

PROPOSED

Species at Risk Act
Management Plan Series
Adopted under Section 69 of SARA

Management Plan for the Flammulated Owl (*Otus flammeolus*) in Canada

Flammulated Owl



2012

Canada

Recommended citation:

Environment Canada. 2012. Management Plan for the Flammulated Owl (*Otus flammeolus*) in Canada [Proposed]. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. 6 pp. + Appendix.

For copies of the management plan, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

Cover illustration: © Jared Hobbs

Également disponible en français sous le titre
« Plan de gestion du Petit-duc nain (*Otus flammeolus*) au Canada [Proposition] »

© Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, 2012. All rights reserved.

ISBN

Catalogue no.

Content (excluding the illustrations) may be used without permission, with appropriate credit to the source.

MANAGEMENT PLAN FOR THE FLAMMULATED OWL (*Otus flammeolus*) IN CANADA

2012

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the “Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia” (Part 2) under section 69 of the *Species at Risk Act*. Environment Canada has included an addition which completes the SARA requirements for this management plan.

The federal management plan for the Flammulated Owl in Canada consists of two parts:

Part 1: Federal Addition to the “Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia”, prepared by Environment Canada.

Part 2: “Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia”, prepared by the Provincial Flammulated Owl Working Group for the B.C. Ministry of Environment.

TABLE OF CONTENTS

PART 1: Federal Addition to the “Management Plan for the Flammulated Owl (<i>Otus flammeolus</i>) in British Columbia”, prepared by Environment Canada	1
PREFACE	2
ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT	3
1. Species Status Information	3
2. Management Goal and Objectives	3
3. Measuring Progress	4
4. Effects on the Environment and Other Species.....	5
REFERENCES	5
PART 2: Management Plan for the Flammulated Owl (<i>Otus flammeolus</i>) in British Columbia, prepared by the Provincial Flammulated Owl Working Group	6

PART 1: Federal Addition to the “Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia”, prepared by Environment Canada

PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA) the federal competent ministers are responsible for the preparation of management plans for listed Special Concern species and are required to report on progress within five years.

SARA section 65 requires the competent Minister, which is the federal Minister of the Environment in this case, to prepare a management plan for all listed special concern species. SARA section 69 allows the Minister to adopt all or part of an existing plan for the species if the Minister is of the opinion that an existing plan relating to a wildlife species includes adequate measures for the conservation of the species.

The attached provincial management plan (Part 2 of this document) for the species was provided as science advice to the jurisdictions responsible for managing the species in British Columbia. Environment Canada has prepared this federal addition to meet the requirements of SARA.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this management plan and will not be achieved by Environment Canada or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Flammulated Owl and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT

The following sections have been included to address specific requirements of SARA that are either not addressed in the “Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia” (see Part 2 of this document, referred to hereafter as the “provincial document”) or need to be highlighted.

1. Species Status Information

Legal Designation: SARA Schedule 1 (Special Concern) (2003)¹

Table 1. Conservation Status (from NatureServe 2011, B.C. Conservation Data Centre 2011, and B.C. Conservation Framework 2011):

Global (G) Rank	National (N) Rank(s)	Sub-national (S) Rank(s)	COSEWIC Status	B.C. List	B.C. Conservation Framework**
G4*	Canada: N3N4B United States: N4B	Canada: British Columbia (S3S4B) United States: Arizona (S4), California (SNR), Colorado (S4), Idaho (S3B), Montana (S3B), Navajo Nation (S4B), Nevada (S4B), New Mexico (S3B,S3N), Oregon (S3B), South Dakota (S1B), Texas (S3B), Utah (S3S4B), Washington (S3B), Wyoming (S1?)	Special Concern (2010)	Blue	Highest priority: Priority 2 under Goal 2

* Rank 1– critically imperiled; 2– imperiled; 3– vulnerable to extirpation or extinction; 4– apparently secure; 5– secure; H– possibly extirpated; SNR – status not ranked; B – breeding; N – non-breeding.

** The three goals of the B.C. Conservation Framework are: 1. Contribute to global efforts for species and ecosystem conservation; 2. Prevent species and ecosystems from becoming at risk; 3. Maintain the diversity of native species and ecosystems. Priority 1 is highest.

It is estimated that the percent of the global range of this species in Canada is 10%.

2. Management Goal and Objectives

Environment Canada supports and adopts the provincial management goals and objectives for the Flammulated Owl. The goals and objectives outlined in section 5 of the provincial document are provided here for reference, as follows:

Goal: To maintain stable or increasing populations of the Flammulated Owl distributed throughout the species’ present range in British Columbia.

¹ Note that the provincial management plan mistakenly identified 2005 as the year this species was listed under SARA.

Rationale: Quantifying population and habitat targets is not feasible at this time due to lack of baseline information. The Flammulated Owl occurs through much of the Interior Douglas-fir and higher elevation Ponderosa Pine zones in B.C. Provided that knowledge gaps are addressed and threats are reduced, the current distribution and numbers are likely sufficient to maintain viability.

Objectives:

1. Identify population, habitat and distribution targets required to maintain viable populations.
2. Initiate protection² and/or management of priority breeding habitat for Flammulated Owl distributed throughout its range in B.C.
3. Investigate knowledge gaps related to cumulative impacts of medium impact threats and extreme severity or unknown threats: problematic native species (e.g., pine beetles), fire and fire suppression, and logging and wood harvest.
4. Investigate knowledge gaps related to management: Natural Disturbance Type fire management, Ungulate Winter Range management, range management, and firewood cutting.
5. Establish and implement a monitoring program for Flammulated Owl habitats and populations.

3. Measuring Progress

As per SARA section 72, the Minister of Environment for Canada must place a report regarding the status of implementation of the management plan on the Species at Risk Public Registry every five years, until the objectives of the management plan have been met. The Minister will use the performance indicators outlined in section 7 of the provincial document, and provided here for reference, as a basis for this report.

Performance Measures relating to Objectives 1 through 5:

1: Population, habitat, and distribution targets have been identified by 2016.

2: Protection and/or management activities were initiated at priority nesting habitats throughout its range, by 2016³.

3 and 4: Investigation into the following knowledge gaps was initiated by 2016: problematic native species (e.g., pine beetles), *Btk* spraying, fire and fire suppression, logging and wood harvest, and climate change.

² "Protection" can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, land use designations, and protected areas. "Protection" in this document should not be confused with the legal protection afforded to the critical habitat of threatened and endangered species.

³ Protection and/or management activities will be an ongoing activity and will not be completed by 2016.

5: A monitoring program to detect trends in owl numbers was established and implemented by 2016⁴.

4. Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

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

Negative impacts to other species are not anticipated. Habitat protection and management that promote conservation of older trees and snags will benefit many other species.

REFERENCES

- B.C. Conservation Data Centre. 2011. BC Species and Ecosystems Explorer. B.C. Ministry of Environment Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed November 2, 2011).
- B.C. Conservation Framework. 2011. Conservation Framework Summary: *Otus flammeolus*. B.C. Ministry of Environment. Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed November 2, 2011).
- NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (accessed November 2, 2011)
- Provincial Flammulated Owl Working Group. 2011. Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 19 pp.

⁴There may not be sufficient data to determine trends by 2016.

