reversible if timber harvesting patterns are changed to more selective harvesting that retains suitable habitat<br><br>b. Yes, current inferred decline is primarily due to habitat lost through timber harvesting<br><br>c. No, as habitat loss is continuing. |
| Are there extreme fluctuations in number of mature individuals? | No |

### Extent and Occupancy Information

| | |
|---|---|
| Estimated extent of occurrence (EOO) | 69,187 km² |
| Index of area of occupancy (IAO) | 1672 km² (418 grid cells) |

| | |
|---|---|
| Is the population "severely fragmented" i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | No<br><br>a. Unknown what the size of habitat patch is that will support a viable population<br><br>b. East Kootenay subpopulation is likely separated from the other subpopulation by a distance larger than individuals are expected to disperse.(see **Extent of Occurrence and Area of Occupancy** section) |
| Number of "locations"* | Unknown, but much greater than 10; probably >100 in Western/Okanagan-Boundary subpopulation, and 17 in East Kootenay subpopulation. |
| Is there an [observed, inferred, or projected] decline in extent of occurrence? | Yes, observed decline of 20,505 $km^2$ in EOO from 2004-2016 (22.9% decline in areal extent). Most of this change reflects improved knowledge of the extent of the occupied area.<br>(see **Extent of Occurrence and Area of Occupancy** section) |
| Is there an [observed, inferred, or projected] decline in index of area of occupancy? | Unknown. Although IAO was not previously estimated, loss of some peripheral sites may represent a small decline. However, abandonment of small areas due to localized timber harvesting or forest clearing may not result in changes in IAO at a 4 $km^2$ cell level. |
| Is there an [observed, inferred, or projected] decline in number of subpopulations? | No |
| Is there an [observed, inferred, or projected] decline in number of "locations"? | Unknown. |
| Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat? | Yes, projected decline in area of habitat, as timber harvesting is ongoing at a rate of about 1% of crown forest per year, in a manner that reduces habitat suitability. (see **Habitat Trends** section). |
| Are there extreme fluctuations in number of subpopulations? | No |
| Are there extreme fluctuations in number of "locations"∗? | No |
| Are there extreme fluctuations in extent of occurrence? | No |
| Are there extreme fluctuations in index of area of occupancy? | No |

* See Definitions and Abbreviations on COSEWIC website and IUCN (Feb 2014) for more information on this term

**Number of Mature Individuals (in each subpopulation)**

| **Subpopulations (give plausible ranges)** (see Table 2) | **N Mature Individuals** |
|---|---|
| 1. Western/Okanagan-Boundary subpopulation | Within contiguous AOs: 870 (95% CI: 477-1263), and outside contiguous AOs: 50 (assumed: 25-100) |
| 2. East Kootenay subpopulation | 40 (assumed: 20-80) |
| Total | 960 (520-1440) |

**Quantitative Analysis**

| | |
|---|---|
| Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]? | Unknown, quantitative analysis not performed. |

**Threats (direct, from highest impact to least, as per IUCN Threats Calculator)**

A threat assessment calculator was completed for this species on 21 December 2016, by Jon McCracken, Marcel Gahbauer, Les Gyug, Guy Morrison, Louise Blight, Leah Ramsay, Darcy Henderson, Kathy Martin, Julien St-Amand, Kristiina Ovaska and Bev McBride.

The overall calculated threat impact is High, and the following contributing threats were identified:

i. Logging and wood harvesting – Medium impact
ii. Fire and fire suppression – Medium - Low impact
iii. Work and other activities – Low impact
iv. Housing and urban areas – Low impact
v. Agriculture – Low impact
vi. Energy production and mining – Low impact

What additional limiting factors are relevant? Reliance on the limited amount of suitable breeding habitat with suitable nest-trees.

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to Canada. | Considered nationally secure in the U.S. and stable on U.S. Breeding Bird Survey routes. Populations adjacent to B.C. considered Vulnerable to Apparently Secure in Washington and Apparently Secure in Montana. |
| Is immigration known or possible? | Yes |
| Would immigrants be adapted to survive in Canada? | Yes |
| Is there sufficient habitat for immigrants in Canada? | No; as population is largely habitat-limited, rescue is unlikely unless additional habitat becomes available, or declines occur for reasons other than habitat loss |
| Are conditions deteriorating in Canada? | Yes, habitat suitability and amount are declining. |
| Are conditions for the source population deteriorating?[+] | Unknown |

[+]See Table 3 ( Guidelines for modifying status assessment based on rescue effect)

| | |
|---|---|
| Is the Canadian population considered to be a sink?+ | No |
| Is rescue from outside populations likely? | Unlikely, as sufficient breeding habitat may not be available to support immigrants |

**Data Sensitive Species**

| |
|---|
| Is this a data sensitive species? No |

**Status History**

| |
|---|
| COSEWIC: Designated Endangered in May 2005. Status re-examined and confirmed in November 2017. |

**Status and Reasons for Designation:**

| **Status:** Endangered | **Alpha-numeric codes:** C2a(ii) |
|---|---|
| **Reasons for designation:** This migratory woodpecker depends on old-growth coniferous and mixed forests in the Southern Interior of British Columbia, with fewer than 1000 individuals breeding in two Canadian subpopulations. Its distribution is largely limited by the availability of large nest-trees, mostly several hundred years old. The main threat to this species is logging and forest harvesting, including removal of dangerous trees for worker safety, forest fires and fire suppression. Lower impact threats are housing and urban development, ranching, and renewable energy development. Despite recent forest harvest regulations in British Columbia intended to protect its nesting habitat, breeding numbers are anticipated to decline further. | |

**Applicability of Criteria**

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Estimated reduction in total number of mature individuals does not meet thresholds. |
| Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. EOO and IAO do not meet thresholds, and population is not severely fragmented or subject to extreme fluctuations. |
| Criterion C (Small and Declining Number of Mature Individuals): Meets criterion for Endangered, C2a(ii). The population is estimated to be less than 2500 mature individuals, there is an inferred continuing decline in numbers of mature individuals, and the Western/Okanagan-Boundary subpopulation is inferred to contain greater than 95% of all mature individuals. |
| Criterion D (Very Small or Restricted Population): Meets criterion for Threatened, D1. The population estimate is below the threshold of 1,000 mature individuals. |
| Criterion E (Quantitative Analysis): Analysis not conducted. |

+See Table 3 ( Guidelines for modifying status assessment based on rescue effect).

## PREFACE

The first COSEWIC status report on Williamson's Sapsucker was prepared in 2005 (COSEWIC 2005) when it was assessed by COSEWIC as Endangered. Much of the information in that report was based on inventories conducted from 1996-1999 and 2003-2004, primarily by the British Columbia (B.C.) Ministry of Environment, which were neither complete in coverage nor intensive. The Williamson's Sapsucker Recovery Team established in 2006 coordinated subsequent fieldwork. Considerable research and inventory was undertaken by many partners from 2006-2008 and in 2012 to address information gaps about distribution, density, population size and habitat use in Canada. Much of this work has been published and is cited in this report. Habitat modelling which took place from 2008-2011 helped to identify Critical Habitat in the final Recovery Strategy of 2014. The main focus of fieldwork after 2009 was monitoring for population change using indices of relative abundance. A radio-telemetry project by the University of British Columbia was initiated in 2014.

Since 2006, the B.C. provincial government has undertaken initiatives to protect areas around known Williamson's Sapsucker nests from timber harvesting in Wildlife Habitat Areas, and to develop timber harvest strategies that maintain Williamson's Sapsucker habitat suitability through best management practice recommendations.

**COSEWIC HISTORY**

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

**COSEWIC MANDATE**

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

**COSEWIC MEMBERSHIP**

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

**DEFINITIONS**
**(2017**)

| | |
|---|---|
| Wildlife Species | A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. |
| Extinct (X) | A wildlife species that no longer exists. |
| Extirpated (XT) | A wildlife species no longer existing in the wild in Canada, but occurring elsewhere. |
| Endangered (E) | A wildlife species facing imminent extirpation or extinction. |
| Threatened (T) | A wildlife species likely to become endangered if limiting factors are not reversed. |
| Special Concern (SC)* | A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. |
| Not at Risk (NAR)** | A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. |
| Data Deficient (DD)*** | A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction. |

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada
Canadian Wildlife Service

Environnement et Changement climatique Canada
Service canadien de la faune

Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

# COSEWIC Status Report

on the

# Williamson's Sapsucker
*Sphyrapicus thyroideus*

**in Canada**

2017

**TABLE OF CONTENTS**

**List of Figures**



**List of Tables**



**List of Appendices**

## WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

### Name and Classification

Williamson's Sapsucker (*Sphyrapicus thyroideus)* was first recorded from Canada in the Similkameen Valley of the southern interior of British Columbia in 1882 (Fannin 1891, Cannings 1987). The French name for the species is Pic de Williamson (Godfrey 1986).

Williamson's Sapsucker is now considered monotypic (Patten 2012), although two subspecies were formerly considered. The subspecies occurring in the western part of the range, including Canada's Western and Okanagan-Boundary subpopulation, was the nominate *Sphyrapicus thyroideus thyroideus*. The smaller-billed subspecies in the eastern part of the range in the Rocky Mountains, including the East Kootenay subpopulation, was *Sphyrapicus thyroideus nataliae*.

Male and female plumages are strikingly different (Figure 1; see **Morphological Description** below), to the extent that the sexes were originally described as separate species. The female was described in 1851 as the Black-breasted Woodpecker (*Picus thyroideus*) (Cassin 1852), and the male as Williamson's Woodpecker (*Picus williamsonii*) (Newberry 1857). Baird (1858) recognized both as sapsuckers and renamed them to the genus *Sphyrapicus* as *S. thyroideus* and *S. williamsonii*. The male and female were recognized as the same species (*S. thyroideus*) in 1873 by Henshaw (1874).

Figure 1. Male (left) and female (right) Williamson's Sapsucker. Photos by Les W. Gyug, used with permission.

## Morphological Description

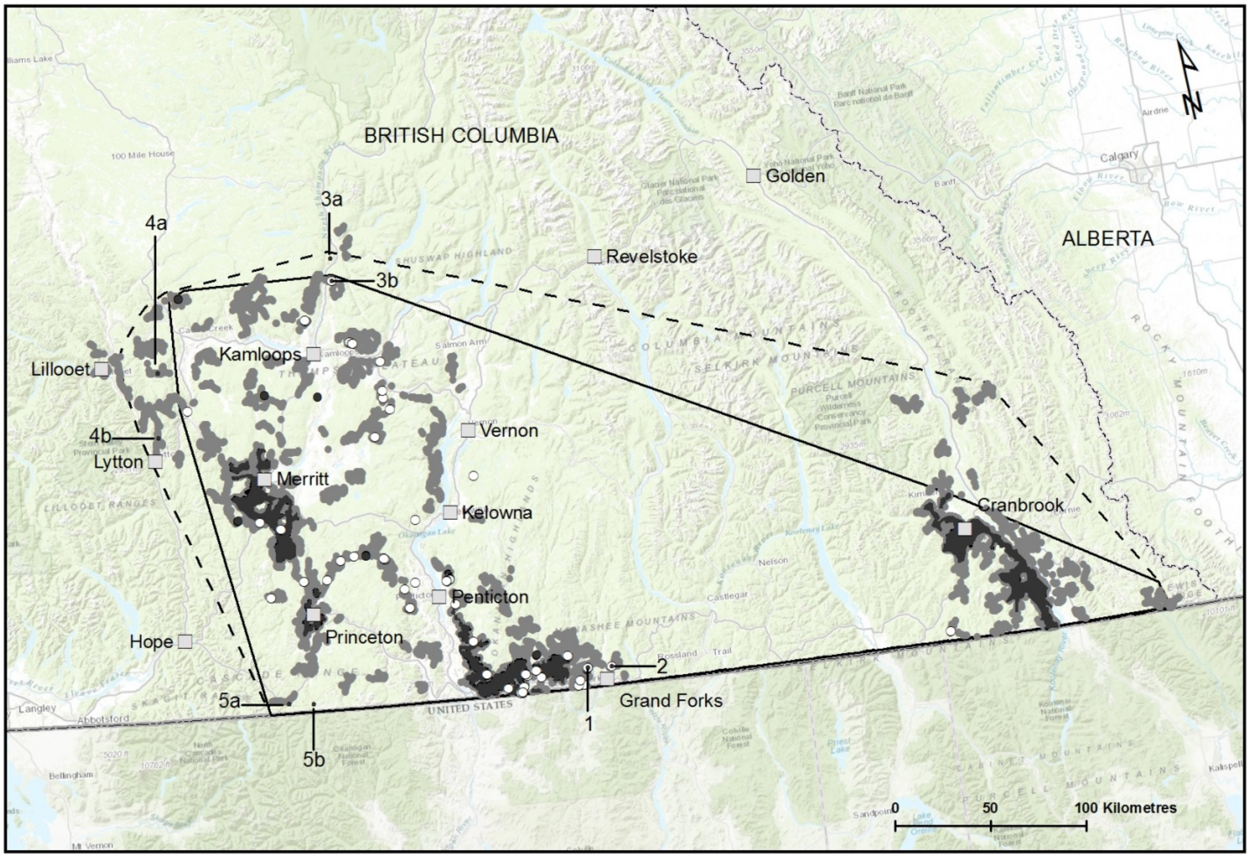
Williamson's Sapsucker is a medium-sized woodpecker with total length averaging 23 cm (Godfrey 1986, Winkler *et al*. 1995), and weighing 44-64 g (Short 1982). Male and female plumages exhibit distinct sexual dimorphism to a degree unique among woodpeckers (Figure 1). The female is predominantly brown and black, reminiscent of the colouration of the Gila Woodpecker (*Melanerpes uropygialis*) or the Northern Flicker (*Colaptes auratus*). The male is predominantly black and white, reminiscent of many *Picoides* woodpeckers.

The male has a glossy black head, breast and underparts with a white supercilium, moustache, rump and wing panel, a small red throat patch, and a yellow belly with flanks heavily striped and barred black and white (Winkler *et al*. 1995). The female has a brownish head with obscure moustachial stripes, heavily barred underparts and wings, a white rump, and a blackish breast with yellow belly and heavily barred flanks (Winkler *et al*.1995). Juveniles resemble the adults, but the juvenile male has a white throat and the juvenile female lacks black on the breast.

## Population Spatial Structure and Variability

The structure of two subpopulations of Williamson's Sapsucker within Canada is based on occurrence in three separate geographic areas. These migratory birds may migrate several thousand kilometres between the breeding range in Canada and wintering ranges in the southwestern U.S., or northern Mexico. It is assumed that there are no barriers to possible genetic mixing beyond traditional use of breeding areas by individuals. The extent of possible genetic mixing between the two Canadian subpopulations is unknown, but is assumed to be low, as birds from the subpopulations differ slightly in morphology and were once described as two subspecies (Patten 2012). While the contiguous areas of occupancy of the Western and Okanagan-Boundary regions do not overlap (see Figure 2 and **Canadian Range** section), birds in these regions are considered to be one subpopulation, based on the relative abundance of Williamson's Sapsucker detections in intervening areas since 2004 (Figure 2). It is likely that there is ongoing demographic and genetic exchange between the Western and Okanagan-Boundary regions (at least one successful migrant individual per year), although actual rates of interchange are unknown.

There have been no genetic studies of Williamson's Sapsucker except as an outlier group to compare with other sapsuckers (e.g., Johnson and Zink 1983; Cicero and Johnson 1995). There are no known genetic differences between the two formerly recognized subspecies, as morphological variability between them is slight and inconsistent (Browning and Cross 1999), and differences assessed were not of the magnitude expected between subspecies (Patten *et al*. 2003).




Sites identified by numbers on figure (see **Extent of Occurrence and Area of Occupancy**) are: 1. Phoenix Mountain, 2. Sand Creek, 3a. Mount Goudreau, 3b. 10 km south of Mount Goudreau, 4a. Hat Creek, 4b. Botanie Creek, 5a. E.C. Manning Provincial Park, 5b. Pasayten River.

Figure 2. Extent of occurrence of Williamson's Sapsucker in southern British Columbia in 2004 (dashed line) and 2016 (solid black line), showing contiguous areas of occupancy (AO; black polygons), detections since 2004 outside the contiguous AOs (white-filled dots), known nest-sites outside the contiguous AOs (black dots) and call-playback survey point sites outside the contiguous AOs (grey dots). The Western Region includes sites near Merritt and Princeton, the Okanagan-Boundary Region between Penticton and Grand Forks, and the East Kootenay Region in the vicinity of Cranbrook south to the U.S. border.

There are four species in the sapsucker genus *Sphyrapicus*, which is limited in distribution to North America. Williamson's Sapsucker is the most genetically distinctive of these, with the other three species forming the *Sphyrapicus varius* superspecies: the Yellow-bellied Sapsucker (*S. varius*); the Red-breasted Sapsucker (*S. ruber*); and the Red-naped Sapsucker (*S. nuchalis;* Johnson and Zink 1983; Cicero and Johnson 1995). It is probable that *S. thyroideus* diverged genetically from the *S. varius* superspecies about 3.7-5.2 million years ago, is closer to ancestral stock, and is most closely related to *Melanerpes* woodpeckers (Cicero and Johnson 1995). It is likely that *S. thyroideus* evolved in western North America, while the ancestral *S. varius* probably evolved in eastern North America and then spread westward, evolving more recently into the currently recognized three species (Short and Morony 1970; Johnson and Zink 1983, Cicero and Johnson 1995). The range and distribution of Williamson's Sapsucker overlaps broadly with Red-naped Sapsucker. These two species occasionally hybridize, with two hybrid specimens collected on the winter range in 1891 and 1929 (Short and Morony 1970).