PART 2: Management Plan for the Flammulated Owl
(*Otus flammeolus*) in British Columbia, prepared by the Provincial
Flammulated Owl Working Group

Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia



Prepared by the Provincial Flammulated Owl Working Group



Ministry of
Environment

December 2011

About the British Columbia Management Plan Series

This series presents the management plans that are prepared as advice to the Province of British Columbia. Management Plans are prepared in accordance with the priorities and management actions assigned under the British Columbia Conservation Framework. The Province prepares management plans for species that may be at risk of becoming endangered or threatened due to sensitivity to human activities or natural events.

What is a management plan?

A management plan identifies a set of coordinated conservation activities and land use measures needed to ensure, at a minimum, that target species' do not become threatened or endangered. A management plan summarizes the best available science based information on biology and threats to inform development of a management framework. Management plans set goals and objectives, and recommend approaches appropriate for species or ecosystem conservation.

What's next?

Direction set in the management plan provides valuable information on threats to the species and their conservation needs that may be used by individuals, communities, land users, conservationists, academics, and governments interested in implementing species conservation.

For more Information

To learn more about species at risk recovery planning in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

To learn more about the British Columbia Conservation Framework, please visit the Ministry of Environment Conservation Framework webpage at:

< <http://www.env.gov.bc.ca/conservationframework/>>

**Management Plan for the Flammulated Owl
(*Otus flammeolus*) in British Columbia**

Prepared by Provincial Flammulated Owl Working Group

December 2011

Recommended citation

Provincial Flammulated Owl Working Group. 2011. Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 19 pp.

Cover illustration/photograph

The Flammulated Owl cover photograph was donated by Jared Hobbs.

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

Publication information

Library and Archives Canada Cataloguing in Publication

Provincial Flammulated Owl Working Group (British Columbia)
Management plan for the Flammulated owl (*Otus flammeolus*) in British Columbia [electronic resource]

(British Columbia Management Plan Series)

Includes bibliographical references.

ISBN 978-0-7726-6545-4

1. Flammulated owl--Conservation--British Columbia. 2. Endangered species--British Columbia. 3. Rare birds--British Columbia. I. British Columbia. Ministry of Environment II. Title. III. Title: Flammulated owl (*Otus flammeolus*) in British Columbia. IV. Series: British Columbia management plan series

QL696 S83 P7 2011

333.95'897097123

C2012-980008-2

Disclaimer

This management plan has been prepared by the Provincial Flammulated Owl Working Group as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent Flammulated Owl populations in British Columbia from becoming endangered or threatened. Management actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the Flammulated Owl Working Group have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the working group.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this management plan. The Ministry of Environment encourages all British Columbians to participate in the conservation of Flammulated Owls.

PROVINCIAL FLAMMULATED OWL WORKING GROUP MEMBERS

Ted Antifeau, MFLNRO¹ Wildlife Biologist, Nelson, BC
Myke Chutter, MFLNRO Bird Specialist, Victoria, BC
Orville Dyer, MFLNRO Wildlife Biologist, Penticton, BC
Jared Hobbs, MFLNRO Ecosystems Specialist, Victoria, BC
Julie Steciw, MFLNRO Wildlife Biologist, Williams Lake, BC
John Surgenor, MFLNRO Wildlife Biologist, Kamloops, BC

RESPONSIBLE JURISDICTIONS

The British Columbia Ministry of Environment is responsible for the management of Flammulated Owls in British Columbia.

ACKNOWLEDGEMENTS

This management plan was prepared by Myke Chutter and Orville Dyer. It is based on an earlier draft prepared by Manning, Cooper and Associates (2005) that was authored by John M. Cooper, E. Todd Manning, Aaron Deans, and Richard Howie. Funding for this draft was provided by the B.C. Ministry of Environment through the Habitat Conservation Trust Foundation. The Flammulated Owl Working Group developed the threats table, provided additional comments, and reviewed the draft. Jeff Brown and Leah Westereng reformatted this document and provided comments. Jared Hobbs donated the cover photo. We thank Jeffrey Hutchings, Chair of COSEWIC (Committee on the Status of Endangered Wildlife in Canada) for permission to incorporate new information from the interim COSEWIC status report for Flammulated Owl (COSEWIC 2009) prepared by Richard Cannings. We also thank Richard Cannings for providing the global range map. This document follows the B.C. guidance for recovery planning (Ministry of Environment 2010a).

¹ MFLNRO = Ministry of Forests, Lands and Natural Resource Operations

EXECUTIVE SUMMARY

Flammulated Owl (*Otus flammeolus*) is designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of Special Concern in Canada and is on Schedule 1 of Canada's *Species at Risk Act*. Provincially, it is on the Blue list and is a priority 2 under goal 2 (Prevent species and ecosystems from becoming at risk) of British Columbia's Conservation Framework. It is protected from capture and killing, under the *BC Wildlife Act*. It is also listed as a Species At Risk under the *Forest and Range Practices Act*, which enables habitat management tools as per the Identified Wildlife Management Strategy.

The Flammulated Owl is a small (45–63 g) forest owl that stands about 15–17 cm tall. It has grey, dark brown, or reddish brown feathers in a variegated, cryptic pattern. The scapular feathers are tipped with orange, the eyes are dark, and there are small “ear tufts” at the sides of the head. It nests in south-central and southeastern British Columbia in mature and old-growth ponderosa pine and Douglas-fir forests with snags that contain woodpecker cavities for nests and roosts; uses open forest or forest openings with shrubs and grass for feeding; and stands of thick, regenerating forest for cover.

Key threats include problematic native species (e.g., pine beetles), fire and fire suppression, climate change, and logging and wood harvest. Knowledge gaps include impacts from management approaches including Natural Disturbance Type forest management, Ungulate Winter Range management, *Btk* spraying for forest invertebrate pests, and logging activities after pine beetle.

The management goal is to maintain stable or increasing populations of the Flammulated Owl distributed throughout the species' present range in British Columbia.

Management objectives include:

1. Identify population, habitat and distribution targets required to maintain viable populations.
2. Initiate protection² and/or management of priority breeding habitat for Flammulated Owl distributed throughout its range in B.C.
3. Investigate knowledge gaps related to cumulative impacts of medium impact threats and extreme severity or unknown threats: problematic native species (e.g., pine beetles), fire and fire suppression, and logging and wood harvest.
4. Investigate knowledge gaps related to management: Natural Disturbance Type fire management, Ungulate Winter Range management, range management, and firewood cutting.
5. Establish and implement a monitoring program for Flammulated Owl habitats and populations.

² Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, land use designations, and protected areas.