Williamson's Sapsucker was found to have a low index of genetic heterogeneity (H = 0.016) using 39 loci (Johnson and Zink 1983) using gel electrophoresis. Values for other sapsuckers were all higher, up to H = 0.043, which was the mean value reported for other birds in general. This low index may indicate that Williamson's Sapsucker has a relatively low ability to adapt to a variety of habitats or to changing habitats. No genetic studies have been done on Williamson's Sapsucker using microsatellite methods.

## Designatable Units

As Williamson's Sapsucker is now considered to be monotypic (Patten 2012), there is only one designatable unit consisting of the entire population occurring in Canada, which represents a discrete and evolutionarily significant taxon (see **Population Spatial Structure and Variability,** above). The previous COSEWIC (2005) status report also recognized only one designatable unit, as the two subspecies then recognized were only very weakly defined morphologically.

## Special Significance

Williamson's Sapsucker is considered a sensitive indicator species for old-growth forest attributes, because of its specific requirements for habitat with large trees that provide nest cavities and colonial ants on which to forage (Gyug *et al*. 2012). It is of scientific interest as the oldest line, and the least genetically variable, of the North American sapsuckers. It is also of interest as the most sexually dimorphic of all species of woodpeckers, enough so to cause the misidentification of males and females as different species for over 20 years. The evolutionary pressures or circumstances which may have caused this are unknown.

This species is poorly known in Canada due to its relative scarcity, and its occurrence in middle-elevation coniferous forests in British Columbia. Even within its range, Williamson’s Sapsucker is considered a “good bird” for casual birdwatchers as it is rarely encountered without targeted searching.

Williamson’s Sapsucker is a priority species for Partners in Flight in the Great Basin (Partners in Flight British Columbia and Yukon 2003) and for the Canadian Intermountain Joint Venture (2003). It is also a Species of Continental Importance in the Intermountain West Avifaunal Biome, designated by Partners in Flight (Rich *et al*. 2004).

There is no known Aboriginal traditional use or knowledge of this species.

# DISTRIBUTION

## Global Range

The currently known continental breeding range is presented in Figure 3, as derived from Gyug *et al*. (2012). The breeding range is primarily in the mountain ranges of the western United States north to southern British Columbia. It is absent from the central Great Basin ranges of Nevada (Great Basin Bird Observatory 2010). There is one small breeding population in Mexico in northern Baja California, disjunct from other populations.

The species is partially migratory, leaving the northern latitudes of its breeding range in winter that are north of southern Oregon, the area north of the Mogollon Rim in Arizona, and the area north of the mountains of the Santa Fe area in New Mexico. It winters at lower elevations in southern Oregon, in California, occasionally in Colorado, in southern Arizona, in New Mexico, and in the mountains of western Mexico as far south as Jalisco and northern Michoacán, northwest of Mexico City.

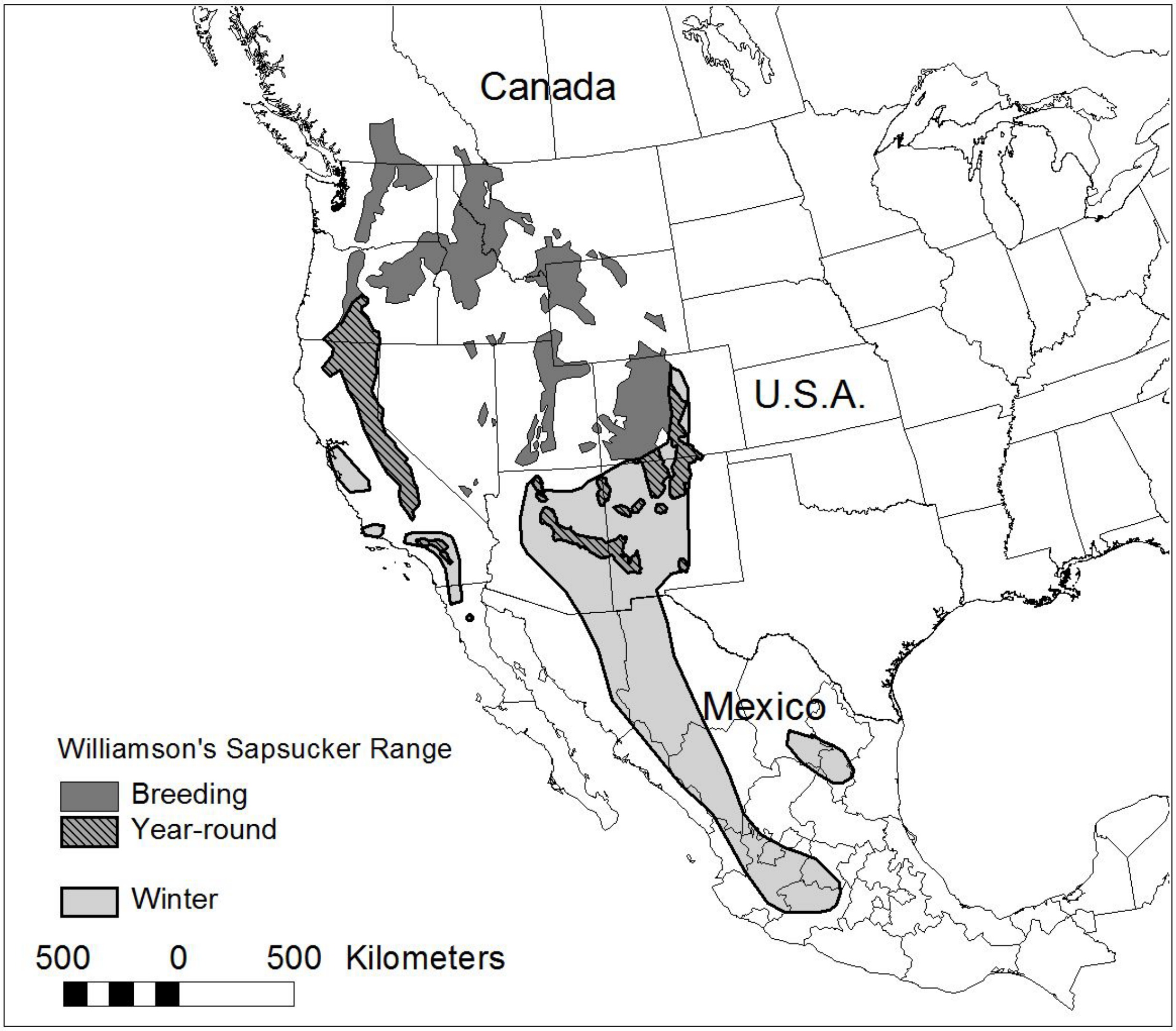



Figure 3. Williamson's Sapsucker breeding and wintering range in North America, updated from Gyug *et al*. (2012) using bulk data downloads (eBird 2012) of Williamson's Sapsucker detections from May-July of all years.

## Canadian Range

The breeding range of Williamson's Sapsucker in Canada is entirely within southern British Columbia; where it is a rare summer resident. There are three accidental records each for Alberta (Pinel 1993) and Saskatchewan (Godfrey 1986). Two of the Alberta records were from Waterton Lakes National Park, with the other from Calgary.

The breeding range of Williamson's Sapsucker in Canada was summarized by Gyug *et al*. (2007) and updated by Gyug *et al*. (2014a) and Environment Canada (2014). The British Columbia breeding range is divided into three geographic regions: the East Kootenay subpopulation in the Rocky Mountain Trench, from the U.S. border 65 km north to Kimberley; the Okanagan-Boundary region on the east side of the Okanagan River valley from the U.S. border 90 km north to the village of Naramata, and 75 km east to the city of Grand Forks; and the Western region, extending about 125 km west of the Okanagan valley through the Similkameen River valley to the Cascade Mountains, and 250 km north of the U.S. border. The East Kootenay subpopulation represents what was formerly considered the *nataliae* subspecies, while the Western and Okanagan-Boundary regions are together considered one subpopulation and represent what was formerly considered the *thyroideus* subspecies.

Williamson's Sapsucker does not overwinter in Canada.

### Extent of Occurrence and Area of Occupancy

The breeding sites of Williamson's Sapsucker used to estimate the size of the extent of occurrence (EOO) in Canada in 2004 (COSEWIC 2005) were mapped by Gyug *et al*. (2007) as two separate subpopulations. The East Kootenay subpopulation is disjunct from the Western/Okanagan-Boundary, separated by 180 km of unsuitable habitat of the wet-belt Columbia Mountains (Figure 2). Although EOO was estimated separately for the two subpopulations in 2004, it was calculated for this report using the minimum convex polygon approach to include the unoccupied area between the subpopulations, in line with current COSEWIC interpretations of IUCN guidelines, for both 2016 (Figure 2) and 2004.

There was an overall reduction of 20,505 $km^2$ in Williamson's Sapsucker extent of occurrence, from 89,692 $km^2$ in 2004 to 69,187 $km^2$ in 2016, representing a 22.9% decline in areal extent. As described below, most of this change reflects improved knowledge of the occurrence of Williamson's Sapsucker, although there was a slight decline in actual area of occupancy on the extreme north and west portions of the EOO (Figure 2).

The furthest north East Kootenay site used to map the occupied area in 2004 was a record from the B.C. Nest Record Scheme. The observer was contacted, and as he had had no recollection of the observation (Chruszcz pers. comm. 2006) and as the original nest record card is not available, this record may have been entered in error. Call playback surveys in 2005-2007 (n = 199 survey points) did not detect Williamson's Sapsucker in that area. There was one eBird record of a Williamson's Sapsucker sighted in the Elk River valley in 2004 (Wrinn 2004), but breeding was not confirmed at this one isolated site. In the Flathead River valley, call-playback surveys (171 total call-playback survey points in 2006, 2007, and 2011) did not detect the species. However, this area was retained within the occupied area because there are eBird records of Williamson's Sapsucker from 2012 and 2014 in the Flathead valley in Glacier National Park, U.S., within 10 km of British Columbia (Moqtaderi 2012; Chaon 2014). The single observation southwest of the East Kootenay occupied area (Figure 2) appears to be a case of vagrancy, as follow-up surveys detected no Williamson's Sapsucker there.

In summary, the change in occupied area of the East Kootenay subpopulation, from 8399 $km^2$ in 2004 to 4401 $km^2$ in 2016, represents an improvement in our knowledge of Williamson's Sapsucker occurrence and breeding there, and not a decrease in actual extent.

The occupied area of the Western/Okanagan-Boundary subpopulation changed slightly at the east, north and west edges since 2004, as follows (bullet numbers match numbers in Figure 2):

1. At the east edge, a nest in the Phoenix Mt. area between Greenwood and Grand Forks has extended the known breeding distribution 8 km east, near the U.S. border (Gyug *et al*. 2007).
2. There was a detection at Sand Creek, north of Grand Forks, during the B.C. Breeding Bird Atlas, but no confirmation of breeding (Cannings 2012).
3. At the north edge, the area around the single known nest at Mt. Goudreau (3a) was burned in the 2003 Barriere fire, and Williamson's Sapsucker did not return to the site (Olsen pers. comm. 2004). Sapsuckers were detected about 10 km south of the Mt. Goudreau site in 2005 (3b; Oaten pers. comm. 2007).
4. At the west edge, the Hat Creek (4a) and Botanie Creek (4b) sites appear to be no longer occupied, as no Williamson's Sapsucker was detected on 736 call-playback points conducted there in 2005, 2007 and 2012.
5. Williamson's Sapsucker has not been detected in Manning Park (5a) since 1984 (eBird 2012), but this area has been retained in the occupied area because this species was reported just south of the international border in the Pasayten watershed (5b) (Clark pers. comm. 2008), and was reported on one eBird checklist within 8 km of the international border (Stepniewski 1989). The upper Pasayten watershed in Washington is an unroaded wilderness area, so data from that area are generally sparse.
6. One historical sighting at Vancouver on June 23, 1995 was submitted to eBird, but no breeding was noted (Clapham 1995) and this bird appears to have been a vagrant.

In summary, the change in occupied area of the Western/Okanagan-Boundary subpopulation, from 34,659 $km^2$ in 2004 to 31,996 $km^2$ in 2016, represents an actual slight reduction in the extent of the area occupied by this subpopulation.

The area of occupancy (AO) of the East Kootenay subpopulation was not estimated in 2004, as there were insufficient recent breeding records (n = 4), to reliably estimate the size and location of the AO. The size of the East Kootenay AO is now estimated as 851 $km^2$, based on 53 known nests and 255 other detections (Figure 2).

In 2004, the AO of the Western/Okanagan-Boundary subpopulation was estimated to be 1016 $km^2$ in total. The AO of the Okanagan-Boundary region is now estimated as 698 $km^2$, based on 214 known nests and 1319 other detections, and the Western region estimated at 742 $km^2$, based on 123 known nests and 1238 other detections (Figure 2), for a total of 1440 $km^2$. The changes in size of the AO represent much better knowledge of Williamson's Sapsucker distribution in B.C. and are not believed to represent an increase in actual area occupied since 2004. For these estimates, the "contiguous area of occupancy" (AO) was defined for the Recovery Strategy for Critical Habitat and for management purposes as: the areas regularly occupied for breeding where a relative density of >1.0 Williamson's Sapsucker responses per 100 survey points was likely to be detected. These densities were based on data from over 14,000 call-playback stations (see below) conducted up to 2012 in a number of different Williamson's Sapsucker survey and inventory projects.

To estimate the index of area of occupancy (IAO), the actual area occupied by the species was mapped on a cell size of 2 km x 2 km, using all known occurrences since 1994. The proportion of the contiguous AO occupied was based on any known occurrences during the breeding season, and then adding any known sites outside the contiguous AO (see Figure 2). This estimate used the centre points of the 2-km cells to determine whether they were within the contiguous AO.

The IAO of the contiguous AO was 565 cells, or 2260 $km^2$, which was very close to the contiguous AO estimate of 2291 $km^2$. The majority of cells (96%) in the contiguous AO had been sampled by call-playback surveys. Williamson's Sapsucker had been detected in 302 of 542 cells, or 56% of the total of 565 sampled cells. The IAO in the contiguous AO was therefore estimated as 302/542 x 565 = 315 cells or 1260 $km^2$. Adding 103 detection sites (103 cells) outside the contiguous AO yielded a total of 418 cells, or 1672 $km^2$. IAO was not estimated in the same way in 2004, so there is no previous estimate of IAO with which to compare this value.

## Search Effort

The COSEWIC assessment of 2005 had been based on historical and incidental data, and on 1471 call-playback survey points completed between 1996 and the end of 2004. Those surveys did not give complete coverage of the possible areas occupied. From 2005-2012, an additional 14,283 call-playback points (Figure 2) were surveyed, primarily to determine areas and habitats occupied (see Gyug *et al*. 2014a). Of these points, 6865 were inside the contiguous AO, and 7418 were outside. In addition, three census areas (two of which are described in Gyug *et al*. 2007) between 2 - 4.5 $km^2$ in size were sampled in several years, without recording individual call-playback points.

No widespread, systematic surveys have been conducted in the Western/Okanagan-Boundary subpopulation outside the contiguous AO since 2007. In the East Kootenay, no such surveys have been conducted outside the contiguous AO since 2011.

The B.C. Breeding Bird Atlas was undertaken from 2008-2012, with coverage over most accessible areas of southern B.C. The atlas did not result in any changes to the breeding range as estimated mainly by the 2005-2007 surveys (Gyug *et al*. 2014a), with the single exception near Grand Forks previously described.

Williamson's Sapsucker tends to be generally quiet and not advertising territorially during the BBS survey period in June or early July, so that BBS routes may generally underestimate Williamson's Sapsucker relative abundance (Gyug *et al*. 2012, and see **Sampling Effort and Methods** section).

# HABITAT

## Habitat Requirements

Throughout its breeding range, Williamson's Sapsucker breeds in middle- to high-elevation coniferous and mixed coniferous-deciduous forests (Gyug *et al*. 2012). These include Western Larch (*Larix occidentalis*), Douglas-fir (*Pseudotsuga menziesii*), Ponderosa Pine (*Pinus ponderosa*), and pine-fir forests. It is uncommon in montane spruce-fir, Rocky Mountain Lodgepole Pine (*Pinus contorta latifolia*), and mixed pine-fir-Mountain Hemlock (*Tsuga mertensiana*) forests. It also nests in mixed deciduous-coniferous forests where Trembling Aspen (*Populus tremuloides*) is an important nesting substrate.

There was considerable research on Williamson's Sapsucker habitat in B.C. between 2006 and 2008. Habitat suitability was modelled based on the results of that research, (Gyug 2009, 2010a, b, c; see Appendix 1) using GIS forest inventory attributes with physical attributes including elevation, biogeoclimatic zone, slope and aspect. Stereo aerial photo interpretation was used to identify isolated veteran trees, which are typically used for nesting, as forest inventory mapping frequently did not identify such trees. Individual veteran trees extending above the surrounding canopy could be identified in stereo aerial photos, if the stand was <100 years old. These trees had usually survived many previous fires, and many had survived previous rounds of timber harvest. This habitat modelling was found to reliably predict relative nesting densities (Gyug 2014). The low or better habitat suitability classes were then incorporated spatially as Critical Habitat in the Williamson's Sapsucker Recovery Strategy (Environment Canada 2014).

Habitat suitability modelling was found to be less effective in the East Kootenay (Gyug 2011), partly because typical nest trees there were often mid-canopy Western Larch infected with heart rot that could not be identified from aerial photos or in GIS forest attribute inventories, and partly because nesting densities were only about 10% of those in the other subpopulation. Attempts to test the East Kootenay model in 2010-12 resulted in very few Williamson's Sapsucker detections (4 in 2010, 3 in 2011, 5 in 2012, compared to 21 and 25 in the Okanagan-Boundary and Western regions, respectively, in 2010, with similar effort), and resulted in no new nests found. Critical Habitat identification in the East Kootenay was therefore based on a 500-m radius around confirmed breeding territories, rather than on a habitat suitability model.

Essential habitat elements for Williamson's Sapsucker in B.C. were found to be: large live or dead trees (generally >30-cm diameter at breast height (dbh) for broad-leaved trees and >59 cm dbh for conifers) with internal decay suitable for excavating nest cavities; live coniferous trees, generally Douglas-fir, for sap well creation; colonies of aphid-tending ants at sufficient densities – particularly carpenter ants and/or *Formica rufa* species group ants; live trees >17.5-cm dbh averaging >85/ha for gleaning ants from the bark surface to feed nestlings (Gyug 2011); and live or dead trees with decay supporting insects for which the adults forage by pecking, primarily early in the breeding season (St. Amand 2017).

<u>Nest trees</u>

Probability of occurrence was strongly tied to the density of potential nest trees (Drever *et al*. 2015). Typically, Williamson's Sapsucker nests are in trees with outward signs of decay, because they are relatively weak excavators and do not excavate cavities in completely sound wood (Gyug *et al*. 2009a). In the Okanagan-Boundary and East Kootenay regions where Western Larch occurs, it is the primary nesting tree (76%; n = 189). In the region west of Okanagan Lake, where larch is almost entirely absent, Trembling Aspen is the primary nest tree (77%; n = 73).

Western Larch nest trees were of relatively large diameter and age compared to other trees in the same stands (Gyug *et al*. 2009a). 73% of live larch nest trees were >59 cm dbh (n = 123). Average live larch nest tree dbh was 76 cm (range 29-163 cm), while the average dbh of all larch trees >22-cm dbh in Williamson's Sapsucker territories was 38 cm (range 30-51 cm dbh; n = 86 territories). The only larch used as a Williamson's Sapsucker nest tree for which age was determined was 80-cm dbh and 543 years old. The majority of larch trees used for nesting were still alive (86%; n=143). Live larch nest trees had typically survived one or more fires, usually showing outward signs of decay, including dead tops (54%), broken tops (21%), fire scars (33%) or fungal conks (Gyug *et al*. 2009a).

Trembling Aspen nest trees typically showed signs of decay, usually with either dead tops or conks (Gyug *et al*. 2009a). The majority of aspen nest trees were alive (69%; n = 54). Average live aspen nest tree dbh was 35 cm (range 22 – 59 cm). The smallest nest tree found in B.C. was 22.1 cm dbh, although the smallest in Colorado was 18 cm dbh (Crockett 1975). Other broad-leaved trees used for nesting in B.C. included Water Birch (*Betula occidentalis*) (n = 9) and Black Cottonwood (*Populus trichocarpa*) (n = 1).

Other conifers used for nesting in B.C. include Ponderosa Pine, Douglas-fir, White Spruce (*Picea glauca*), Engelmann Spruce (*P. engelmannii*) and hybrids of the latter two species (Gyug *et al*. 2009a). These trees were more often dead (59%; n = 32) than alive, and were also typically very large (mean of 63 cm dbh; n = 27), similar to the large larch trees used for nesting. The tendency to prefer live larch for nesting, but standing dead trees for other conifer species, has been found throughout Williamson's Sapsucker breeding range (see review by Gyug *et al*. 2009a).

Nests in B.C. have been found at elevations ranging from 700 m to 1550 m (Gyug *et al*. 2014a). Nest trees have ranged in height from 49 m standing live trees to 5 m broken-trunk dead trees (Gyug *et al*. 2009a). One nest was found in a power pole, but no other nests have ever been found in man-made structures, and this species is not known to use nest boxes.

Suitable nest trees typically occur at very low densities across the landscape, in the order of 0.15/ha (Gyug *et al*. 2009a). Suitable nest trees will generally not develop from trees regenerating after timber harvest within a single rotation of 100 years. This means that suitable nest trees in a given stand will only be those left from the previous stand, or trees that become suitable over time, which will also usually only be from older trees with existing decay left from the previous stand.

<u>Sap Trees</u>

Sapsuckers are specialized for feeding on the sap and phloem fibres of trees with brush-like, tufted tongue tips, rather than the barbed tongue-tips of most woodpeckers (Winkler *et al*.1995). It was thought that Williamson's Sapsucker feeds primarily on conifer sap and phloem during the pre-nestling period, shifting mainly to ant-gleaning after hatching of the young (Gyug *et al*. 2012). However, a recent B.C. radio-telemetry study indicated this may be an overgeneralization, as breeding adults were observed in the pre-nestling period foraging by gleaning (typically picking ants from tree trunks), sap feeding, and pecking (typically involves shallow excavation in the bark layer to extract insects) (St. Amand 2017). Throughout the breeding season, 10-30% of adult telemetry relocations were of sap feeding. Before the nestling period, 50% of relocations were of foraging of insects by pecking, and 20-30% were by gleaning. During and after the nestling period, 50-75% of relocations were of gleaning, as foraging shifted primarily to ants that were fed to nestlings and that were eaten by adults.

Of 115 sap trees used by Williamson's Sapsucker, 85.2% were Douglas-fir, 7.8% were Western Larch, 4.3% were Lodgepole Pine, and 2.6% were Ponderosa Pine (Gyug *et al*. 2009b). Similarly, St. Amand (2017) found 84% of sap feeding was on Douglas-fir, 11% on Western Larch, and 5% on other species in the Okanagan-Boundary, and 99% on Douglas-fir in the Western region. The majority of sap trees (75%) were between 23 and 47 cm dbh (Gyug *et al*. 2010). Douglas-fir that were 23-52 cm dbh, with injuries to the trunk, and within 60 m of nests were six times more likely to be used as sap trees than other classes of trees. Crockett (1975) estimated that pairs maintained 4-5 sap trees within their breeding territory, but the B.C. radio-telemetry study found some individuals using up to 17 sap trees (St. Amand pers. comm. 2015).

Ant Consumption

In four older studies that examined detailed food habits (Beal 1911; Stanford and Knowlton 1942; Crockett 1975; Otvos and Stark 1985), ants formed the majority (75-99%) of the diet of Williamson's Sapsucker during the nestling period. A detailed study of nestling diet in B.C. using fecal sac examination confirmed this, and showed that 98% of the nestling diet was ants (Gyug *et al*. 2014b). Ants of two large-bodied groups were preferred and together or singly comprised at least 50% of the nestling diet biomass of every nest examined: carpenter ants (*Camponotus* subgenus *Camponotus*) and *Formica rufa* species group (probably primarily *Formica obscuripes*, the Western Thatching Ant). Other ant groups fed to the nestlings included *Formica fusca* species group, *Formica sanguinea* species group, *Lasius* spp., and *Camponotus* subgenus *Tanaemyrmex*.

Williamson's Sapsucker tends to rely more heavily on carpenter ants in the Okanagan-Boundary region (72% of fecal biomass) and about equally on carpenter ants (45-46%) and *Formica rufa* species group ants (33-39%) in the Western and East Kootenay regions (Gyug *et al*. 2014b).

Live Tree Density for Ant Gleaning

Ants are gleaned primarily from tree trunks (97% of the time, Stallcup 1968; 84% of the time, Crockett 1975). Gyug *et al*. (2010) found that density of live trees ≥18-cm dbh around 160 Williamson's Sapsucker nests was correlated with nest productivity and success. Nest productivity was significantly lower where tree densities were <85/ha within 225-m of the nest, and 33% of nests failed where tree densities were <85/ha. 94% of nests in cuts with <50 trees/ha were within 160 m of mature forest, with Williamson's Sapsucker regularly seen commuting those distances to more suitable foraging sites. The majority of Williamson's Sapsucker nests were in sites with an average density between 75 and 275 live trees/ha (Gyug *et al*. 2010). Williamson's Sapsucker was rarely found nesting where live tree densities within 225 m of the nest exceed 300 live trees (≥18-cm dbh)/ha (Gyug *et al*. 2010). Moderate tree densities appear to be preferred foraging areas, rather than those which are very open or very densely treed.

Live and Dead Trees for Insect Foraging by Pecking

St. Amand (2017) identified that pecking was a more important foraging method in B.C. than previously thought. Crockett (1975) found that Williamson's Sapsucker in Colorado spent 0.4% of total foraging time during the breeding season pecking for insects in the bark or under the bark in the manner of many other woodpeckers. They appeared to do so there only in periods of cold weather when ants were inactive. However, in B.C., St. Amand (2017) found about 50% of adult foraging sites prior to the nestling stage were pecking, about 10% during the nestling phase, and about 30% post breeding. Most of the foraging trees used for pecking were live trees, with at least half of those showing obvious outward signs of decay. Only for Ponderosa Pine in the Western region were the majority of the foraging trees dead, probably mostly from pine beetle attack.

## Habitat Trends

Most Williamson's Sapsucker habitat in B.C. is in provincial crown forest (see **Habitat Protection and Ownership** section) so that timber management dictates much of the habitat trends. The Annual Allowable Cut is set by the B.C. government, and is usually timed relatively evenly over the timber rotation period to avoid boom-and-bust cycles. Within the Williamson's Sapsucker AO, the projected timber rotation period is typically 100 years from clearcutting, through regrowth of forest, to the next cut of merchantable trees. Therefore, on average, the annual cut is approximately 1% of the forest per year, not taking into account actual stand conditions, constraints and projected growth rates, which vary among stands.

Almost all Williamson's Sapsucker nests are in sites that had previous timber harvesting history, mostly during the 1930-1960 period. These sites had generally been high-graded for the most valuable timber, leaving many snags and veteran trees with heart rot that had survived many fires, and were not clear cut. Since the 1960s, clearcutting and seed-tree cutting (retaining live tree densities <25/ha) were the most common harvest methods. The current estimate of 0.9% forested habitat loss per year (see below) is based on clearcutting or heavy selective removals that lead to loss of Williamson's Sapsucker habitat.

Forest licensee five-year spatial projections of cutblocks were included in the 2004 status report (COSEWIC 2005). Although licensees are no longer required to produce such plans, B.C. does make publicly available GIS files of cutblocks that have been approved for timber harvest (B.C. Data Catalogue 2016a), including file updates as blocks are harvested. Thus while future timber harvest rates in the Williamson's Sapsucker AO cannot be accurately predicted, cutting rates over the past 10 years are known.

In COSEWIC (2005), an estimated 15% of the Okanagan-Boundary Williamson's Sapsucker subpopulation occurred in larch stands >170-years-old. These were proposed for harvest at a rate of 0.8%/year, which could have reduced the proportion of the population nesting in these stands from 15% to about 7% after 10 years. However, this harvest had less impact, as it was not limited to old larch stands, and later habitat suitability modelling (Gyug 2009, 2010a,b,c) showed that a wider range of stand types could provide suitable nesting habitat, albeit with lower nest densities than in old larch stands.

For the previous 10-year period for which data are available (December 2004 to November 2014), 0.61% of the crown forest available for timber harvest in the East Kootenay contiguous AO had been timber harvested per year (not including Wildlife Habitat Areas or Old-Growth Management Areas), 0.53% of the Okanagan-Boundary contiguous AO, and 0.90% of the Western contiguous AO (Gyug unpubl. data). Harvest tended to concentrate on older forest stands that were more likely to be suitable Williamson's Sapsucker habitat (Gyug unpubl. data). In the Okanagan-Boundary AO, habitat of Moderate or better suitability made up 14% of the AO (as of 2008), and 0.89% of that was harvested per year. Low suitability habitat was harvested at a rate of 0.71% per year, and Very Low suitability habitat at 0.43% per year. In the Western AO, 0.86% of Moderate suitability habitat was harvested per year, 0.96% per year of Low suitability habitat, and 0.48% per year of Very Low suitability habitat. For stands with suitable volume for timber harvest and that are suitable for Williamson's Sapsucker nesting, the average harvest rate was consistently about 0.9%, which is slightly lower than the expected rate of about 1.0% timber harvest per year.

A decline in available habitat of about 9% can be expected on crown lands in the next 10 years if cutting continues at about the same rate and in a manner that continues to reduce habitat suitability, which is currently the case (see Best Management Practices (BMPs) discussion below, this section). Without spatial indications of where future cutting will occur (as licensees are no longer required to indicate where they will harvest), it is not possible to precisely predict whether forest harvesting within the AO in the next 10 years will be above or below the trend of the past decade. Salvage logging to cut dead trees killed by Mountain Pine Beetle (*Dendroctonus ponderosae*) was the focus then, and often occurred in areas higher in elevation than the Williamson's Sapsucker AO. However, as pine beetle infestation has mostly run its course and licensees are beginning to cut other forests again, the proportion of Williamson's Sapsucker AO harvested in the next 10 years may be higher than in the previous decade.

There had been extensive salvage logging of both Lodgepole and Ponderosa pine, particularly from pine beetle infested stands, on private and First Nations land within and near the Western AO, between 2008 and 2015. However, the extent of this logging was not quantified for this assessment, as most lies outside the Williamson's Sapsucker AO, and the database of approved cutblocks (B.C. Data Catalogue 2016a) does not indicate why each cutblock was harvested, or the tree species mix before harvest. This salvage logging began in earnest after the preparation of the Williamson's Sapsucker habitat modelling, which was based on forest inventory GIS spatial files from 2008, and so is not reflected in the existing habitat maps.

Williamson's Sapsucker BMPs were drafted in 2011 and published in 2014 to guide timber harvesting on crown forest (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014a,b,c). These were intended to allow for timber harvesting without reducing habitat suitability for Williamson's Sapsucker.

To assess whether BMPs met this objective, 21 blocks that had been planned under BMPs or draft BMPs were examined following harvest in the spring of 2016 (Gyug unpubl. data). Timber densities remaining on all harvested blocks were <50 trees/ha in the cutover portions. Some individual hectares had no trees left, despite the BMP guidance to retain at least 20 mature trees (>17.5-cm dbh) in each hectare. While the minimum target of 85 trees/ha was reached by averaging cutover areas with Wildlife Tree Patches, the low tree densities within the cutover portions significantly reduced foraging suitability and created large spaces unlikely to be used by Williamson's Sapsucker.

Most Williamson's Sapsucker nests (62% of 124) were in sites where <50% of the 16-ha area (225-m radius) around the nest had been cut <30 years ago (Gyug unpubl. data). In sites where >50% of the area around the nest had been harvested, retained tree densities in the cutover portions between 50 and 125 trees/ha were more likely to be used than random sites of the same tree densities (Figure 4). Most Williamson's Sapsucker nests with >50% of the area around the nest recently cut had average tree densities of 50-150 trees/ha in the cutover portion of the site. Recent cutblocks that had been planned according to the BMPs retained tree densities in the cutover portions below the normal range of tree densities occupied by Williamson's Sapsucker (Figure 4), resulting in a continuing loss of habitat. To date, BMPs do not appear to have been as effective as intended in guiding forestry practices to allow for the maintenance of suitable Williamson's Sapsucker breeding habitat after harvest.