TABLE OF CONTENTS

PROVINCIAL FLAMMULATED OWL WORKING GROUP MEMBERS	iii
RESPONSIBLE JURISDICTIONS	iii
ACKNOWLEDGEMENTS	iii
EXECUTIVE SUMMARY	iv
1 COSEWIC* SPECIES ASSESSMENT INFORMATION	1
2 SPECIES STATUS INFORMATION	1
3 SPECIES INFORMATION	2
3.1 Description of the Species	2
3.2 Populations and Distribution	2
3.3 Needs of the Flammulated Owl	4
3.3.1 Habitat and Biological Needs	4
3.3.2 Ecological Role	6
3.3.3 Limiting Factors	6
4 THREATS	7
4.1 Threat Assessment	7
4.2 Description of the Threats	8
5 MANAGEMENT GOAL AND OBJECTIVES	11
5.1 Management Goal	11
5.2 Rationale for the Management Goal	11
5.3 Management Objectives	11
6 APPROACHES TO MEET OBJECTIVES	11
6.1 Actions Already Completed or Underway	11
6.2 Recommended Management Actions	12
6.3 Narrative to Support Management Actions Table	13
6.3.1 Habitat Protection	13
6.3.2 Monitor Trends	14
6.3.3 Land Stewardship	14
6.3.4 Habitat Restoration	14
7 MEASURING PROGRESS	14
8 EFFECTS ON OTHER SPECIES	15
9 REFERENCES	16

LIST OF TABLES

Table 1. Threat classification table for the Flammulated Owl in British Columbia	7
Table 2. Recommended management actions and implementation schedule for the Flammulated Owl in British Columbia	12

LIST OF FIGURES

Figure 1. Global distribution of Flammulated Owl. (COSEWIC 2009, adapted from McCallum 2004a)	3
Figure 2. Distribution of Flammulated Owl in British Columbia (B.C. Ministry of Water, Land and Air Protection 2004).	4

1 COSEWIC* SPECIES ASSESSMENT INFORMATION

<p>Date of Assessment: April 2010 Common Name (population): Flammulated Owl Scientific Name: <i>Otus flammeolus</i> COSEWIC Status: Special Concern Reason for Designation: In Canada, this small owl is restricted to older Douglas-fir and ponderosa pine forests of the southern Interior of British Columbia. The species requires mature coniferous forests with a mosaic of large-diameter, old trees, clumps of dense regenerating younger trees and small patches of shrubby grassland for breeding. The extent and quality of this habitat was significantly reduced through the early to mid-1900s by forest harvest. Ongoing threats include forestry practices that remove large trees and snags, epidemics of insect pests such as the mountain pine beetle and catastrophic fires combined with the species' small population, limited distribution, small clutch size and delayed breeding of males. COSEWIC Status History: Designated Special Concern in April 1988. Status re-examined and confirmed Special Concern in April 1999, November 2001, and April 2010.</p>

2 SPECIES STATUS INFORMATION

Flammulated Owl^a	
Legal Designation	
Identified Wildlife: ^b Yes <i>B.C. Wildlife Act</i> : ^c Schedule A <i>SARA Schedule</i> : 1 (2005)	
<u>Conservation Status</u> ^d	
B.C. List: Blue B.C. Rank: S3S4B (2005) National Rank: N3B (2000) Global Rank: G4 (2000)	
<u>Subnational Ranks</u> : ^e Arizona (S4), California (SNR), Colorado (S4), Idaho (S3B), Montana (S3B), Navajo Nation (S4B), Nevada (S4B), New Mexico (S3B,S3N), Oregon (S3B), South Dakota (S1B), Texas (S3B), Utah (S3S4B), Washington (S3B), Wyoming (S1?)	
<u>B.C. Conservation Framework</u> ^f	
Goal 1: Contribute to global efforts for species and ecosystem conservation	Priority: ^g 5 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk	Priority: 2 (2009)
Goal 3: Maintain the diversity of native species and ecosystems	Priority: 3 (2009)
<u>Action Groups</u> :	Monitor Trends; Compile Status Report; Planning; Send to COSEWIC; Habitat Protection; Habitat Restoration; Private Land Stewardship

^a Data source: B.C. Conservation Data Centre (2010) unless otherwise noted.

^b Identified Wildlife under the *Forest and Range Practices Act*.

^c Schedule A = Designated as wildlife under the *B.C. Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).

^d S = subnational; N = national; G = global; B = breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = unranked; U = unrankable. U.S. data from NatureServe (2009).

^e Data source: NatureServe (2009).

^f Data source: Ministry of Environment (2010a).

^g Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Description of the Species

The Flammulated Owl is a small (45–63 g) forest owl that stands about 15–17 cm tall. It has grey, dark brown or reddish brown feathers in a variegated, cryptic pattern (see cover photo). The scapular feathers are tipped with orange, the eyes are dark, and there are small “ear tufts” at the sides of the head (COSEWIC 2009). Identification of the Flammulated Owl is done more often by sound; the one- or two-note, low-pitched hoot is a distinctive “boop” or “booboop.” This owl is seldom seen unless specifically searched for.

3.2 Populations and Distribution

The Flammulated Owl occurs in south-central British Columbia (B.C.), north-central Washington, Idaho, western Montana, eastern Oregon, and portions of central California, Nevada, northern Colorado, Utah, central Arizona, and to southern Mexico (McCallum 1994a; Figure 1). All populations winter in Central America and El Salvador (McCallum 1994a; COSEWIC 2009). Partners-in-Flight estimates a global population of 37,000, of which 29,000 are thought to occur in the United States and Canada. However, this estimate is considered to have very low accuracy and is termed a “guesstimate” by the authors (Rich *et al.* 2004). Trends are not available but numbers are thought to be declining (COSEWIC 2009).

Canadian occurrences are restricted to mature or old, dry Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) forest zones of south-central and southeastern B.C. from May to October (Campbell *et al.* 1990; van Woudenberg 1999; COSEWIC 2009; Figure 2). The Flammulated Owl occurs from the Okanagan and Similkameen valleys north through the Nicola and Thompson valleys and the drier parts of the Fraser-Chilcotin valleys to Alexis Creek in the west and McLeese Lake in the north, and in the east Kootenay Trench from the U.S. border north to Radium (Roberts and Roberts 1995; Waterhouse 1996; van Woudenberg 1999; Cannings and van Woudenberg 2004). Recent (2004) observations near Carpenter Lake and Seton Lake extend the potential range of this owl further southwest (Hausleitner and Young 2005). An observation in May 2008 along Kootenay Lake, near Creston (M. Beaucher, pers. comm., 2008), confirmed occupancy in the West Kootenay area, between the East Kootenay and Okanagan-Boundary areas.

The B.C. breeding population is estimated at 1200 to 2000 birds (600–1000 pairs) (COSEWIC 2009), less than 10% of the global population. Most of the Canadian population is thought to occur in the Thompson and Fraser drainages, based on habitat distribution and current records, although records have not been adjusted for inventory effort. Population trends are not known. The number of known locations has increased due to increased inventory efforts, but population trends may be decreasing due to habitat alteration (COSEWIC 2009).

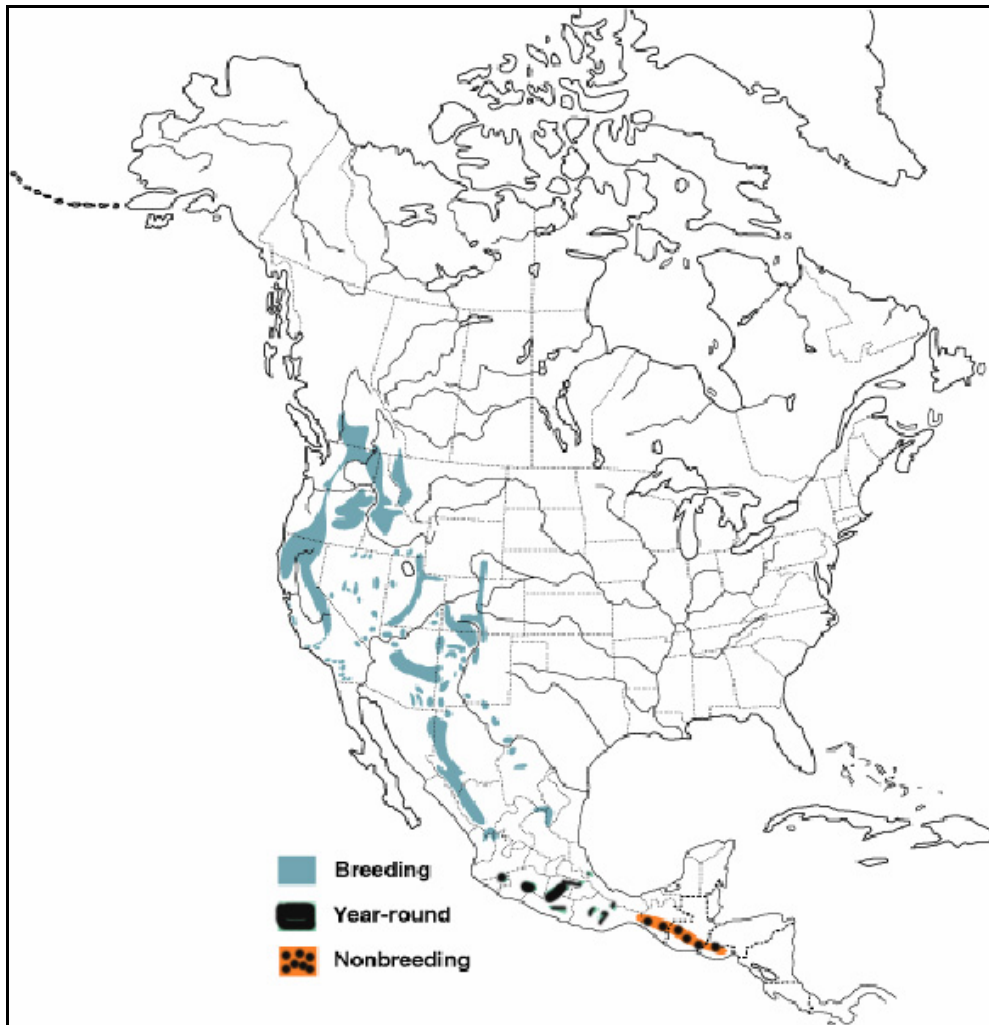


Figure 1. Global distribution of Flammulated Owl. (COSEWIC 2009, adapted from McCallum 2004a)

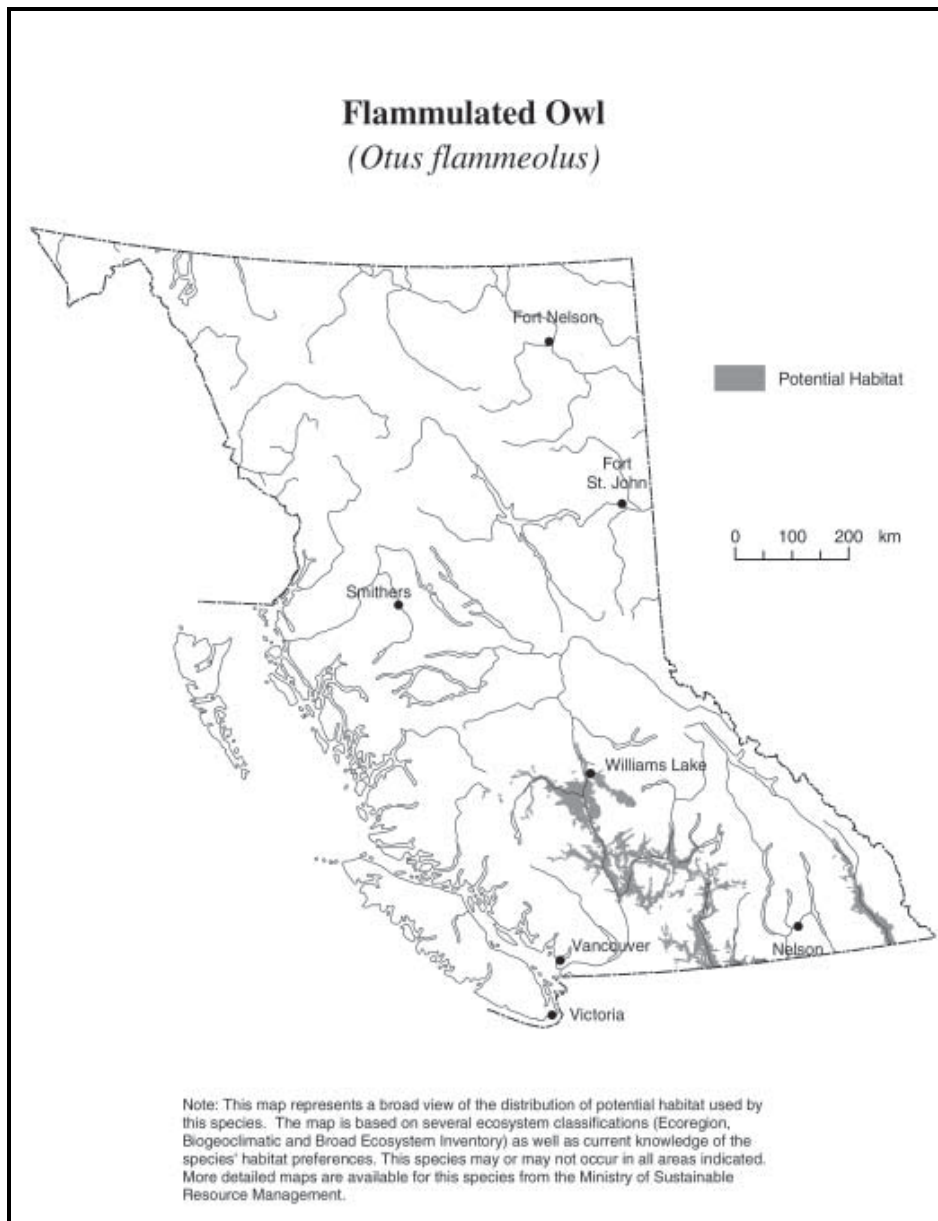


Figure 2. Distribution of Flammulated Owl in British Columbia (B.C. Ministry of Water, Land and Air Protection 2004).

3.3 Needs of the Flammulated Owl

3.3.1 Habitat and Biological Needs

In B.C., the Flammulated Owl depends on mature and old-growth, multi-canopied Douglas-fir–leading forests, often with a ponderosa pine component. Flammulated Owl requires wildlife trees for nesting, a low to moderate canopy closure, thickets of younger Douglas-fir for security cover, and open forest or patches with shrub understory for foraging (COSEWIC 2009). They breed from 400 to 1375 m in elevation (van Woudenberg *et al.* 1999) mainly in NDT4 (Natural Disturbance Type 4) ecosystems with frequent stand-maintaining fires (Province of British

Columbia 1995). Most records are in drier Interior Douglas-fir (IDF) biogeoclimatic subzones and, secondarily, in the Ponderosa Pine (PP) zone. They also use the Bunchgrass (BG) zone, mainly in the Cariboo region, and occasionally have been reported in the drier Interior Cedar–Hemlock (ICH) and Montane Spruce (MS).