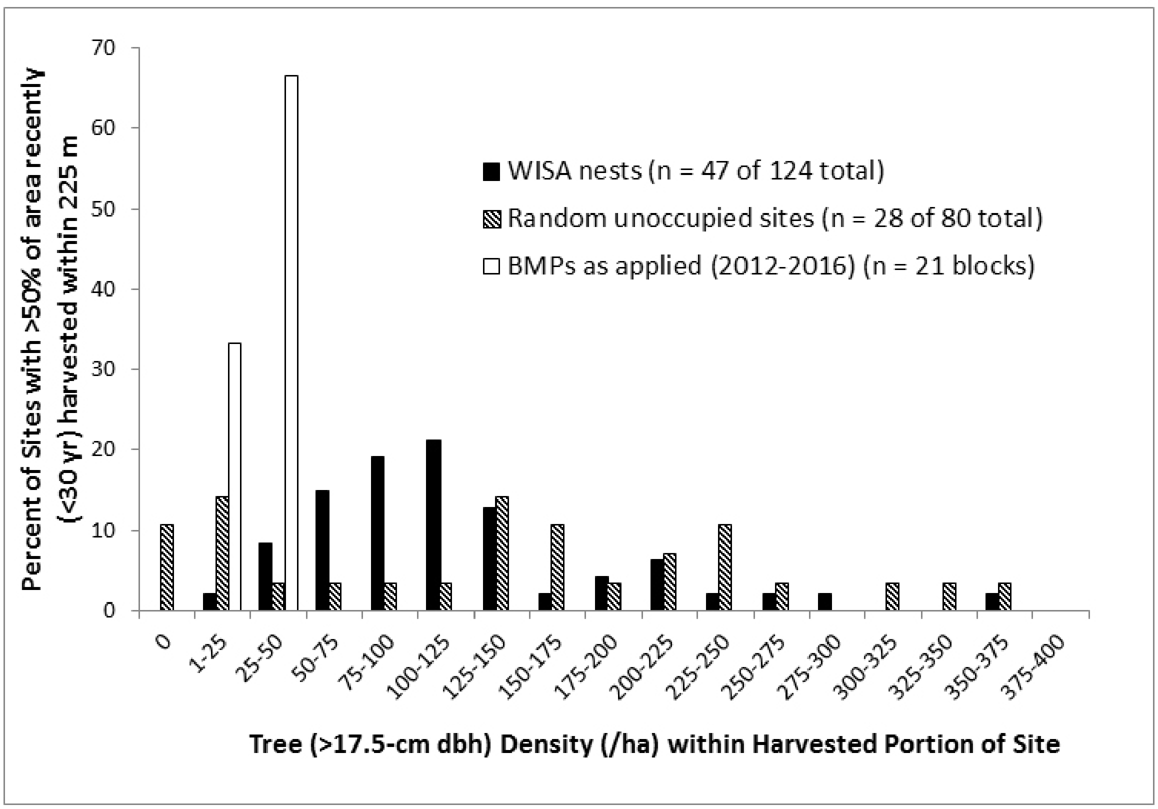



Figure 4. Live tree density in the harvested portions of cutblocks within 225-m of Williamson's Sapsucker (WISA) nests (2006-2008) and within 225-m of randomly selected points where Williamson's Sapsucker was not present (2008). These were contrasted with live tree densities retained within the harvested portions of cutblocks planned and harvested according to Williamson's Sapsucker Best Management Practices (BMPs; see text) Only sites harvested within the past 30 years were included, so that tree densities within the harvested portions would only include trees retained during harvest, as no trees planted after harvest would yet be >17.5-cm dbh.

# BIOLOGY

A comprehensive review of recent literature sources on the biology of Williamson's Sapsucker was undertaken by Gyug *et al*. (2012). St. Amand (2017) conducted a radio-telemetry study of Williamson's Sapsucker in B.C. in the summers of 2014 and 2015.

## Life Cycle and Reproduction

The only long-term band recovery record for Williamson's Sapsucker is of an adult banded in California and recaptured at a minimum age of 6 years (Rowan *et al*. 2014). The age of the oldest known Yellow-bellied Sapsucker was at least 7 years, 9 months; Red-naped Sapsucker was 4 years, 11 months; and Red-breasted Sapsucker was 4 years, 9 months old (United States Geological Survey 2016). However, there are no data available on the average age of adults of any of the sapsuckers, or their generation time. Although adults can breed at one year of age, it is not known what proportion may delay breeding until the age of two. Survivorship is not well-enough known to construct life history tables to assist in estimating generation time. In the absence of other information, it is assumed that generation time is about three years.

Males establish territories when they arrive on the breeding grounds in early March. Females have been reported to arrive 1-2 weeks later (Crockett and Hansley 1977), but in B.C. they may arrive about the same time as males (Gyug unpubl. data). Excavation of a nest cavity begins shortly after pair formation and takes about 3-4 weeks. Birds may re-use an old cavity rather than excavating a new one. Eggs can be found in B.C. from 23 April to 23 June (Campbell *et al*. 1990; Gyug *et al*. 2007). The incubation period is 12-14 days in Colorado (Crockett and Hansley 1977) and Arizona (Gyug *et al*. 2012), and 9-16 days in Canada (average 13 days, St. Amand 2017). Clutch size is usually 4-6 eggs, averaging 4.4 eggs/nest in Colorado and 4.9 eggs/nest in Arizona (Gyug *et al*. 2012). St. Amand (2017) reported an average of 6.3 ± 0.9 SD (n = 16) eggs per nest in B.C. Nestlings fledge after 26-33 days. Fledging date for 27 nests in B.C. in 2006 ranged from 26 June to 10 July (Gyug *et al*. 2007). Average number of fledglings per nest was 3.2 (Gyug *et al*. 2010), and 2.2-2.8 (St. Amand 2017). After fledging, adults and young may stay in the vicinity of the nest for a few days or weeks, or may disperse widely (Gyug *et al*. 2012; St. Amand 2017). There is only one brood per season.

## Physiology and Adaptability

There have been no studies of the physiology of Williamson's Sapsucker, and no records of them nesting in nest boxes.

Diet during the breeding season is described in the **Habitat Requirements** section. In brief, Williamson's Sapsucker adults and fledged young lick sap from sapwells, small holes drilled in rows in the bark of live trees that are checked periodically for sap reserves (Gyug *et al*. 2009b; Gyug *et al*. 2012). Adults and fledged juveniles also eat ants they glean from tree trunks, as well as other insects located by pecking at tree trunks. Ants gleaned by adults from tree trunks form about 98% of the food they provide to nestlings (Gyug *et al*. 2014b).

Sap and phloem fibres constitute the primary diet during the non-breeding season on the winter range, although berries may also provide a substantial part of the diet (Gyug *et al*. 2012).

Williamson's Sapsucker has been reported to be fairly tolerant of human activity at the nest, with many nests examined by researchers without apparent ill effects (Gyug *et al*. 2012). However, adults scold intruders near nests (within approximately 50 m) and remain agitated as long as intruders stay nearby. Some pairs appear not to accommodate human visitors near the nest, and do not resume feeding nestlings until intruders have left the area of the nest (Gyug unpubl. data).

## Home Range

Males establish breeding territories around the nest site. Breeding territory size has only been estimated in Colorado, where Crockett (1975) reported territory sizes of 4-9 ha (mean 6.75 ha), based on re-sightings of banded individuals. An estimate of minimum territory size of 0.8 ha (Young 1975) seems improbably small and may have been based on too few observations to be valid.

A radio-telemetry study in B.C. found one nesting male to have a home range of 54 ha (Manning and Cooper 1996). Estimates of home range size from the B.C. radio-telemetry study averaged 24.6 ha (range 3.5-64.7 ha, based on 12 birds at 8 nests) in the Okanagan-Boundary region, and 39.2 ha (range 6.8-112.8 ha, based on 10 birds at 6 nests) in the Western region (St. Amand pers. comm. 2015). About 75% of radio-telemetry relocations were within 200 m of the nest, and 95% were within 350 m of the nest.

Pairs are territorial during the breeding season, with little toleration of other conspecifics. Inter-nest spacing in the absence of apparent habitat or nest site availability constraints averaged 450 m in B.C. (Gyug *et al*. 2007). The closest that two Williamson's Sapsucker nests have been found to each other in B.C. is 122 m (Gyug unpubl. data).

## Dispersal and Migration

Williamson's Sapsucker is a migratory woodpecker that typically returns to British Columbia between mid-March and early April. The earliest detection in the spring in B.C. is from 28 February 2015 (Gyug 2015 a,b). Fall migrants generally depart by mid-September, with occasional records from October (Campbell *et al*. 1990).

Nothing is known of possible dispersal of adults or young between sites, subpopulations or populations, either in B.C. or elsewhere in their breeding range. There are limited data on return of adults and young to banding sites in subsequent years (see **Survivorship and Mortality** section below), but no information on dispersal.

## Survivorship and Mortality

Annual survivorship of adults returning to a study area in Colorado was 48.5% (n = 33 banded adults); survivorship after 2 years was 44% (n = 9 banded at year 1) (Crockett 1975). Annual survivorship of adults returning to a study area in Arizona was 24% in 1994 and/or 1995 of 67 adults banded in 1993, and was 22% in 1995 from 65 birds banded in 1994 (Gyug *et al*. 2012). In B.C., annual return rate was 33% (n = 8 returns of 24 banded adults) one year after banding, and 13% (n = 2 of 16 banded adults) after two years (St. Amand 2017). These were not based on mark-recapture models but were simple return rates. In all cases, survivors that may have emigrated outside the study areas could not be included in the estimates, so these survivorship estimates are minimum values.

Monitoring Avian Productivity and Survivorship (MAPS) program survivorship data using estimates of annual adult apparent survival probability from modified Cormack-Jolly-Seber mark-recapture analyses was reported as 0.29 ± 0.12 (SE) for Williamson's Sapsucker (Gyug *et al*. 2012). However, the website from which that information was obtained was not available in 2016, and there does not appear to be any available update.

Limited information is available on survivorship of juvenile Williamson's Sapsucker. Crockett (1975) reported six young were banded in nests, three of which returned to nest in following years. Of >100 young banded in Arizona, none were re-sighted over the subsequent 4 years (Gyug *et al*. 2012).

In B.C., nest failures were observed at 11% of nests (n = 175, Gyug *et al*. 2010), and at 36% of nests (n = 25, St. Amand 2017). The number of young fledged per nest averaged 3.24 ± 0.11 SE from all nests (n = 175), and 3.63 young ± 0.08 SE from successful nests (n = 156, Gyug *et al*. 2010). St. Amand (2017) reported 2.2-2.8 fledglings per nest (n = 25) including all nests, even those that failed. Significantly fewer young were fledged per nest where mature live tree density was <85 trees/ha in the 225-m radius area around the nest (Gyug *et al*. 2010). Of nine nests in Arizona for which both clutch size and number of fledged young were known, clutch size was 5.22 ± 0.28 SE and number of fledged young was 3.89 ± 0.31 SE, indicating that hatching failure and/or nestling mortality was 1.33 young per nest (Gyug *et al*. 2012).

## Interspecific Interactions

Other species of woodpeckers and sapsuckers occasionally experience hostility from territorial male Williamson's Sapsucker (Gyug *et al*. 2012), but inter-nest spacing can be much smaller than from conspecifics. For example, Williamson's Sapsucker has nested as close as 15 m to Red-naped Sapsucker (Gyug unpubl. data). When Williamson's and Red-naped Sapsucker interact, Young (1975) considered Williamson's to be aggressive toward, and behaviourally dominant to, Red-naped.

Between 1999 and 2016, 37 Williamson's Sapsucker nests in B.C. were observed with other active cavity nests in the same tree at the same time (Gyug unpubl. data). These included Northern Flicker, Mountain Chickadee (*Poecile gambeli*), Black-capped Chickadee (*Poecile atricapillus*), Red-breasted Nuthatch (*Sitta canadensis*), White-breasted Nuthatch (*Sitta carolinensis*), Pygmy Nuthatch (*Sitta pygmaea*), Tree Swallow (*Tachycineta bicolor*), European Starling (*Sturnus vulgaris*), Mountain Bluebird (*Sialia currucoides*), House Wren (*Troglodytes aedon*), Red Squirrel (*Tamiasciurus hudsonicus*) and Northern Flying Squirrel (*Glaucomys sabrinus*). The nest entrances were within 30 cm of each other in two cases of Mountain Chickadee and Williamson's Sapsucker.

Williamson's Sapsucker is a prey species for all three Accipiter species in western North America – Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*A. cooperii*) and Northern Goshawk (*A. gentilis*) (Reynolds and Meslow 1983). Nest predators include Red Squirrel (Gyug *et al*. 2012, St. Amand 2017), Long-tailed Weasel (*Mustela frenata*; Crockett and Hansley 1977), Black Bear (*Ursus americanus*; Walters and Miller 2001), and probably snakes (Crockett and Hansley 1977). Based on observations of nest predation of other species of woodpeckers in B.C. in areas where Williamson's Sapsucker occurs, other possible nest predators include Deer Mouse (*Peromyscus maniculatus*) and House Wren (Walters and Miller 2001).

# POPULATION SIZES AND TRENDS

## Sampling Effort and Methods

The Breeding Bird Survey (BBS) cannot be used to track Williamson's Sapsucker population trends in B.C. as they have only been detected on two of the 172 BBS survey routes in B.C. (19 of which are within the EOO). Their relative abundance as detected on the BBS does not reflect actual abundance, as Williamson's Sapsucker tends to be much quieter during the breeding bird survey period than in April, when they are actively establishing breeding territories. Williamson's Sapsucker has only been detected once on the Canford route near Merritt B.C., in 2009. It has been detected an average of 0.31 times per year on the Oliver BBS route. Using the same Oliver BBS route stops, an average of 4.0 (n = 2) were detected on the route in late March or early April using silent listening, and an average of 5.4 (SD 2.2, n = 10) using call playbacks (Gyug unpubl. data).

There has been only one Breeding Bird Atlas in B.C., so current atlas data (from 2008-2012) cannot be used to determine trends.

Christmas Bird Counts cannot be used to estimate trends in Canada, as Williamson's Sapsucker is absent in the winter. However, trends can be estimated on the U.S. wintering range, as this species has been found on 7-32 counts per year since 1972 (Audubon Christmas Bird Count 2016).

Gyug *et al*. (2014a) described sampling effort used to derive three independent estimates of population size for the Okanagan-Boundary and Western regions. Breeding territory population size was estimated by extrapolating the numbers of breeding territories found within the areas sampled (assuming 300-m sample radius for call-playbacks) to the entire contiguous AO, using call-playbacks conducted prior to 2008 and nest searches to follow up on call-playback detections. The number of known territories was adjusted for annual re-occupancy rates determined from searches of previously known nesting territories in subsequent years. The sample consisted of 2510 call-playback points sampling 434 $km^2$ of the contiguous AO (29%) as mapped at the time. In 2008, a simple random sample of 174 225-m radius plots within the contiguous AO was searched intensively for territorial activity and nests, and the density extrapolated to the entire contiguous AO. In 2012, breeding territory density was estimated in each of 30 census areas in the contiguous AO, ranging in size from 1.0 to 6.7 $km^2$. The regression of these densities with average habitat suitability of each census area was used to extrapolate densities to the entire contiguous AO, based on habitat suitability.

Gyug *et al*. (2014a) described the two-stage subsampling design that was used to estimate the number of pairs from the Western region that nested outside the contiguous AO. A grid of 10 x 10 km grid squares was surveyed at 3038 call playback survey points with follow-up nest searches. However, as only one nest was found despite this extensive sampling, no reliable estimate of numbers nesting there could be produced.

Sampling was conducted in the East Kootenay contiguous AO in 2011 and 2012 to estimate population size (Ohanjanian *et al*. 2012). A dual-frame design was used, where a "list frame" of previously known nests was checked for re-occupancy, and the remainder of the area (the "area frame") was sampled by random sampling stratified by habitat. In the list frame, 35 and 40 previously known nest territories were searched in 2011 and 2012, respectively. The area frame was sampled by 108 and 126 call-playback points in 2011 and 2012, respectively. However, as only one nest was found in the two years of sampling, no reliable population estimate could be produced.

In the Western and Okanagan-Boundary contiguous AOs, initial attempts to establish a long-term monitoring program in 2010 and 2011, using off-road points or a combination of on-road and off-road points, proved too costly and inefficient to continue annually.

For trend monitoring, roadside monitoring routes were established in 2012 within the Western and Okanagan-Boundary contiguous AOs to determine annual relative abundance (number of Williamson's Sapsucker detected per call-playback point; Gyug 2014). Call-playback points were sampled in April (preferably early in the month) each year, as Williamson's Sapsucker are actively establishing breeding territories then and are 3-4 times more responsive to call-playbacks than later in the breeding season (Gyug 2014a). These roadside monitoring points were sampled twice annually when possible. Power of this monitoring to detect a 10% change in population size over 10 years was high (90%) because the Coefficient of Variation (CV = SD/Mean) was very low (3%, Gyug 2015c).

In 2014, randomly selected off-road points were surveyed to compare with the 225 long-term road monitoring points, to determine whether the road points were representative of relative abundance throughout the AO. Those surveys found no significant differences in relative abundance by habitat suitability class between the sets of survey points (Gyug 2014), indicating that the roadside monitoring points were representative of the whole subpopulation.

In the East Kootenay, a first attempt in 2014 at a monitoring program using off-road call playback points at 400-m grid spacing in four previously-known breeding areas only encountered 18 Williamson's Sapsuckers at 129 sampling points (Ohanjanian 2014). In comparison to prior relative abundances at these sites, the relative abundance in 2014 had very high variance (CV = 62 to 173%, Gyug unpubl. data). As the power to detect trend at such high variance would be low, further monitoring has not been undertaken.

## Abundance

The only estimate of global Williamson's Sapsucker population size is 300,000, based on analyses of BBS results (Blancher *et al*. 2007), with estimated populations in Washington State of 19,000, Idaho 4,000, Montana 8,000, and B.C. 1,300. However, the methods used have been criticized due to the many assumptions required to derive population estimates (e.g., Thogmartin *et al*. 2006). For Williamson's Sapsucker, the limiting assumptions for developing an accurate population estimate from BBS data are most likely that: 1) the assumed 125 m detection distance may be low, and 2) many Williamson's Sapsuckers would go undetected as they are much quieter during the BBS survey period (generally June) than earlier in the season (e.g. Crockett 1975). Gyug *et al*. (2014a) found Williamson's Sapsucker nests discovered after call playback to be 260 m on average from the call playback survey point (n = 187), rather than the 125 m detection distance assumed by Blancher *et al*. (2007). It is thus very difficult to assess the accuracy of Williamson's Sapsucker population estimates derived from BBS data.