In the United States, home range is estimated to be 5–20 ha (e.g., Yasuda 2001) and appears highly variable depending on the quality of habitat (McCallum 1994a). Average home-range size was recorded as 10 ha in Oregon (Goggins 1986); 11.1 ha (Linkhart *et al.* 1998) and 14.1 ha in Colorado (Reynolds and Linkhart 1987b); and as large as 15.9 ha elsewhere in the United States (McCallum 1994a). In the Kamloops Forest District in B.C., smaller home ranges (2.2–3.7 ha) estimated by van Woudenberg (1992) have been cited in other reports; however, this work was based on small sample sizes and the author herself cautions that this “likely represents only part of the full home ranges the birds used.” It is recommended that van Woudenberg’s (1992) smaller areas should not be used as valid home range estimates for B.C. Until more robust estimates have been calculated here, we should use those recorded in the United States. Most foraging is known to occur within intensive foraging areas of about 1 ha, often overlapping the nest tree (McCallum 1994b).

Ponderosa pine trees are most often used as nest trees, but Douglas-fir are used readily when pines are absent (Bull and Anderson 1978; Reynolds and Linkhart 1984, 1987a, 1987b; McCallum and Gehlback 1988; van Woudenberg 1999; Cannings and van Woudenberg 2004; Manley *et al.* 2004). Occasionally, trembling aspen (Campbell *et al.* 1990) and western larch (T. Antifeau, pers. comm., 2004) are used. Nest trees are generally dead (COSEWIC 2009) and tend to be large in diameter (50–80 cm diameter at breast height (dbh)), but trees as small as 35 cm dbh are also used. Flammulated Owls depend on Pileated Woodpecker (*Dryocopus pileatus*) and Northern Flicker (*Colaptes auratus*) cavities for nesting and roosting (McCallum 1994a). Nest success is higher in territories with older forest and areas with large, contiguous stands of old forest are more likely to be occupied (COSEWIC 2009). Clutch sizes range from 2 to 4 eggs, and one brood is produced annually. Males provide food to females in the nest, and females do all incubating and most brooding (McCallum 1994a). B.C. data are very limited but mean clutch size is 2.4 eggs (R.J. Cannings, unpublished data). Fledging occurs from mid-July through late August (van Woudenberg 1999).

Canopy cover at nest sites is generally low to moderate, reflecting a preference for the more open forests often associated with old growth under historic fire regimes. In the Kamloops Forest District, crown closure of 40–50% was used as a good predictor for this species (Christie and van Woudenberg 1997) and Manley (2005) found 15–28% canopy closures in the East Kootenay.

Younger, denser thickets of Douglas-fir and older Douglas-fir trees are used for cover and roosting (COSEWIC 2009).

Flammulated Owl feeds almost exclusively on arthropods and abundant insect prey is critical for breeding success. It may also occasionally eat vertebrates (Cannings 1994). Main insect prey include Lepidoptera (e.g., noctuid moths), Orthoptera (e.g., crickets), and Coleoptera (e.g., beetles) (Goggins 1986; McCallum 1994a). Most foraging occurs in open forest or forest openings, but canopy foraging for caterpillars occurs during outbreaks.

3.3.2 Ecological Role

The Flammulated Owl is a migratory, insectivorous cavity-nester that has ecological relationships with many other species during its breeding, migration, and wintering periods.

As a secondary cavity-nester, the Flammulated Owl is dependent on larger woodpeckers such as Northern Flickers and Pileated Woodpeckers to excavate its nest chamber (McCallum 1994a). Dependence on these cavities brings it into competition with other cavity-nesting birds and mammals. Cannings and Cannings (1982) identify Red Squirrels (*Tamiasciurus hudsonicus*) and Northern Flying Squirrels (*Glaucomys sabrinus*) as serious competitors for nest cavities; these squirrels may sometimes kill incubating owls to usurp the nest site.

The Flammulated Owl primarily preys on invertebrates such as moths, beetles, grasshoppers, crickets, myriapods (centipedes and millipedes), and spiders (McCallum 1994a). They will at least occasionally eat small vertebrates such as shrews (Cannings 1994). The Flammulated Owl may compete with nocturnal insectivores (e.g., bats; McCallum 1994a), especially in the early breeding season (April and May) when moths dominate the diet of the owls.

The species may also be prey, particularly for larger raptors. Barred Owl (*Strix varia*), Great Horned Owl (*Bubo virginianus*), and several accipiter species have shown some predatory risk, especially for fledglings (McCallum 1994a).

3.3.3 Limiting Factors

Limiting factors are biologically intrinsic/evolved characteristics of a species' life history or ecology that may influence its potential for recovery.

McCallum (1994a) suggests that the Flammulated Owl's low reproductive rate may limit its ability to recover from low population levels. The clutch size of the Flammulated Owl is small, about 2–4 young per pair (McCallum 1994a), so populations are dependent on birds living a long time. The balance may be precarious and could be upset by factors (i.e., threats – see section 4) such as pesticide impacts on invertebrate prey, habitat changes, nutritional losses, or seasonal climate extremes (e.g., spring snowstorms; Ligon 1968) that could alter fecundity.

Competition may limit nest site availability and nocturnal insect foraging potential. As Flammulated Owls arrive relatively late on the breeding grounds, other cavity-nesters are thought to limit nest site availability (McCallum 1994a); however, this is likely only if there are few cavities. Squirrels, other owls, and cavity-nesting birds from the size of bluebirds and up are potential nest competitors. However, Flammulated Owl nests containing bluebird and flicker eggs suggest that Flammulated Owls evict some nest competitors (McCallum 1994a). Competition with bats, and possibly other nocturnal insectivores, such as Common Poorwills (*Phalaenoptilus nuttalli*), for food is likely but has not been studied (McCallum 1994a).

As a long distant migrant, the Flammulated Owl must travel through sometimes unfamiliar (especially for juveniles) or changed habitats, potentially increasing the risk of mortality. In addition, there may be unknown limiting factors operating in their winter ranges.

4 THREATS

Threats are defined as the proximate (human) activities or processes that have caused, are causing, or may cause the destruction, degradation, and/or impairment of biodiversity and natural processes. Threats can be past (historical), ongoing, and/or likely to occur in the future. Threats do not include intrinsic biological features of the species or population such as inbreeding depression, small population size, and genetic isolation, which are considered limiting factors.

4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system see the [CMP website](#) (CMP 2010). For information on how the values are assigned see [Master et al.](#) (2009) and table footnotes for details. Threats for the Flammulated Owl were assessed for the entire province (Table 1) and are further described in 4.2.

Table 1. Threat classification table for the Flammulated Owl in British Columbia.

Threat number	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d
1	Residential & commercial development	Low	Small	Extreme	High
1.1	Housing & urban areas	Low	Small	Extreme	High
2	Agriculture & aquaculture	Low	Large	Slight	High
2.3	Livestock farming & ranching	Low	Large	Slight	High
3	Energy production & mining	Low	Small	Extreme	Moderate
3.3	Renewable energy	Low	Small	Extreme	Moderate
5	Biological resource use	Low	Small	Extreme	High
5.3	Logging & wood harvesting	Low	Small	Extreme	High
6	Human intrusions & disturbance	Unknown	Small	Unknown	High
6.3	Work & other activities	Unknown	Small	Unknown	High
7	Natural system modifications	Low	Small	Extreme	High
7.1	Fire & fire suppression	Low	Small	Extreme	High
7.3	Other ecosystem modifications	Unknown	Restricted-Small	Unknown	High
8	Invasive & other problematic species & genes	Medium	Large	Moderate	High
8.2	Problematic native species	Medium	Large	Moderate	High
11	Climate change & severe weather	Unknown	Unknown	Unknown	High
11.1	Habitat shifting & alteration	Unknown	Unknown	Unknown	High

^a **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each stress is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each

combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown).