Total population size of Williamson's Sapsucker in Canada was estimated to be about 960 breeding adults (95% confidence limits of 520-1440), based on the average of three separate surveys from 2007-2012 (Table 1). This includes 486 individuals (95% CL: 228-744) in the Okanagan-Boundary region, and 384 individuals (95% CL: 243-525) in the Western region (Gyug *et al*. 2014a), based on the mean estimate calculated from three independent survey methods (Table 1).

**Table 1. Estimated number of Williamson's Sapsucker breeding territories or nesting pairs for the Okanagan-Boundary and Western regions of British Columbia, determined using the mean of three independent methods from Gyug *et al*. (2014a).**

| Population Estimation Method | Region | | Total |
|---|---|---|---|
| | Western | Okanagan-Boundary | |
| i. Territory detections from call-playback detections and follow-up nest searches (1996-2007) | 167 | 214 | 381 |
| ii. Random 16-ha area searches (2008) | 187 | 212 | 399 |
| iii. Census Area densities extrapolated by habitat suitability (2012) | 223 | 303 | 526 |
| **Mean** | **192** | **243** | **435** |
| Std. Error (SD/Mean) | 16.4 | 30.0 | 45.6 |
| **Number of breeding adults (Mean x 2)** | **384** | **486** | **870** |
| 95% Conf. Interval | 243-525 | 228-744 | 477-1263 |

A statistically reliable population estimate is not available for the East Kootenay subpopulation (see **Sampling Effort and Methods** section), but it was estimated to be about 20 pairs, or 40 breeding adults (assumed range: 20-80), in 2011-12 (Gyug unpubl. data). A reliable estimate of the number of adult Williamson's Sapsucker breeding in the remainder of the Western/Okanagan-Boundary EO, outside the contiguous AOs, is similarly not available (see **Sampling Effort and Methods** section). However, it is thought that about 50 additional breeding individuals (assumed range: 25-100), or 25 pairs, nested outside the contiguous AOs in that EOO as of 2007 (Gyug unpubl. data).

The 2004 Canadian population estimate was 430 individuals (COSEWIC 2005) or about half the current estimate. The number estimated in 2004 for the Okanagan-Boundary (364) was fairly similar to the estimate made here for the same region (486; Table 1). However, the numbers estimated in 2004 for other regions were considerably lower than presented here, with an estimated 36 in the Western region and 30 in all other areas outside the Okanagan-Boundary, including the East Kootenay (COSEWIC 2005). The three current estimates of 167-223 for the Western region derived using different methods (Table 1) are far above the 2004 estimate. This almost certainly reflects a relative lack of knowledge of those regions in 2004 because of insufficient inventory coverage, rather than a population increase. For example, there had been only 161 call playback sample points completed west of Okanagan Lake prior to 2005, compared to 5877 call playback sample points completed there from 2005-2009.

## Fluctuations and Trends

No long-term population numbers are known for Williamson's Sapsucker in Canada. Annual trend monitoring of the relative abundance of Williamson's Sapsucker in B.C. only began in 2012, so no trends are yet available.

There appears to have been a slight historical geographic increase in area of occupancy, with Williamson's Sapsucker known from the Merritt and Princeton areas after about 1940 (Gyug *et al*. 2007). There seems to have been a further increase in numbers in the Princeton area from the 1990s to the 2000s, when they were relatively easy to find on surveys in areas where they had previously been largely absent (Herzig pers. comm. 2000). It is unclear why this apparent increase occurred in this small group of less than 30 nest territories, and not elsewhere in B.C. Salvage logging in several areas near Princeton had caused abandonment of some previously known nesting territories (Gyug unpubl. data), so that the general principles of habitat suitability summarized earlier would apply here. Of the 68 Williamson's Sapsucker nesting territories for which >4 years of data exist, those in the Princeton area had a significantly higher annual territory occupancy rate (mean 0.89, SD 0.12, n = 7) than other territories in the Western and Okanagan-Boundary (mean 0.63, SD 0.26, n = 61; ANOVA, p<0.001). However, it is unknown why apparently suitable habitat is now consistently occupied, after being underutilized or unoccupied in the 1990s, in this area alone.

Inventory surveys in 2006 also identified relatively large occupied areas of the Western region near Merritt, where Williamson's Sapsucker were not previously known when preparing the 2005 COSEWIC status report. However, this is likely not reflective of a population increase, but of increased search effort.

On the assumption that there is a direct relationship between the availability or amount of suitable habitat and the size of the Williamson's Sapsucker population in Canada, the population is probably declining over the long term, reflecting decreases in suitable habitat within the current EOO.

There are anecdotal long-term population records for only two areas of the Okanagan-Greenwood (Okanagan Boundary) region (COSEWIC 2005). At Schoonover Mountain (east of Okanagan Falls), the species was first collected in 1913 (Munro and Cowan 1947) and was still common as of 2004 (COSEWIC 2005) – probably because much of the old, veteran Western Larch stand remained. A second location, consisting of 2.1 $km^2$ of mixed Western Larch-Douglas-fir forest near Okanagan Falls, which had the highest nest density in B.C. in 2003 and 2004, was designated as a benchmark area (Gyug *et al*. 2007). However, this stand was already isolated from similar old-growth stands by 2004 and 33% of it had already been cut, with harvest of a further 27% in 2006-2007. Nest density there declined significantly from 3.2 nests/$km^2$ in 2003-2004 to 1.1 nests/$km^2$ in 2009-2015 (Gyug 2016). Similar declines were not observed elsewhere in unlogged areas.

Continentally, Williamson's Sapsucker overall population trends on North American Breeding Bird Survey routes are considered of at least moderate precision based on moderate abundance, and showed an overall upward trend of 0.42%/year from 1966-2013 (Sauer *et al*. 2014). However, the 95% CI of that trend overlapped zero (-1.2 – 2.0) so was not significantly different from zero. State-by-state trends varied considerably, ranging from a high of 5.2% annual increase in California, to a low of 1.5% annual decrease in Montana.

Christmas Bird Count results showed no apparent trend ($r^2 = 0.02$, $p = 0.34$, $n = 44$ years) on the winter range in the southwest U.S., where between 13 and 59 Williamson's Sapsucker were detected annually from 1972 to 2015 (Audubon Christmas Bird Count 2016). As only 0.0002-0.0005 Williamson's Sapsuckers were counted per party hour, indicating that they were relatively uncommon, this result should be interpreted with caution.

## Rescue Effect

There are significant populations of Williamson's Sapsuckers in areas of Washington and Montana adjacent to B.C. Relative densities in Washington are higher than in Canada (Gyug unpubl. data), and occurrences are much more common in adjacent Montana than in the East Kootenay (eBird 2012). This species is considered to be nationally secure in the U.S. and numbers are stable on U.S. BBS routes (see **Fluctuations and Trends** section). As sizable populations in adjacent states appear to be stable (Vulnerable to Apparently Secure in Washington and Apparently Secure in Montana, Table 2), they could provide potential immigrants for rescue through immigration from the U.S., should Canadian populations decline.

However, it appears that a decrease in the availability of suitable habitat is the principal factor limiting the size of the Okanagan-Boundary breeding population, and likely other areas in Canada (see **Threats** section). Thus, unless the B.C. population declines in the future for reasons other than habitat loss, there would likely be insufficient suitable habitat to support immigrant birds, and thus it is unlikely that rescue could occur.

**Table 2. Global, national and local status of Williamson's Sapsucker in Canada and the United States in 2004 (as reported in COSEWIC 2005) and in 2015, based on NatureServe (2015) and B.C. Species and Ecosystem Explorer (B.C. Conservation Data Centre 2016).**

| Jurisdiction | Status[1] 2004 | Status[1] 2015 | Other Status |
|---|---|---|---|
| Global | G5 | G5 | |
| National | | | |
| Canada | N3B | N3B | COSEWIC/*Species-at-Risk Act* Schedule 1 Endangered |
| United States | N5B, N3N | N5B, N5N | |
| State/Province | | | |
| British Columbia | S3B (S1, S2B) | S3B | Blue-listed (*S. t. nataliae* subspecies – as of 2012, subspecies no longer ranked separately) |

| Jurisdiction | Status[1] 2004 | Status[1] 2015 | Other Status |
|---|---|---|---|
| Arizona | S4 | S4 | |
| California | S3 | SNR | Species not ranked in 2015 |
| Colorado | S4B | S4B | |
| Idaho | S5B | S4B | |
| Montana | S4B | S4B | |
| Nevada | S5 | S2 | |
| New Mexico | S5B, S5N | S4B,S5N | |
| Oregon | S4B, S3N | S4B,S3N | |
| Texas | S2N | S2N | |
| Utah | S2B | S3B | |
| Washington | S4B | S3S4B | |
| Wyoming | S3B | S2 | |

[1] 1 = Critically imperilled; 2 = Imperilled; 3 = Vulnerable; 4 = Apparently Secure; 5 = Secure.
B suffix indicates breeding season only; N indicates non-breeding season only; no suffix indicates both breeding and non-breeding seasons; NR indicates not ranked.

# THREATS AND LIMITING FACTORS

## Threats

An assessment of threats to Williamson's Sapsucker was conducted during the preparation of the Recovery Strategy (Environment Canada 2014) and again during the update of this status report (Appendix 2). The threats reviewed below are categorized following the IUCN-CMP (International Union for the Conservation of Nature – Conservation Measures Partnership) unified threats classification system, based on the standard lexicon for biodiversity conservation of Salafsky *et al*. (2008). The assigned overall threat impact is High (see Appendix 2 for details).

Over the next 10 years, biological resource use, principally logging and wood harvesting, was identified as having a Medium impact; natural system modifications, principally fire and fire suppression, as having a Medium-Low impact; and four threats as having a Low impact, including housing and urban development, livestock farming and ranching, renewable energy and work activities (i.e., removal of 'dangerous trees' for worker safety reasons). There are no known threats on the wintering grounds, and no other specific references have been made to those here or in the threats calculator, although forest harvest activities in northern Mexico may affect their winter habitat. Possible impacts from climate change were of unknown severity in the next 10-year period and are not discussed further here.

<u>Logging and Wood Harvesting</u>

Tree harvesting throughout much of the Williamson's Sapsucker breeding and foraging habitat in Canada has been identified as a high-priority threat to this species (COSEWIC 2005), and future harvesting within the range is planned. Harvesting rates in the past 10 years are discussed under **Habitat Trends**.

The severity of impact from forest harvesting depends on the specific characteristics of trees retained within the cutblock, the size of the cutblock, and the spatial context of the surrounding landscape. Suitable nest trees will generally not develop from trees regenerating after timber harvest within a single rotation of 100 years. This means that suitable nest trees in a given stand will only be those left from the previous stand, or trees that become suitable over time, which will also usually only be from older trees with existing decay left from the previous stand. In general, most suitable nest trees with decay will be felled during timber harvesting to meet WorkSafe BC standards, so that even partial harvesting under the current regime will provide very few possible nest trees within the partially harvested area. Williamson's Sapsucker will nest in partial-retention blocks only if there are suitable nest trees, and if these stands are adjacent to mature stands that meet foraging requirements, depending on the number of trees left during partial harvest (Gyug *et al*. 2010; St. Amand 2017). In the Okanagan-Boundary and the East Kootenay, partial-retention harvesting has occurred for almost 100 years in most forests used by Williamson's Sapsucker. However, harvesting before about 1960 tended to be "high-grading" where only sound and valuable older-age timber was taken, leaving many smaller trees which then grew into multi-aged stands, and trees with decay which are now the suitable Williamson's Sapsucker nest trees. Current harvesting trends are to leave fewer standing trees (or none in clear cut blocks), to replant in an "even-aged" management strategy, and to fell trees with decay to meet WorkSafe BC standards, all of which are unlikely to provide suitable breeding habitat for Williamson's Sapsucker.

B.C. provincial regulations limit the amount of sound "waste" wood which can be left on the ground after forest harvesting, with lower limits of only 4 $m^3$/ha in most of Williamson's Sapsucker AO (B.C. Forest Service Revenue Branch 2005). Williamson's Sapsucker breeding territories averaged 19-30 $m^3$/ha of large woody debris (logs) along with stumps, snags and standing decaying trees that were not part of the volume estimate (see **Habitat** section). Therefore, these regulations may negatively affect Williamson's Sapsucker through a long-term reduction in ant nest substrates, and therefore nestling food resources.

In addition, the Mountain Pine Beetle epidemic has left B.C. with an abundance of dead standing and downed timber that the province has included in the development of a domestic renewable fuel industry (British Columbia Energy Plan *cited in* Environment Canada 2014). If residual coarse woody debris or potential nest trees are removed for use as biofuel, both the quality and quantity of available ant nest substrate and therefore suitable Williamson's Sapsucker breeding habitat may be reduced.

Based on provincial forest pest infestation mapping, over 20% of the breeding range of Williamson's Sapsucker in B.C. is or has been recently affected by Mountain Pine Beetle. Extensive proliferation of beetle infestations has led to significant salvage logging in areas affected by the current epidemic (B.C. Ministry of Forests and Range 2009). Many current or potential nest trees are being removed for salvage, or felled as hazard trees, and stands are left with tree densities too low for Williamson's Sapsucker to use as foraging habitat.

Stand mortality from Mountain Pine Beetle in the southern portion of the province has not been as extensive as in the central interior, because Lodgepole Pine salvage logging was undertaken in the 1980s-1990s to combat pine beetle infestation then. As Lodgepole Pine stands are not normally inhabited by Williamson's Sapsucker, the first epidemic had little effect on the species. However, the more recent infestation also caused significant Ponderosa Pine mortality. Extensive areas of Ponderosa Pine, particularly in the area occupied by the Western region, were salvage logged after ~2008, but the extent of that salvage logging has not yet been quantified.

Salvage logging is also a concern in stands that have been affected by other natural disturbances, including other insect pests (e.g., Spruce Budworm *Choristoneura fumiferana*), wildfire and windthrow. Salvage harvest of stands affected by windthrow has been documented in the benchmark census area near Okanagan Falls, in addition to the planned timber harvest (Gyug unpubl. data).

Felling of standing dead trees for firewood, either illegally or under a free-use firewood permit, may also represent a significant loss of nesting opportunities in some areas. However, there is no reliable way to estimate the magnitude of firewood harvest as permits do not limit or document the amount taken. In the Okanagan-Boundary and East Kootenay regions, Western Larch trees are a favourite target for firewood harvesting. This threat may only be locally important, as firewood harvesters are generally restricted to taking easily accessible trees, and free-use permits typically do not provide for the harvest of live trees or larger snags that are valuable nesting habitat features for Williamson's Sapsucker. However, a few known nest trees have been felled by firewood cutters (e.g., Gyug *et al*. 2009a). In the Okanagan Forest District, larch and cedar are no longer allowed to be cut under permit for firewood. Overall, this threat was considered negligible (<1% impact over 10 year period) and was not included in the threat calculator separately from logging and wood harvesting.

Unfledged nestlings may be killed when nest trees are accidentally removed during forest harvesting or removal of 'dangerous trees'. There are currently no legal restrictions preventing forest licensees from timber harvesting during the nesting season. While occupied nests may be theoretically protected from this incidental take under the *Migratory Birds Convention Act* and the *British Columbia Wildlife Act*, in practice, timber harvesting is routinely undertaken during the bird nesting season. However, the long-term impact of timber harvesting on habitat loss has much more impact than the loss of individual nests in any given year.

Fire and Fire Suppression

Stand-replacing wildfires represent a significant threat to Williamson's Sapsucker, as they have the potential to destroy high-quality sapsucker habitat, such as veteran nesting snags and the coarse woody debris elements important for ant nests. While Williamson's Sapsucker has evolved in ecosystems in which wildfires have always been an important ecological process, there is evidence that the frequency and severity of wildfires has increased in recent decades in the western U.S. (Westerling *et al*. 2006). Stand-replacing fires create sites that cannot be used by Williamson's Sapsucker, except for potential nest snags or partially burned areas near the edge of the burn (Bock and Lynch 1970; Hutto *et al*. 2015; Hutto and Patterson 2016; Gyug unpubl. data), because they must have access to live trees nearby for sap wells and from which to glean ants.

Anthropogenic fire suppression has been advanced as a primary factor for the increase in wildfires, along with climate change. In the past, fires in low or moderate tree density stands may have killed many, but not all of the trees in the stand, typically leaving the oldest Western Larch, Ponderosa Pine and Douglas-fir that all have thick bark to resist ground fires (Gyug *et al*. 2009a). Currently, most of the forest stands in the breeding range have not been burned for many decades and infilling of young Douglas-fir, which is more shade tolerant than larch or Ponderosa Pine, creates dense ladder fuels that result in crown fires. This was observed in the area occupied by the Okanagan-Boundary region in 2003, where a fire near Vaseux Lake burned into a large area occupied by Williamson's Sapsucker, killing many large Western Larch that were 400-600 years old and had survived many previous fires. One known nest-tree there was cut down during salvage logging (Gyug unpubl. data).

<u>Work and Other Activities</u>

High-value habitat trees may pose a safety hazard to people, equipment or facilities, so are often labelled as 'dangerous trees' when they occur within worksites, i.e., defined as a site where logging is taking place (WorkSafe B.C. 2009). Consequently, 'dangerous trees' are often flagged for removal during forestry operations. Their removal within Williamson's Sapsucker nesting habitat results in loss of important nesting resources. Nest trees are typically those showing outward signs of decay (see **Habitat Requirements** section) and therefore likely to be assessed as 'dangerous trees'. While removal of potential nest trees due to safety concerns has not been explicitly quantified, it is expected to be a significant threat because the majority of Williamson's Sapsucker nesting habitat falls outside of protected areas. However, as most factors related to this threat have been accounted for under the <u>Logging and Wood Harvesting</u> heading, removal of 'dangerous trees' is a threat of Low concern only.

<u>Housing and Urban Areas</u>

New housing developments are restricted to small areas of the range, at Anarchist Mountain in particular. There large (2-4 ha) lot subdivisions are being developed in an area of about 20 $km^2$, or about 1.4% of the Western/Okanagan-Boundary subpopulation's contiguous area of occupancy (Gyug unpubl. data). This area was formerly known locally as "Sapsucker Woods" due to the abundance of Williamson's Sapsuckers (R. J. Cannings pers. comm. 2004). It lost most of its capacity to support sapsuckers with initial clearing of much of the area for agriculture in the 1970s and 1980s, although it continued to support a least three breeding pairs. With further subdivision of the agricultural land into large building lots, one breeding site was lost to a new road intersection in 2005 and another when a subdivided lot was sold in 2017 (Gyug, pers. obs.). As further building occurs, trees with decay suitable to support Williamson's Sapsuckers will likely be felled, reducing the value of any remaining territories.

## Agriculture

Agricultural impacts to Williamson's Sapsucker breeding habitat have occurred primarily in Anarchist Mountain in the Okanagan-Boundary Region and in forested areas near natural grasslands in the Western Region. In the early 1900s, Anarchist Mountain was considered the "centre of abundance" of Williamson's Sapsucker in B.C. (Spreadborough *cited in* Macoun and Macoun 1909; Guiguet 1970). Clearing of these forests for hayfields about a century ago resulted in loss of this nesting habitat. However, recent clearing of Douglas-fir and Lodgepole Pine forests to create new cattle summer pasture and rangeland on private rangelands is an ongoing process in the Western Region. Although aspen frequently left on such sites may provide some nesting opportunities for Williamson's Sapsucker, their value is limited if there are no coniferous foraging sites nearby. Private rangelands make up over 30% of the Western region (Table 3). The rate of forest conversion for agriculture has not been quantified, but on average it is likely less than 100 ha per year, or about 1% of the Western Region contiguous area of occupancy over ten years (Gyug unpubl. data).

**Table 3. Area of Williamson's Sapsucker contiguous area of occupancy (AO) within each region, and the percentage within each tenure type.**

| Land Tenure Type | Region | | | Total |
|---|---|---|---|---|
| | East Kootenay | Okanagan-Boundary | Western | |
| Total Area (km$^2$) | 850.6 | 697.9 | 742.5 | 2290.9 |
| % within each tenure type | | | | |
| Private Land | 15.4 | 17.9 | 31.5 | 21.4 |
| First Nations Reserves | 0.0 | 1.5 | 6.2 | 2.5 |
| Crown Forest (general) | 74.5 | 61.1 | 50.0 | 62.5 |
| Old-growth Management Areas | 4.2 | 8.1 | 7.2 | 6.3 |
| Wildlife Habitat Areas | 1.8 | 2.7 | 2.8 | 2.4 |
| Woodlots (Crown and Private portions) | 4.1 | 8.2 | 2.1 | 4.7 |
| Provincial Parks and Ecological Res. | 0.0 | 0.5 | 0.2 | 0.3 |
| | 100.0 | 100.0 | 100.0 | 100.0 |

Energy Production and Mining

A new co-generation electricity plant has recently been opened in Merritt, B.C. within the Western Region (Gyug, pers. comm. 2017). It will generate electricity by burning wood waste; primarily sawdust and wood chips. Much of this waste wood will likely come from "opportunity wood", mainly forests affected by Mountain Pine Beetle infestations. In the past, these forests may not have been logged due to a lack of markets for small-diameter trees or for cracked wood that had been standing dead for several years. The Merritt plant will require fuel on a continuing basis, at least some of which will come from forests within the Western Region. This may contribute to loss of coniferous foraging sites, as well as loss of standing dead Ponderosa Pine trees that Williamson's Sapsucker use for nesting in the Merritt area (Gyug unpubl. data). The extent of possible impact on sapsucker habitat has not been quantified, but is likely to be much less than 1% per year, considerably less than the overall impact of regular timber harvesting.

## Limiting Factors

Based on recent habitat modelling and several field seasons of verification of habitat modelling predictions, the principal limiting factor to the Williamson's Sapsucker population in Canada appears to be its reliance on the limited amount of suitable breeding habitat (e.g., Gyug 2014). The Canadian population is likely occupying almost all available suitable nesting habitat, so there likely remains little other habitat which could support a population increase, and declines in habitat availability will likely result in a population decrease.

Abundance or density of suitable nest trees may also be limiting (Gyug *et al*. 2009a), although it is difficult to separate this from other aspects of habitat. Veteran Western Larch that are typically 300-600 years old are the preferred nest trees. As noted above, these are often felled as 'dangerous trees', as firewood, or as part of commercial timber harvesting. Without long-term planning (i.e., for harvesting at more than the typical stand rotation of 100 years or selectively retaining some veteran larches), these trees will not continue to be part of the landscape.

## Number of Locations

Many of the Williamson's Sapsucker territories within the Okanagan-Boundary and Western regions are largely contiguous and therefore difficult to separate into individual locations meeting the COSEWIC definition of a place where "a single threatening event can rapidly affect all individuals" (COSEWIC 2016). There are probably more than 100 such locations in this subpopulation, where forest harvesting is likely to be the relevant threatening event. Individual locations can be more easily identified in the East Kootenay subpopulation, where density appears to be far lower with sites much farther apart, and thus unlikely to be impacted by the same forest harvesting event. In the East Kootenay, there are 17 breeding sites known or assumed to be >2 km from the next nearest breeding site. Intensive sampling between most of these sites has failed to find breeding sites between them, indicating that they can be considered separate locations.

# PROTECTION, STATUS AND RANKS

## Legal Protection and Status

The Williamson's Sapsucker is protected from direct persecution under the *Migratory Birds Convention Act*. It was assessed by COSEWIC as Endangered in 2005 and in 2017 and is listed as Endangered on Schedule 1 of the *Species at Risk Act*, thereby receiving protection of the individual under section 32 and protection of the residence under section 33. Both birds and eggs are also protected from possession, take, injury, molestation or destruction under the *British Columbia Wildlife Act*. None of these acts directly protects Williamson's Sapsucker habitat, although habitat loss is the main population threat. As timber harvesting in B.C. is routinely undertaken during bird nesting season, in practice, the acts identified here currently provide little relief from incidental destruction of occupied nests.

There is a SARA Recovery Strategy in place for Williamson's Sapsucker (Environment Canada 2014), and a British Columbia Recovery Plan (B.C. Ministry of Environment 2012) that explicitly only applies to provincial Crown lands in B.C. (i.e., >90% of the province and about 76% of the breeding range of the species). The population and recovery goals of both documents are to ensure the persistence of populations within each of the identified areas of occupancy by maintaining them at or above 1) the current abundance, and 2) the current distribution, allowing for natural fluctuations in both cases.

The Recovery Strategy (Environment Canada 2014) identifies Critical Habitat spatially with a list of activities likely to result in the destruction of Critical Habitat. However, the identification of Critical Habitat does not automatically give it legal protection. Activities already completed or underway include long-term monitoring (see Sampling Effort and Methods section). Five broad strategies for recovery were identified in the Recovery Plan: 1) Habitat protection and management, primarily to be implemented by the B.C. government on crown forest lands through BMPs, which have yet to effectively protect Critical Habitat (see **Habitat Trends** section), 2) Habitat supply analysis, which has yet to be initiated, 3) Habitat research, which includes the radio-telemetry study currently underway, 4) Evaluation of the regulatory environment and enforcement, which has yet to be initiated, with the exception of ongoing 'dangerous tree' evaluations, and 5) Stewardship, outreach and education, with some efforts ongoing.

The intent of the B.C. Recovery Plan (B.C. Ministry of Environment 2012) was to manage habitat within the Identified Wildlife Management Strategy (B.C. Ministry of Water, Land and Air Protection 2004), a provincial policy and guidance document meant to limit effects of forestry practices on certain wildlife species occurring on Crown land. This strategy provides a framework for legal establishment of Wildlife Habitat Areas (WHAs; see **Habitat Protection and Ownership** section) and General Wildlife Measures under the *Forest and Range Practices Act*. The latter measures have not yet been established outside of Wildlife Habitat Areas. The Best Management Practices (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014a,b,c) were intended as guidelines to achieve habitat protection on provincial crown forest, but have yet to prove successful in adequately protecting habitat quality during timber harvest (see **Habitat Trends section**), the primary threat to Williamson's Sapsucker habitat (see **Threats** section).

Recovery actions set out in the B.C. Recovery Plan (B.C. Ministry of Environment 2012) include: 1) monitor population trends (ongoing by federal government), 2) complete implementation of *Forest and Range Practices Act* (Wildlife Habitat Areas established; see below), 3) develop and implement best management practices and evaluate effectiveness (BMPs published, but while effectiveness evaluation methods were drafted in 2016, effectiveness has not yet been evaluated), 4) update habitat suitability models by 2014 (not yet begun), 5) map survival and recovery habitats by 2012 (not yet begun), 6) establish protocol for monitoring trends in amount and quality of habitat by 2012 (not yet begun), 7) increase awareness of wildlife tree values (ongoing), 8) investigate feasibility and need for wildlife tree creation (ongoing on local basis), 9) evaluate forestry policies and regulations including residue and waste, residual trees and stocking standards (not yet begun), 10) evaluate worker safety regulations governing dangerous trees (unknown progress), 11) evaluate impact of firewood cutting (some progress), and 12) evaluate wildfire policy (not yet begun).

## Non-Legal Status and Ranks

Breeding populations of Williamson's Sapsucker are considered globally secure (G5; Table 2) and nationally secure in the U.S. (N5B). The U.S. states in which it breeds consider it as either Apparently Secure (S4), Vulnerable (S3) or as Imperilled (S2). In Canada, the species is considered Vulnerable (Canada: N3B, B.C.: S3B). Changes acknowledging a reduced threat level from 2004 to 2016 took place in California, which no longer ranks the species, and Utah, which downgraded it from S2 to S3. Changes acknowledging an increased threat level from 2004 to 2016 included Nevada which upgraded from S5 to S2, New Mexico which upgraded from S5B to S4B, Washington which upgraded from S4B to S3S4B and Wyoming which upgraded from S3B to S2. Nevada and Wyoming, both of which upgraded to S2, have very small populations of Williamson's Sapsucker.

## Habitat Protection and Ownership

Land ownership GIS spatial files were downloaded from Data B.C. (B.C. Data Catalogue 2016b). These were intersected with spatial layers of the breeding range, known Williamson's Sapsucker sites, and habitat suitability models. In Canada, the majority (76%) of the occupied breeding range is on crown forest lands, including woodlots, which also include a portion of private land managed under provincial forest legislation (Table 3). A small portion of these lands is protected as Wildlife Habitat Areas, as outlined below. Private land, mostly large ranches, makes up 21% of the occupied area, with a much smaller proportion (2.5%) on First Nations reserves.

There are no known Williamson's Sapsucker nests in provincial parks or ecological reserves. Taken together, protected areas make up only a tiny fraction (0.3%) of the Canadian breeding range (Table 3).

As Williamson's Sapsucker is included in the category of species at risk under the *Forest and Range Practices Act* of British Columbia, WHAs may be established around known nests. General Wildlife Measures contained in the Identified Wildlife Management Strategy account for Williamson's Sapsucker are to be applied within Williamson's Sapsucker WHAs and do not allow for salvage or harvest of trees. As of early 2016, 147 WHAs had been established for Williamson's Sapsucker, totalling 58.4 $km^2$, or about 2.5% of the species' occupied range in B.C. These WHAs protected a total of 171 known nest territories. In any given year, about 40% of previously known nest territories are occupied (Gyug 2016). Therefore, on average, about 68 nests are likely to be given some protection within WHAs in any given year, or about 14% of the estimated breeding population of 480 nesting pairs (i.e., 960 breeding adults).

Old-growth Management Areas (OGMAs) may be established by order under the British Columbia *Forest and Range Practices Act*. However, these are not always spatially defined, and may just be the sum of the areas contained in stands of a certain age, within a unit such as a forest district. In Williamson's Sapsucker breeding range in B.C., the OGMAs are non-legislated but have been identified spatially, even though there is no legal requirement to do so. However, these are not permanently located, and therefore do not provide permanent habitat protection to Williamson's Sapsucker nest sites. Overall, 6.3% of the breeding range is temporarily protected within OGMAs (Table 3). These sites contain 16 known nest trees and nine other known breeding territory centres. Given that about 40% of these 25 breeding territories are occupied in any given year, OGMAs likely protect about 10 breeding territories, or about 2% of the population.

## ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

This report was prepared by Les Gyug with funding from Environment and Climate Change Canada. The report writer offers thanks to many biologists and technicians, all of whom have been cited in one or another of the series of published Williamson's Sapsucker papers that arose from their research and inventories. Funding for the Williamson's Sapsucker inventory and research from 1996-2016 was provided to L. Gyug and a number of other biologists and contractors by a number of sources: primarily Environment and Climate Change Canada's Canadian Wildlife Service from 2006-2016, but also including B.C. Ministry of Environment, B.C. Ministry of Forests, Lands and Natural Resource Operations, Weyerhaeuser Ltd., Tolko Industries Ltd., Pope and Talbot Ltd. (now Interfor), Tembec Industries (now Canfor), B.C. Conservation Foundation, Council of Forest Industries, and B.C. Timber Sales. Helpful review comments on the draft report were provided by Peter Arcese, Louise Blight, Ruben Boles, Syd Cannings, Richard Elliot, Eric Gross, Jon McCracken and Scott Wilson.

| Name of jurisdiction | Name of contact and date |
|---|---|
| Canadian Wildlife Service | Rhonda Millikin<br>Randal Lake<br>22 April 2016 |
| Provincial / territorial representative(s) corresponding to the range of the wildlife species | Lisa Tedesco<br>John Surgenor<br>B.C. Ministry of Forests, Lands and Natural Resource Operations<br>22 April 2016 |
| Conservation Data Centre(s) corresponding to the range of the wildlife species | British Columbia CDC<br>cdcdata@gov.B.C.ca<br>22 April 2016<br>Rec'd data May 16 |
| COSEWIC Secretariat for information and instruction on:<br>a) sources of Aboriginal Traditional Knowledge<br>b) the preparation of distribution maps and the calculation of extent of occurrence, area of occupancy, and index of area of occupancy | Sonia Schnobb<br>22 April 2016<br>Jenny Wu<br>19 December 2017 |
| Williamson's Sapsucker recovery team | Lisa Rockwell and 14 others<br>22 April 2016 |
| Other relevant contacts (e.g., experts, third-party agencies, suggestions by jurisdictions) as directed by Co-chair. | Kari Stuart-Smith, Canfor<br>22 April 2016<br>Brian Drobe, Weyco<br>3 May 2016<br>George Edney, B.C.T.S. Kootenay, 3 May 2016 |

## INFORMATION SOURCES


Audubon Christmas Bird Count. 2016. Audubon Christmas Bird Count historical results. Website: http://netapp.audubon.org/CBCObservation/Historical/ResultsBySpecies.aspx?1 [accessed 9 January 2017].

Baird, S.F. 1858. Catalogue of North American birds chiefly in the Museum of the Smithsonian Institution. Smithsonian Institution, No. 106. Washington DC.19 pp.

B.C. Conservation Data Centre. 2016. B.C. Species and Ecosystems Explorer. B.C. Ministry of Environment, Victoria, British Columbia. Website: http://a100.gov.bc.ca/pub/eswp/ [accessed 19 June 2016].

B.C. Data Catalogue. 2016a. Forest Tenure Cutblock Polygons (FTA 4.0). Website: https://apps.gov.bc.ca/pub/dwds/addProductsFromExternalApplication.do?productTypeId=0&productId=9781 [accessed 29 April 2016].

B.C. Data Catalogue. 2016b. Generalized Forest Cover Ownership. Website: https://apps.gov.bc.ca/pub/dwds/addProductsFromExternalApplication.do?productTypeId=0&productId=6167 [accessed 29 April 2016].

B.C. Forest Service Revenue Branch. 2005. Provincial Logging Residue and Waste Assessment Procedures Manual. With updates to October 1, 2013. Website: http://www.for.gov.bc.ca/ftp/hva/external/!publish/web/manuals/RWProcedures [Accessed 28 January 2014].