^b **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%)

^c **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%)

^d **Timing** – High = continuing; Moderate = only in the future (could happen in the short term: less than 10 years or 3 generations) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of the Threats

The overall province-wide Threat Impact for this species is High³. Problematic native species are the greatest current threat. Logging and wood harvest, fire and fire suppression, and habitat shifting and alteration currently appear to be low threats. However, there is substantial uncertainty regarding these impacts, now and for the future. They require additional investigation. Details for each threat are described below.

IUCN #1.1 Housing and urban areas

Urban expansion is undoubtedly removing a small portion of Flammulated Owl habitat, but this is not considered a significant short-term threat for the species. Threats will be addressed on a site-specific basis, as needed.

IUCN #2.3 Livestock farming and ranching

Ranching is common in the grasslands along the edges of Flammulated Owl habitat. Cattle are allowed to range freely into the owl's habitat, especially during the summer when the birds are breeding, which could result in occasional disturbance. Cattle grazing could have an impact on the owl's habitat by removing or altering the understory vegetation, potentially impacting invertebrate prey abundance. Historically, and to a lesser extent into the future, some suitable owl habitat can be lost to conversion of forested areas to grassland for grazing. It is unclear what impact cattle presence and grazing have on the abundance and availability of cover or insect prey but it is currently thought to be a low population impact.

IUCN #3.3 Renewable energy

The increased interest in wind farming in B.C. raises the possibility that some suitable habitat may be lost in the future if wind farms are developed in Flammulated Owl habitat. Concerns include habitat loss to access road/right-of-way construction as well as clearing at the site itself. It is currently thought to have a low impact, but is a developing issue that may increase in concern and require additional information and monitoring.

³ The overall threat impact was calculated following Master et al. (2009) using only the number of Level 1 Threats assigned to this species where Timing = High. This includes 1 Medium, 4 Low, and 2 Unknown threats (Table 1). The overall threat considers the cumulative impacts of multiple threats. A High overall threat is recommended as a starting point for 1 Medium and 4 Low threats.

IUCN #5.3 Logging and wood harvest

Flammulated Owl habitat in B.C. has been significantly impacted due to past forest practices. Old-growth ponderosa pine and Douglas-fir, needed for nesting, were selectively harvested and snags were removed for safety throughout a substantial portion of available habitat (COSEWIC 2009). Logging has been continuous but harvest rates have decreased in recent decades and, as a result, harvesting is currently considered to be a low impact threat. However, harvest rates can change quickly dependent on market pressures, so this could change in the future. Additionally, the impacts of logging activities including Natural Disturbance Type (Ministry of Forests 1995) restoration and management, Ungulate Winter Range management, elimination of snags for safety during harvesting, firewood cutting, and post-pine-beetle harvesting in relation to past and current harvesting and future fire and climate change scenarios are unclear. Activity and noise related to forestry operations, road-building or other resource-related operations may lead to nest failure if the noise is of sufficient intensity at or near nests; however, thresholds of intensity, duration, and proximity are unknown. These knowledge gaps require additional investigation.

IUCN #6.3 Work and other activities

Disturbance of birds caused by human activity is not a common threat to Flammulated Owls and is considered a low impact threat. Van Woudenberg (1999) documented that prolonged observations at nests by researchers reduced feeding rates initially until birds became habituated, or may have caused females to leave nests more frequently than usual; both of these factors may increase risk of mortality. Nest abandonment may occur if disturbance is prolonged and continuous, or disturbance occurs during the incubation or early nestling period (van Woudenberg 1999).

IUCN #7.1 Fire and fire suppression

Currently, wild and human-caused fires are considered a low impact threat. However, catastrophic fires such as those that have occurred across southern B.C. in the past decade have destroyed large areas of suitable Flammulated Owl habitat, and are likely to become more common if climate change scenarios, predicting longer, hotter summers in B.C. (COSEWIC 2009), are correct. Additionally, years of fire suppression have increased the fuel load, likely artificially increasing fire intensity.

Fire suppression has influenced canopy composition and understory structural dynamics in Flammulated Owl habitats (van Wagtenonk 1985). In the United States, effective suppression of wildfire has allowed many ponderosa pine stands to proceed to more shade-tolerant fir forest types, which are less suitable habitat for this species (Marshall 1957; Reynolds *et al.* 1989); in B.C. stands infill with Douglas-fir. These stands have a closed-canopy and high stem-density structure with altered stand productivity rates, attributes that are unfavourable for Flammulated Owls. Forest disturbance risk factors increase the susceptibility of such stands to wildfire, and insect and disease outbreaks (Smith 1986; Covington and Moore 1992; Harrington and Sackett 1992). The loss of the ponderosa pine component, as it is replaced by Douglas-fir, from the landscape may have long-term consequences for the abundance of breeding owls by reducing the number of the most suitable trees for nesting (van Woudenberg 1999). Currently, this is thought to be a low population impact but should be better quantified.

IUCN #7.3 Other ecosystem modifications

Aerial spraying of insecticides in and around Flammulated Owl habitats may threaten individual owl survival/productivity. Western Spruce Budworm (*Choristoneura occidentalis*) and Douglas-fir tussock moth (*Orgyia pseudotsugata*) infestations in B.C. are treated by aerial spraying of *Bacillus thuringiensis kurstaki* (*Btk*). If applied in Flammulated Owl habitats, these applications would reduce lepidopteran prey availability. However, the effect this may have on owl populations is unknown (COSEWIC 2009). In 2007, 57,000ha of the southern Interior of B.C.—the majority of the spraying was in Flammulated Owl habitat—was treated with *Btk* (Westfall and Ebata 2008 in COSEWIC 2009). This is currently considered a low impact threat but is a knowledge gap that requires investigation.

IUCN #8.2 Problematic native species

Insect epidemics that kill Douglas-fir and pines (young and old trees) may currently be affecting large areas of suitable habitat. For example, Douglas-fir Beetles (*Dendroctonus pseudotsugae*) have affected 7000 ha in the Nelson Forest Region and 2000 ha in the Kamloops Forest Region (Ministry of Forests 2001). Insect outbreaks in Douglas-fir forests have increased annually since then, which is likely of serious consequence to Flammulated Owls if large trees are killed. Of more recent concern are the Mountain Pine Beetle (*Dendroctonus ponderosae*) and Western Pine Beetle (*Dendroctonus brevicomis*) epidemics that have ravaged ponderosa pine throughout much of the range of the Flammulated Owl in B.C. This has impacted a substantial amount of potential nest tree habitat, especially in the Thompson area (Ministry of Forests, Lands and Natural Resource Operations 2011a). An additional related concern is the impact of salvage logging on the remaining habitat – specifically, the removal of current and potential nest trees. The combined effects related to insect epidemics are considered a moderate population impact for Flammulated Owls, currently and in the next 10 years.