B.C. Ministry of Environment. 2012. Recovery plan for the Williamson's Sapsucker (*Sphyrapicus thyroideus*) on Crown lands in British Columbia. British Columbia Ministry of Environment, Victoria, British Columbia. 21 pp.

B.C. Ministry of Forests and Range. 2009. Monitoring Harvest Activity Across 29 Mountain Pine Beetle Impacted Management Units. Forest Analysis and Inventory Unit. Website: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/Monitoring-Harvest-Activity-Across-29-Mountain-Pine-Beetle-impacted-management-units_FINAL.pdf [accessed 9 December 2011].

B.C. Ministry of Forests, Lands and Natural Resource Operations. 2014a. Best management practices for timber harvesting, roads, and silviculture for Williamson's Sapsucker in British Columbia: East Kootenay Area of Occupancy. British Columbia Ministry of Forests, Lands and Natural Resource Operations, Nelson, British Columbia. 15 pp.

B.C. Ministry of Forests, Lands and Natural Resource Operations. 2014b. Best management practices for timber harvesting, roads, and silviculture for Williamson's Sapsucker in British Columbia: Okanagan-Boundary Area of Occupancy. British Columbia Ministry of Forests, Lands and Natural Resource Operations, Nelson, British Columbia. 15 pp.

B.C. Ministry of Forests, Lands and Natural Resource Operations. 2014c. Best management practices for timber harvesting, roads, and silviculture for Williamson's Sapsucker in British Columbia: Western area of Occupancy. British Columbia Ministry of Forests, Lands and Natural Resource Operations, Nelson, British Columbia. 15 pp.

B.C. Ministry of Water, Land and Air Protection. 2004. Accounts and measures for managing identified wildlife. Version 2004. British Columbia Ministry of Water, Land and Air Protection, Victoria, British Columbia. Website: http://www.env.gov.bc.ca/wld/frpa/iwms/accounts.html#fourth_ [accessed 24July 2017].

Beal, F.E.L. 1911. Food of the woodpeckers of the United States. U.S. Dept. Agr., Biol. Surv. Bull. 37.

Blancher, P. J., K. V. Rosenberg, A. O. Panjabi, B. Altman, J. Bart, C. J. Beardmore, G. S. Butcher, D. Demarest, R. Dettmers, E.H. Dunn, and W. Easton, W. 2007. Guide to the Partners in Flight Population Estimates Database. Version: North American Landbird Conservation Plan 2004. Partners in Flight Technical Series No 5. 26 pp.

Bock, C. E., and J.F. Lynch. 1970. Breeding bird populations of burned and unburned conifer forest in the Sierra Nevada. Condor 72:182-189.

Browning, M.R., and S.P. Cross.1999. Specimens of birds from Jackson County, Oregon: Distribution and taxonomy of selected species. Oregon Birds 25:62-71.

Campbell, R.W., A.K. Dawe, I. McTaggart-Cowan, J. Cooper, G. Kaiser, and M.C. McNall. 1990. Birds of British Columbia: Volume 2, Nonpasserines; Diurnal Birds of Prey through Woodpeckers. Royal British Columbia Museum. 636 pp.

Canadian Intermountain Joint Venture. 2003. *The Canadian Intermountain Joint Venture: Biological Foundation and Prospectus.* Canadian Intermountain Joint Venture. 71pp.

Cannings, R.A. 2012. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S11655762. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed 12 July 2016].

Cannings, R.A., R.J. Cannings and S.G. Cannings. 1987. Birds of the Okanagan Valley, British Columbia. Royal British Columbia Museum. xx+ 420 pp.

Cannings, R.J. pers. comm. 2004. [former] BC Programs Manager, Bird Studies Canada, and [former] Co-chair Birds Specialist Subcommittee, COSEWIC. Penticton, B.C. *personal communications to L. Gyug*, April-August 2004.

Cassin, J. 1852. Description of birds of the genera *Laniarius, Dicrurus, Graucalus, Manacus* and *Picus*, specimens of which are in the collection of the Academy of Natural Sciences of Philadelphia. Proc. Acad. Nat. Sci. 5 (1850 & 1851):347-349.

Chaon, P. 2014. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S19101728. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed 19 June 2016].

Chruszcz, B., pers. comm. 2006. *Email correspondence to L. Gyug.* March 2006. Biologist, Cranbrook, British Columbia.

Cicero, C., and N. K. Johnson. 1995. Speciation in sapsuckers (*Sphyrapicus*): 3. Mitochondrial-DNA sequence divergence at the cytochrome-b locus. Auk 112:547-563.

Clapham, P. 1995. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S9690399. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed 19 June 2016].

Clark, J., pers. comm. 2008. *Personal communication to L. Gyug*. July 2008. Wildlife Technician, Nicola Tribal Association, Merritt, British Columbia.

COSEWIC 2005. Assessment and status report on the Williamson's Sapsucker, *Sphyrapicus thyroideus,* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 45 pp.

Crockett, A. B. 1975. Ecology and behavior of the Williamson's Sapsucker in Colorado. PhD. Thesis. Univ. of Colorado, Boulder. xi + 126 pp.

Crockett, A.B., and P.L. Hansley. 1977. Coition, nesting and postfledging behavior of Williamson's Sapsucker in Colorado. The Living Bird 16:7-19.

Drever, M.C., L.W. Gyug, J. Nielsen, A.K. Stuart-Smith, I.P. Ohanjanian, and K. Martin. 2015. Using Field Data and GIS-Derived Variables to Model Occurrence of Williamson's Sapsucker Nesting Habitat at Multiple Spatial Scales. PLoS One 10(7):e0140849

eBird. 2012. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Website: http://www.ebird.org. [accessed 16 June 2016].

Environment Canada. 2014. Recovery Strategy for the Williamson's Sapsucker (*Sphyrapicus thyroideus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vi + 32 pp.

Fannin, J.1891. Checklist of British Columbia birds. British Columbia Provincial Museum, Victoria, British Columbia. 49 pp.

George, T.L., R.J. Harrigan, J.A. LaManna, D.F. DeSante, J.F. Saracco, and T.B. Smith. 2015. Persistent impacts of West Nile virus on North American bird populations. Proceedings National Academy of Sciences 2015 112(46):14290-14294.

Godfrey, W.E. 1986.The Birds of Canada. Rev. ed. Natl. Mus. Nat. Sci., Ottawa, Ontario. 595 pp.

Great Basin Bird Observatory. 2010. Nevada Comprehensive Bird Conservation Plan, ver. 1.0. Great Basin Bird Observatory, Reno, Nevada. Website: www.gbbo.org/bird_conservation_plan.html [accessed November 2011].

Guiguet, C.J. 1970. Birds of British Columbia, (1) Woodpeckers, (2) Crows and their allies. British Columbia Provincial Museum, Handbook No. 6. Victoria, British Columbia. 51 pp.

Gyug, Les W., unpublished data. Data collected during research and inventory studies and in volunteer time between 1996 and 2016. Consulting biologist, West Kelowna, British Columbia.

Gyug, L.W. 2009. Final species account for species-habitat model for Williamson's Sapsucker in the Boundary. B.C. Timber Sales, Kootenay Business Region, Nelson, British Columbia. 26 pp.

Gyug, L.W. 2010a. Final species account for species-habitat model for Williamson's Sapsucker in the East Kootenay. Report prepared for Environment Canada - Canadian Wildlife Service, Delta, British Columbia, and Ministry of Environment, Victoria, British Columbia. 23 pp.

Gyug, L.W. 2010b. Final species account for species-habitat model for Williamson's Sapsucker West of Okanagan Lake. Report prepared for Environment Canada, Canadian Wildlife Service, Delta, British Columbia, and Ministry of Environment, Victoria, British Columbia. 30 pp.

Gyug, L.W. 2010c. Final species account for species-habitat model for WISA in the Okanagan. Report prepared for Weyerhaeuser Co. Ltd., Princeton, British Columbia. 25 pp.

Gyug, L.W. 2011. Assessment of Williamson's Sapsucker Habitat Suitability Models in B.C. and Recommendations for Management in the East Kootenay. Report prepared for Environment Canada - Canadian Wildlife Service, Delta, British Columbia. 14 pp.

Gyug, L.W. 2014. Williamson's Sapsucker monitoring 2014: Okanagan, Boundary and West. Report prepared for Environment Canada - Canadian Wildlife Service, Delta British Columbia. 22 pp.

Gyug, L.W. 2015a. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S22109515. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed: 15 July 2016]

Gyug, L.W. 2015b. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S22109453. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed: 15 July 2016]

Gyug, L.W. 2015c. Williamson's Sapsucker monitoring 2015: Okanagan, Boundary and West. Report prepared for Environment Canada - Canadian Wildlife Service, Delta, British Columbia. 25 pp.

Gyug, L.W. 2016. Draft Williamson's Sapsucker WHA and BMP effectiveness protocols. Report prepared for Thompson-Okanagan Region, Ministry of Forest, Lands and Natural Resource Operations, Kamloops, British Columbia. 40 pp.

Gyug, L. W., J. M. Cooper, and C. Steeger. 2014a. Distribution, relative abundance and population size of Williamson's Sapsucker in south-central British Columbia. British Columbia Birds 24:9-19.

Gyug, L.W., R. C. Dobbs, T. E. Martin, and C. J. Conway. 2012. Williamson's Sapsucker (*Sphyrapicus thyroideus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online. Website: http://bna.birds.cornell.edu/bna/species/285

Gyug, L.W., R.J. Higgins, M.A. Todd, J.M. Meggs, and B.S. Lindgren. 2014b. Dietary dependence of Williamson's Sapsucker on coarse woody debris-associated ants in British Columbia. Canadian Journal of Forest Research 44(6):628-637.

Gyug, L. W., I. Ohanjanian, C. Steeger, I. A. Manley, and P. W. Davidson. 2007. Distribution and density of Williamson's Sapsucker in British Columbia, Canada. British Columbia Birds 16:2-15.

Gyug, L. W., C. Steeger, and I. Ohanjanian. 2009a. Williamson's Sapsucker (*Sphyrapicus thyroideus*) nest tree characteristics and densities in British Columbia. Canadian Journal of Forest Research 39:2319-2331.

Gyug, L. W., C. Steeger, and I. Ohanjanian. 2009b. Williamson's Sapsucker (*Sphyrapicus thyroideus*) sap trees in British Columbia. British Columbia Birds 19:6-12.

Gyug, L. W., S. Wilson, C. Steeger, and I. Ohanjanian. 2010. Williamson's Sapsucker (*Sphyrapicus thyroideus*) nest productivity in relation to tree densities in British Columbia. British Columbia Birds 20:9-15.

Henshaw, H.W. 1874. On a hummingbird new to our fauna, with certain other facts ornithological. Auk 8:241-243.

Herzig, J., pers. comm. 2000. *Personal communication to L. Gyug.* June 2000. Birder, Princeton, British Columbia.

Hutto, R.L., M.L. Bond, and D.A. DellaSala. 2015. Using bird ecology to learn about the benefits of severe fire. pp. 55-88. *in* DellaSala, D.A. and C.T. Hanson (eds.) The ecological important of mixed-severity fires: nature's phoenix. Elsevier Inc. Amsterdam, Netherlands. 450 pp.

Hutto, R.L., and D.A. Patterson. 2016. Positive effects of fire on birds may appear only under narrow combinations of fire severity and time since fire. International Journal of Wildland Fire 25(10):1074-1085.

Johnson, N. K., and R. M. Zink. 1983. Speciation in sapsuckers (*Sphyrapicus*): I. genetic differentiation. Auk 100:871-884.

Macoun, John, and James M. Macoun. 1909. Catalogue of Canadian birds. Department of Mines, Geological Survey Branch, Ottawa. 761 pp.

Manning, E.T., and J.M. Cooper. 1996. Progress Report (Year 1 – 1996). An assessment of woodpecker foraging, home range and patch utilization at Wallace Creek, British Columbia. Prepared for B.C. Ministry of Environment, Penticton, British Columbia. i + 9 pp. + 4 p. tables and figures.

Moqtaderi, C. 2012. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S11111552. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed 19 June 2016].

Munro, J. A., and I. McTaggart Cowan.1947. A review of the bird fauna of British Columbia. British Columbia Provincial Museum Special Publication, No. 2, Victoria, British Columbia. 285 pp.

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Website: http://explorer.natureserve.org. [accessed 19 June 2016].

Newberry, J.S. 1857. No. 2. Report upon the zoology of the route. Pages 34-114 *in* Part 4. Zoology report. Reports of explorations and surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean, 1854-1855. Vol. 6. War Dept. Washington. 114 pp.

Oaten, D., pers. comm. 2007. *Personal communication to L. Gyug*. May 2007. M.Sc. student, University of British Columbia, Vancouver, British Columbia.

Ohanjanian, P. 2014. Focused sampling to inform population monitoring of Williamson's Sapsucker (*Sphyrapicus thyroideus*) in the East Kootenay Area of Occupancy, 2014. Report produced for Environment Canada – Canadian Wildlife Service, Delta, British Columbia. 10 pp.

Ohanjanian, P., L.-A. Isaac, and P. Davidson. 2012. Population monitoring of Williamson's Sapsucker, *Sphyrapicus thyroideus*, in the East Kootenay Area of Occupation. Report produced for Environment Canada, Delta, British Columbia.12 pp.

Olsen, D., pers. comm. 2004. *Personal communication to L. Gyug.* December 2004. Consulting biologist, Kamloops, British Columbia.

Otvos, I. S., and R. W. Stark. 1985. Arthropod food of some forest-inhabiting birds. Canadian Entomologist 117:971-990.

Partners in Flight British Columbia and Yukon. 2003. *Canada's Great Basin Landbird Conservation Plan, Version 1.0.* Partners in Flight British Columbia and Yukon, Delta, British Columbia. 100 pp.

Patten, M.A. 2012. Systematics *in* Gyug, L.W., R. C. Dobbs, T. E. Martin, and C. J. Conway. 2012. Williamson's Sapsucker (*Sphyrapicus thyroideus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: Website: http://bna.birds.cornell.edu/bna/species/285

Patten, M. A., G. McCaskie, and P. Unitt. 2003. Birds of the Salton Sea: Status, Biogeography, and Ecology. University of California Press, Berkeley. 374 pp.

Pinel, H.W. 1993. First verified record of Williamson's Sapsucker for Alberta. Blue Jay 51:209-210.

Reynolds, R.T., and E.C. Meslow. 1983. Partitioning of food and niche characteristics of coexisting Accipiter during breeding. Auk 101:761-779.

Rich, T.D., C. J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, New York. (not paginated)

Rowan, E., R.B. Siegel, D.R. Kashube, and S. Stock. 2014. North American longevity records for nine landbird species monitored at Yosemite National Park's MAPS stations. North American Bird Bander 39:153-159.

Salafsky, N., D. Salzer, A.J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S.H.M. Butchart, B. Collen, N. Cox, L.L. Master, S. O'Connor, and D. Wilkie. 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. Conservation Biology 22: 897-911.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2014. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2013. Version 01.30.2015 USGS Patuxent Wildlife Research Center, Laurel, Maryland. Website:* http://www.mbr-pwrc.usgs.gov/bbs/bbs2013.html *[accessed 12 July 2016]*

Short, L.L. 1982. Woodpeckers of the World. Delaware Mus. Nat. His. Monogr. Ser. no. 4. xviii + 676 pp.

Short, L.L., and J.J. Morony, Jr. 1970. A second hybrid Williamson's x Red-naped Sapsucker and an evolutionary history of sapsuckers. Condor 72:310-315.

St. Amand, J., pers. comm. 2015. *Email correspondence to L. Gyug.* December 2015 – June 2016. M.Sc. student, University of British Columbia, Vancouver, British Columbia.

St. Amand, J. 2017. Foraging ecology of endangered Williamson's Sapsuckers in Canada: multi-scale habitat selection in two biogeoclimatic zones. M.Sc. thesis, University of British Columbia, Vancouver, British Columbia. 117 pp.

Stallcup, P.L. 1968. Spatio-temporal relationships of nuthatches and woodpeckers in ponderosa pine forests of Colorado. Ecology 49:831-843.

Stanford, J.S. and G.F. Knowlton. 1942. Food of some Utah birds. Auk 59:580-581.

Stepniewski, A. 1989. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S7418786. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed 19 June 2016].

Thogmartin, W.E., F.P. Howe, F.C. James, D.H. Johnson, E.T. Reed, J.R. Sauer, and F.R. Thompson III. 2006. A review of the population estimation approach of the North American Landbird Conservation Plan. Auk 123(3):892-904.

United States Geological Survey, 2106. Longevity records of North American birds. Website: https://www.pwrc.usgs.gov/bbl/longevity/longevity_main.cfm [accessed 9 January 2016].

Walters, E.L., and E.H. Miller. 2001. Predation on nesting woodpeckers in British Columbia. Canadian Field-Naturalist 115:413-419.

Westerling A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and earlier spring increase western US forest wildfire activity. Science 313:940-943.

Winkler, H., D. A. Christie, and D. Nurney. 1995. Woodpeckers: An Identification Guide to the Woodpeckers of the World. Houghton Mifflin Co., Boston. 406 pp.

WorkSafe B.C. 2009. Occupational Health and Safety (OHS) Regulation. Website< <http://www2.worksafeB.C.com/Publications/OHSRegulation/Home.asp>. [accessed 26 August 2009.]

Wrinn, J. 2004. eBird Checklist: Website: http://ebird.org/ebird/view/checklist?subID=S22507202. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [accessed 19 June 2016].

Young, R.C. 1975. Interspecific territoriality in Williamson's and Red-naped sapsuckers (*Sphyrapicus thyroideus* and *S. varius nuchalis*). M.S. Thesis, Univ. New Mexico, Albuquerque, New Mexico 32 pp.

## BIOGRAPHICAL SUMMARY OF REPORT WRITER

Les W. Gyug is a Registered Professional Biologist with the College of Applied Biology of British Columbia. He has a B.Sc. (Honours) degree in Biology from Carleton University, Ottawa (1978), and an M.Sc. degree in Zoology from University of Western Ontario, London (1979). Les has worked throughout the southern interior of British Columbia since 1981; with the Canadian Wildlife Service from 1981-1984 on the wildlife component of the biophysical inventories of mountain National Parks; as a seasonal naturalist for Parks Canada from 1986-1990; and as a consulting biologist from 1991 to the present. For the past 25 years, much of his work has involved species-at-risk, habitat modelling and assessing the effects of forestry on wildlife including songbirds, woodpeckers, owls, ungulates, grizzly bears, furbearers, small mammals, and amphibians, from the stand to the landscape level. Les prepared the COSEWIC status report for Mountain Beaver *Aplodontia rufa* in 1999, Williamson's Sapsucker in 2005, and the Mountain Beaver update status report in 2012.

## COLLECTIONS EXAMINED

No collections were examined in the preparation of this report.

## Appendix 1. Williamson's Sapsucker habitat suitability step-down tables to be applied spatially to GIS forest inventory attributes and including slope, aspect and aerial photo interpretation, summarized from Gyug (2009, 2010 a,b,c).

| **WISA Habitat Suitability for Okanagan-Boundary contiguous AO** | | | | | | |
|---|---|---|---|---|---|---|
| **Input Variables** | **High (H) (1)** | **Moderately High (M) (2)** | **Moderate (M) (3)** | **Low (L) (4)** | **Very Low (5)** | **Nil (6)** |
| Rank 1 Layer Projected Age | >190 years | >190 years | >120 | | Any other forested, potentially forested or non-productive polygons; OR, Rock and Swamp polygons as per adjustments below | All other non-forest polygons |
| Rank 1 Layer Projected Ht | >29.0 m | | | | | |
| Rank 1 Layer Site Index | >15.0 | | | | | |
| Rank 1 Layer Crown Closure | >30% | >20% | | | | |
| Crown Closure ≥15.0 m ht | | | >20% | | | |
| Age of oldest layer | >190 years | >190 years | >125 years | >80 years | | |
| Tree Species | Fd or Lw leading, contains Lw | Fd or Lw leading, contains Lw | Fd, Lw present | Fd or Lw present | | |
| Cw %. | <10% | <10% | <10% | <10% | | |
| Sum of Pl and Bl % | <30% | <30% | <30% | <60% | | |
| Sum of Fd and Lw % | | | | >40% | | |
| Boundary: % Fd of all layers ≥15.0 m ht | 10-90 | 10-90 | 10-90 | Fd <100% | | |
| Okanagan: Sum of Fd and Lw % of L1 and L2 (if multi-layered) | | | | >40% | | |
| **Adjustments:** | | | | | | |
| Reduce 1 level if polygon >1 ha and | Slope >30% | | | | Do not reduce | |
| Upgrade from VL to L if | • Forested polygon and Lw present at >1/ha and Lw age >125 yr | | | | | |
| | • Contains Fd or Lw, contains At >4% of stand, age >55 yr, and Pl <55% of stand | | | | | |
| | • NP but age>125, on south or gentle slope, contains Lw, Crn Clos >10% | | | | | |
| Upgrade from VL to L if slope <30% and | • Lw or At vets present in ST cut (>2 ST/ha) up to 150 m from adjacent H/M/L with >30% Crown Closure) (or up to 200 m if surrounded on all sides by forested stands | | | | | |
| | • Mature At patches >1 ha and adjacent to Fd/Lw forest, i.e., not Pl/Se | | | | | |
| | • Fire-origin (60-100 year), old high-graded stands, or old light partially cut stands (1960s-1980s) if: | | | | | |
| | 1. Lw vets scattered throughout at >0.5/ha, or | | | | | |
| | 2. Upgrade the portions of the stand with clumps of vets | | | | | |
| | • if Ep/Ew and Lw occur in Layer 1, stand is not NP, slope <30%, Crown closure >25% and >10 m tall, and >50 years old | | | | | |
| | • Any other forested stands containing vets >0.5/ha but was assigned VL | | | | | |
| Upgrade from VL to L if slope >30% and if | • Lw vets present at >1/ha, if adjacent to H/M/L, and if polygon size >1 ha | | | | | |
| OR, R, NP polygons | • assign as Nil if no mature trees | | | | | |
| | • if partly treed, e.g., at the edges or within an arm of an irregularly shaped polygon, then remain VL | | | | | |

| | |
|---|---|
| | • if NP polygons had been rated M or L, reduce to VL if crown closure <10% |
| | • Small swamps (<1 ha) ringed by At, Ac or tall shrubs remain VL |
| | • 20-m buffer inside large OR and SWAMP polygons adjacent to H, M or L may be rated L if boundaries not mapped precisely, i.e., OR or Swamp contains mature trees |
| Downgrade from M/L to VL if | • Clearcuts with no mature trees, i.e., not really ST cuts |
| Downgrade from H/M/L to VL if | • ST Cuts, partial cuts or high grading but no vets and no mature At detectable |
| | • ST cuts, even if ST Lw vets present, if surrounding stands were VL or young Pl stands |
| | • 5% crown closure but >15 m ht, and not adjacent to intact forest stands – usually at lower edges of AO adjacent to open Py slopes |

**WISA Habitat Suitability for Western contiguous AO**

| Input Variables | Moderately High (MH) (2) | Moderate (M) (3) | Low (L) (4)* | | Very Low (5) | Nil (6) |
|---|---|---|---|---|---|---|
| BEC Zone | IDF or PP | | | | | Other BEC zones |
| Elevation and Slope | 600 -1400 m, slope <45% | | | | | <600 m, >1400 m, >45% slope |
| Oldest Layer Age | ≥100 | ≥180 | ≥180 | ≥58 years | Any other forested, potentially forested or non-productive polygons; OR polygons (see below) | All other non-forest polygons, OR >120 m from forests and not containing trees (see below) |
| Oldest Layer Ht | ≥20.0 | ≥19.0 | ≥18.0 | ≥14.0 | | |
| Site Index | ≥10.0 | ≥11.0 | ≥10.0 | ≥11.0 | | |
| Crown Closure ≥15.0 m ht | ≥20% but variable | ≥20% | ≥1% | ≥15% | | |
| Tree Species | Extensive unsalvaged MPB-killed Py, At present (but not always in VRI) | Py present | Py present | At present, Either Fd and/or Py in this or adjacent polygon | | |
| Pl % composition of Layer 1 or 2 | | ≤30% | ≤50% | ≤30% | | |
| **Adjustments:** | | | | | | |
| Reduce to Low if: | | 600-800 m 1200-1400 m | | | | |
| Reduce one level if: | | Slope >25% | | | | |
| Upgrade from VL to L if veteran Py present or if mature At patches present, and if: | | | In a forested stand ≥88 years old containing Fd or Py but ≤30% Pl | | | |
| | | | In a potentially forested stand <150 m from stands ≥88 years old, and containing Fd and/or Py, but ≤30% Pl | | | |
| | | | In open range within 150 m of forested stands ≥88 years old and containing Fd and/or Py, but ≤30% Pl | | | |
| Reduce one level if: | | Slope >25% and north aspect | | | | |

*Note that there are two columns for Low (4) because Low habitat may be Py-dominated and without any At, or may be based on At presence within or adjacent to coniferous stands.

## Appendix 2. Threats classification and assessment calculator.

**THREATS ASSESSMENT WORKSHEET**

| | | | |
|---|---|---|---|
| **Species or Ecosystem Scientific Name** | Williamson's Sapsucker (*Sphyrapicus thyroideus*) | | |
| **Element ID** | | **Elcode** | |
| | 21 December 2016 | | |
| **Assessor(s):** | Jon McCracken, Marcel Gahbauer, Les Gyug, Guy Morrison, Louise Blight, Leah Ramsay, Darcy Henderson, Kathy Martin, Julien St-Amand, Kristiina Ovaska, Bev McBride, Richard Elliot | | |
| **References:** | Draft COSEWIC status report (November 2016), WISA Recovery Strategy (2014) | | |

**Overall Threat Impact Calculation Help:**

| **Threat Impact** | | **Level 1 Threat Impact Counts** high range | low range |
|---|---|---|---|
| A | Very High | 0 | 0 |
| B | High | 0 | 0 |
| C | Medium | 2 | 1 |
| D | Low | 4 | 5 |
| | **Calculated Overall Threat Impact:** | High | High |

| | |
|---|---|
| **Assigned Overall Threat Impact:** | **B = High** |
| **Impact Adjustment Reasons:** | |
| **Overall Threat Comments** | Assumptions: population estimate is about 960 adults; exact generation time is unknown, but the 3-generation time period is considered to be 10 years; EOO is 69,187 $km^2$; IAO is 1672 $km^2$ (418 grid cells). |

| **Threat** | | **Impact (calculated)** | | **Scope (next 10 Yrs)** | **Severity (10 Yrs or 3 Gen.)** | **Timing** | **Comments** |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | D | Low | Small (1-10%) | Extreme (71-100%) | High (Continuing) | |
| 1.1 | Housing & urban areas | D | Low | Small (1-10%) | Extreme (71-100%) | High (Continuing) | New housing developments are restricted to small areas within the Area of Occupancy (AO), e.g., Anarchist Mountain and a few other sites. The severity scoring is extreme, as all trees are usually felled in developments. |
| 1.2 | Commercial & industrial areas | | Negligible | Negligible (<1%) | Extreme (71-100%) | Moderate (Possibly in the short term, < 10 yrs/3 gen) | AO is mostly outside settled areas, and no examples of industrial development impacts are known. Most such development would be in valley bottoms away from the species' habitat - some activity is possible near Cranbrook. |
| 1.3 | Tourism & recreation areas | | Negligible | Negligible (<1%) | Moderate (11-30%) | High (Continuing) | Scattered recreational lodges on private lands. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 2 | Agriculture & aquaculture | D | Low | Small (1-10%) | Serious (31-70%) | High - Moderate | |
| 2.1 | Annual & perennial non-timber crops | | | | | | |
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | D | Low | Small (1-10%) | Serious (31-70%) | High - Moderate | Large private ranches (e.g., Douglas Lake Ranch) are subjected to continuing land clearing for pastures. Severity is only considered serious, as aspen patches are often left which may provide WISA nest sites. |
| 2.4 | Marine & freshwater aquaculture | | | | | | |
| 3 | Energy production & mining | D | Low | Small (1-10%) | Serious (31-70%) | High (Continuing) | |
| 3.1 | Oil & gas drilling | | | | | | |
| 3.2 | Mining & quarrying | | Negligible | Negligible (<1%) | Extreme (71-100%) | Moderate (Possibly in the short term, < 10 yrs) | Includes gravel pits and quarrying. Scope is likely < 1%, although at least one nest has been lost to quarrying in the past few years (documented). |
| 3.3 | Renewable energy | D | Low | Small (1-10%) | Serious (31-70%) | High (Continuing) | Includes the burning of wood chips for energy ("opportunity wood"), presumed to be linked to salvage logging. A new plant in Merritt will require fuel on a continuing basis. Loss of foraging sites is of concern. |
| 4 | Transportation & service corridors | | Negligible | Negligible (<1%) | Extreme (71-100%) | High (Continuing) | |
| 4.1 | Roads & railroads | | Negligible | Negligible (<1%) | Extreme (71-100%) | High (Continuing) | Road construction has eliminated nest sites in the past and new forestry roads are being constructed. Road clearing eliminates opportunities for nesting and foraging. Note that danger tree removal is considered elsewhere in threat 6.3. |
| 4.2 | Utility & service lines | | Negligible | Negligible (<1%) | Extreme (71-100%) | Moderate (Possibly in the short term, < 10 yrs) | Power-line construction has eliminated some nest sites in recent past. A new approved pipeline will cross the AO, and local transmission lines may be constructed or improved, especially near Cranbrook. |
| 4.3 | Shipping lanes | | | | | | |
| 4.4 | Flight paths | | | | | | |
| 5 | Biological resource use | C | Medium | Restricted (11-30%) | Extreme (71-100%) | High (Continuing) | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 5.1 | Hunting & collecting terrestrial animals | | | | | | |
| 5.2 | Gathering terrestrial plants | | | | | | |
| 5.3 | Logging & wood harvesting | C | Medium | Restricted (11-30%) | Extreme (71-100%) | High (Continuing) | This threat includes compounded effects of new logging, salvage logging, and firewood cutting. New logging is expected to affect ~1% (perhaps slightly less) of AO/year over the next 10 years. Salvage logging (e.g., harvesting pine-beetle affected stands and trees left after fires) increases the scope above 11%, but it is towards lower end of Restricted range. Impacts include loss of foraging and nesting habitat and direct threats to nestlings if logging is conducted during nesting season. |
| 5.4 | Fishing & harvesting aquatic resources | | | | | | |
| 6 | Human intrusions & disturbance | D | Low | Small (1-10%) | Serious (31-70%) | High (Continuing) | |
| 6.1 | Recreational activities | | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | Considerable low-impact recreational activity takes place within the AO, especially during fall hunting season. However, nesting birds are not vulnerable to this disturbance during fall, and effects on habitat are minimal. |
| 6.2 | War, civil unrest & military exercises | | | | | | |
| 6.3 | Work & other activities | D | Low | Small (1-10%) | Serious (31-70%) | High (Continuing) | Identification and removal of dangerous trees in work areas may lead to felling of scarce suitable nest trees. B.C. regulations require removal of potentially dangerous trees within 1.5 tree lengths of each work site, including road work, logging, and transmission lines. Threat posed by species research is negligible in scope and severity (20 birds studied recently). |
| 7 | Natural system modifications | CD | Medium - Low | Large (31-70%) | Moderate - Slight (1-30%) | High (Continuing) | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 7.1 | Fire & fire suppression | CD | Medium - Low | Large (31-70%) | Moderate - Slight (1-30%) | High (Continuing) | Includes both direct effects of fires and fire suppression. WISA readily occupies edges of burned areas - several US papers show that densities along edges may actually increase. There is thus uncertainty about net impact of fires, hence the range in severity score. Fire suppression leads to infilling by Douglas-fir, which may result in hotter stand-replacing fires that kill trees, rather than leave veteran trees suitable for nesting. Older nest trees left following fire or logging may be crowded by young Douglas-fir, which reduces survival through competition for water and nutrients. Stand-replacing fires are becoming more common with fire suppression, leading to long-term habitat loss. |
| 7.2 | Dams & water management/use | | | | | | |
| 7.3 | Other ecosystem modifications | | | | | | Ecosystem restoration; small prescribed burns considered here are not a threat to this species, but may be beneficial. |
| 8 | Invasive & other problematic species & genes | | | | | | |
| 8.1 | Invasive non-native/alien species/diseases | | | | | | |
| 8.2 | Problematic native species/diseases | | | | | | |
| 8.3 | Introduced genetic material | | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | | Although West Nile Virus has caused mortality of other woodpecker species in the US (Washington), the threat presented to WISA is likely negligible. |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | | | | | | |
| 9.1 | Domestic & urban waste water | | | | | | |
| 9.2 | Industrial & military effluents | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 9.3 | Agricultural & forestry effluents | | | | | | Monosodium Methanearsonate (MSMA) has been applied directly into trees in the past to control Mountain Pine-beetle, but its use is not anticipated in the future. It is unlikely to affect ant prey, but could possibly contaminate tree sap. |
| 9.4 | Garbage & solid waste | | | | | | |
| 9.5 | Air-borne pollutants | | | | | | |
| 9.6 | Excess energy | | | | | | |
| 10 | Geological events | | | | | | |
| 10 | Volcanoes | | | | | | |
| 10 | Earthquakes/tsunamis | | | | | | |
| 10 | Avalanches/landslides | | | | | | |
| 11 | Climate change & severe weather | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 11 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Possibly over the long term |
| 11 | Droughts | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Increasing probability of droughts may increase wildfire threat to stand-replacing fires (accounted for in threat 7.1) and affect food supply. |
| 11 | Temperature extremes | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Possibly a concern over the long term, which could influence sap production and foraging but no data are available. Birds have been documented to be arriving earlier than ~20 years ago, but population effects of this are unknown. Effects may be either positive or negative (e.g., if food supply is affected) |
| 11 | Storms & flooding | | Negligible | Negligible (<1%) | Negligible (<1%) | | |
| 12 | Other impacts | | Negligible | Negligible (<1%) | Negligible (<1%) | | |

Classification of Threats adopted from IUCN-CMP, Salafsky *et al*. 2008).