In B.C., Barred Owls have undergone an extensive range and population increase over the past six decades and now completely overlap the range of the Flammulated Owl (Campbell *et al.* 1990). This increased distribution is at least partially due to human-caused habitat changes (Campbell *et al.* 1990). Some researchers feel that Barred Owls now provide the greatest risk of predation for Flammulated Owls (van Woudenberg 1992), especially on fledglings (McCallum 1994a). This notion is debatable, however, as Barred Owls are not widely distributed in dry forests of the IDF and PP biogeoclimatic zones. Although they will hunt into the drier forests, Barred Owls tend to occur in damper, shadier valleys with some riparian areas. This potential threat requires further investigation.

IUCN #11.1 Habitat shifting and alteration

Climate change is anticipated to result in a gradual increase in the extent of grasslands and thus loss of adjacent lower elevation forests in the B.C. Interior, which would reduce the amount of suitable habitat for Flammulated Owls. The PP and IDF biogeoclimatic zones are predicted to move up in elevation as well. This change can be sped up by natural disturbances such as the current epidemic of Mountain Pine Beetle brought about by the lack of severe winters, and the recent increase in severity of forest fires brought about by hotter, drier conditions (Austin and Eriksson 2009). Impacts of these climatic changes on habitat and insect prey populations are unknown and require additional research.

5 MANAGEMENT GOAL AND OBJECTIVES

5.1 Management Goal

Maintain stable or increasing populations of the Flammulated Owl distributed throughout the species' present range in B.C.

5.2 Rationale for the Management Goal

Quantifying population and habitat targets is not feasible at this time due to lack of baseline information. The Flammulated Owl occurs through much of the Interior Douglas-fir and higher elevation Ponderosa Pine zones in B.C.

5.3 Management Objectives

1. Identify population, habitat, and distribution targets required to maintain viable populations.
2. Initiate protection⁴ and/or management of priority breeding habitat for Flammulated Owl distributed throughout its range in B.C.
3. Investigate knowledge gaps related to cumulative impacts of the following threats: problematic native species (e.g., pine beetles), Btk spraying, fire and fire suppression, logging and wood harvest, and climate change.
4. Investigate knowledge gaps related to management: Natural Disturbance Type fire management, Ungulate Winter Range management, range management, and firewood cutting.
5. Establish and implement a monitoring program for Flammulated Owl habitats and populations.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (Ministry of Environment 2010b). Status of the action group for this species is given in brackets.

Compile Status Report (complete)

- Status report is completed (van Woudenberg 1999) and COSEWIC report completed (COSEWIC 2001, 2009).

⁴ Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, land use designations, and protected areas.

Send to COSEWIC (complete)

- Flammulated Owl assessed as Special Concern (COSEWIC 2001) and re-confirmed as Special Concern (COSEWIC 2010).

Planning (complete)

- Management plan is complete (this document, 2011).

Habitat protection (in progress)

- Approximately 7% of records were in Parks and Protected Areas (i.e., Junction Sheep Range Park, Okanagan Mountain Park [pre-fire in 2003], Columbia Lake Park, Dewdrop-Rosseau Creek Wildlife Management Area, Churn Creek Protected Area, South Okanagan Grasslands Protected Area, Lac Du Bois Grasslands Protected Area, Soap Lake Ecological Reserve (COSEWIC 2009).
- Twelve Wildlife Habitat Areas have been established in the Kootenays to manage forestry and range activities for Flammulated Owls (Ministry of Environment 2010c). This represents approximately 1% of nest sites in the province.

Land stewardship (in progress)

- Wildlife Tree Programs are ongoing on Crown and Private land (Ministry of Forests, Lands and Natural Resource Operations 2011b; Partners in Flight 2007).
- Nest boxes have been used on a limited scale (Cannings and Cannings 1982 in COSEWIC 2009).

Monitoring (in progress)

- Bird Studies Canada Nocturnal Owl Surveys are done annually in part of the species' range.

6.2 Recommended Management Actions**Table 2.** Recommended management actions and implementation schedule for the Flammulated Owl in British Columbia.

Obj. no.	Conservation Framework action group	Management action	Threat ^a or concern addressed	Priority	Timeline (start date)
1, 2, 3, 4	Habitat Protection	Identify population, priority nesting habitat and distribution targets using known locations, refined models for habitat suitability and viability, etc.	Knowledge gaps	Essential	2012
		Investigate cumulative impacts of threats from problematic native species, fire and fire suppression, logging and wood harvest, climate change and Btk spraying using GIS analysis with ground truthing at selected sites.	5.3, 7.1, 7.3, 8.2, 11.1, Knowledge gaps	Essential	2012
		Protect and/or manage priority nesting habitats using Parks and Protected Areas, Wildlife Habitat Areas, Best Management Practices,	1.1, 3.3, 5.3, 7.1	Essential	2012

Obj. no.	Conservation Framework action group	Management action	Threat ^a or concern addressed	Priority	Timeline (start date)
		stewardship, Forest Stewardship Plans, and other effective actions.			
		Investigate the following knowledge gaps related to management: timber harvest approaches, Natural Disturbance Type (NDT) fire management, Ungulate Winter Range management, livestock range management and firewood cutting, using GIS analysis, models, habitat mapping and on-site assessments.	Knowledge gaps	Essential	2012
1, 2, 3	Monitor Trends	Develop a prioritized monitoring strategy for nesting habitats, populations, and threats at strategic sites throughout B.C.	2.3, 3.3, 5.3, 7.1, 7.3, 8.2, 11.1	Necessary	2013
		Implement the above monitoring strategy.	2.3, 3.3, 5.3, 7.1, 7.3, 8.2, 11.1	Necessary	2015
1, 2	Land Stewardship	Conduct targeted landowner contact at priority nesting habitats on private land, if sites are identified.	2.3, 3.3, 5.3	Beneficial	2012
2, 3	Habitat Restoration	Develop a restoration plan for habitats at priority nesting habitats, if necessary.	5.3, 7.1, 7.3, 8.2, 11.1	Beneficial	2015

^a Threat numbers according to the IUCN-CMP classification (see Table 1 for details).

6.3 Narrative to Support Management Actions Table

Recommended actions have been categorized by the action groups of the Conservation Framework.

6.3.1 Habitat Protection

Habitat protection and management are required to maintain populations. Habitat protection occurs when the land base is protected, such as in a Park or Protected Area, and is well managed. These areas form core areas with greater population security. However, most of the species' habitat is not expected to be lost to development or other land pressures, but may still be impacted by other threats and therefore effective management rather than protection may be sufficient. The impacts related to the following threats are changing over time and are not well understood. Impacts from fire, insects, and climate change are expected to increase in the near future and their cumulative effects may make the forestry impact higher (currently a low impact threat). Additionally, looking beyond the 10-year term of the IUCN threat assessment, "scope" may be greater and thus indicate that the threat from forestry is higher over the long term. The impacts of forestry practices such as NDT ecosystem restoration and management of fire and fuel loading, Ungulate Winter Range management, Btk spraying, and logging practices on Flammulated Owls are not clear, especially in relation to the changing, main threats, above.

Clarification and assessment of these threats and knowledge gaps must be done first to develop effective protection and management strategies.

6.3.2 Monitor Trends

A strategic population, habitat, and threat monitoring program must be developed to address knowledge gaps related to medium impact, extreme severity, or unknown threats: problematic native species, fire and fire suppression, logging and wood harvest and climate change. The impact of these threats is expected to increase in the future. Accurate information is needed to support adaptive management.

6.3.3 Land Stewardship

Most (89%) of the known records are on Crown land (COSEWIC 2009); some of these lands are available for stewardship activities under forestry and range leases. Stewardship on private land is not likely to contribute substantially to the conservation of the population in B.C. but may be useful at some nesting sites.

6.3.4 Habitat Restoration

Habitat restoration may be required at specific sites, especially in relation to those impacted by pine beetle and fire-impacted sites. However, it should be targeted strategically only after a detailed analysis to determine where it is required and development of science-based, best management practices for restoration.

7 MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the management goal and objectives. If monitoring indicates that Flammulated Owl populations have not declined and are distributed throughout the species' present range in B.C., then the management goal will have been met. Performance measures are listed below for each objective.

Objective 1: Population, habitat, and distribution targets have been identified by 2016.

Objective 2: Protection and/or management activities were initiated at priority nesting habitats throughout its range, by 2012⁵.

Objectives 3 and 4: Investigation into the following knowledge gaps was initiated by 2012: problematic native species (e.g., pine beetles), Btk spraying, fire and fire suppression, logging and wood harvest, and climate change.

⁵ Protection and/or management activities will be an ongoing activity and will not be completed by 2016.

Objective 5: A monitoring program to detect trends in owl numbers was established and implemented by 2016⁶.

8 EFFECTS ON OTHER SPECIES

Negative impacts to other species are not anticipated. Habitat protection and management that promote conservation of older trees and snags will benefit many other species.

⁶ There may not be sufficient data to determine trends by 2016.

9 REFERENCES

- Austin, M.A. and A. Eriksson. 2009. The biodiversity atlas of British Columbia. 135 pp. <http://www.biodiversitybc.org/assets/Default/BBC_Biodiversity_Atlas.pdf> [Accessed July 8, 2010]
- B.C. Conservation Data Centre. 2010. BC Species and Ecosystems Explorer. B.C. Min. Environ., Victoria, BC. <<http://a100.gov.bc.ca/pub/eswp/>> [Accessed June 30, 2010]
- Bull, E.L. and R.G. Anderson. 1978. Notes on Flammulated Owls in north-eastern Oregon. *Murrelet* 59:26–27.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia, Vol. 2: Nonpasserines, diurnal birds of prey through woodpeckers. Royal B.C. Museum in association with Environment Canada, Can. Wildl. Serv., Victoria, BC.
- Cannings, R.J. 1994. A Flammulated Owl eats vertebrate prey in late fall. *Northwest. Nature*. 75:30–31.
- Cannings, R.J. and S.R. Cannings. 1982. A Flammulated Owl nests in a box. *Murrelet* 63:66-68.
- Cannings, R.J. and A.M. van Woudenberg. 2004. Flammulated Owl *Otus flammeolus*. In Accounts and measures for managing identified wildlife Southern Interior Forest Region. B.C. Min. Water, Land and Air Protection and B.C. Min. For., Victoria, BC.
- Christie, D.A. and A.M. van Woudenberg. 1997. Modeling critical habitat for flammulated owls (*Otus flammeolus*). Pages 97–106 in J.R. Duncan, D.H. Johnson, and T.H. Nicholls, eds. Biology and conservation of owls in the Northern Hemisphere. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. GTR NC-190, St. Paul, MN.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2001. COSEWIC assessment and update status report on the Flammulated Owl *Otus flammeolus* in Canada. Ottawa, ON. vi + 24 pp. <www.sararegistry.gc.ca/status/status_e.cfm>
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2009. Six-month interim status report on the Flammulated Owl, *Otus flammeolus*, in Canada. Ottawa, ON.
- Covington, W.W. and M.M. Moore. 1992. Postsettlement changes in natural fire regimes: implications for restoration of old-growth ponderosa pine forests. In W.R. Kaufmann, W.H. Moir, and R.L. Bassett, eds. Old-growth forests in the Southwest and Rocky Mountain Regions: proceedings of a workshop. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. RM-213. Portal, AZ.
- Goggins, R. 1986. Habitat use by Flammulated Owls in northeastern Oregon. M.S. thesis. Oregon State Univ., Corvallis, OR. 54 pp.
- Harrington, M.G. and S.S. Sackett. 1992. Past and present fire influences on southwestern ponderosa pine oldgrowth. In W.R. Kaufmann, W.H. Moir, and R.L. Bassett, eds. Old-growth forests in the Southwest and Rocky Mountain Regions: proceedings of a workshop. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. RM-213. Portal, AZ.
- Hausleitner, D. and V. Young. 2005. Inventory and monitoring of the Northern Spotted, Western Screech and Flammulated Owls. BC Hydro Bridge Coastal Fish and Wildlife Restoration Program, Burnaby, BC.
- International Union for Conservation of Nature and Conservation Measures Partnership (IUCN and CMP). 2006. IUCN – CMP unified classification of direct threats. Version 1.0 – June 2006. Gland, Switzerland. 17 pp.

- <http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy>> [Accessed June 30, 2010]
- Ligon, D.J. 1968. Some aspects of temperature relations in small owls. *The Auk* 86: 458-472. July 1969.
- Linkhart, B.D., R.T. Reynolds, and R.A. Ryder. 1998. Home range and habitat of breeding Flammulated Owls in Colorado. *Wilson Bull.* 110:342–351.
- Manley, I. 2005. Inventory of Flammulated Owls breeding in the East Kootenay 2004. Unpublished report for Min. of Water, Land and Air Protection, Nelson, BC. 29 pp. + appendices.
- Manley, I., P. Ohanjanian and M.-A. Beaucher. 2004. Inventory of Flammulated Owls breeding in the East Kootenay in 2003. Unpub. Report for Wings Over the Rockies, Invermere, BC. 26 pp.
- Manning, Cooper and Associates. 2005. Draft Flammulated Owl Management Plan for B.C. Unpublished report for Min. of Water, Land and Air Protection, Penticton, BC. 39 pp. + appendices.
- Marshall, J.T. 1957. Flammulated Owl. Page 75 in *Birds of pine-oak woodland in southern Arizona and adjacent Mexico*. *Pacific Coast Avifauna* 32:1–125.
- Master, L., D. Faber-Langendoen, R. Bittman, G.A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. NatureServe conservation status assessments: factors for assessing extinction risk. NatureServe, Arlington, VA.
<http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.pdf> [Accessed June 30, 2010]
- McCallum, D.A. 1994a. Flammulated Owl (*Otus flammeolus*). A. Poole and F. Gill, eds. *The Birds of North America*, No. 93. Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union. 24 pp.
- McCallum, D.A. 1994b. Review of technical knowledge: Flammulated Owls. Chapter 4 in *Flammulated, Boreal and Great Gray Owls in the United States: a technical assessment*. G.D. Hayward and J. Verner, eds. U.S. Dep. Agric. For. Serv., Rocky Mountain Forest and Range Experiment Station, Laramie, WY, Gen. Tech. Rep. RM-253.
- McCallum, D. A., and F. R. Gehlbach. 1988. Nest-site preferences of Flammulated Owls in western New Mexico. *Condor* 90:653-661.
- Ministry of Environment. 2010a. British Columbia guide to recovery planning for species and ecosystems. Victoria, BC. 32 pp.
<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>> [Accessed December 13, 2010]
- Ministry of Environment. 2010b. Conservation framework. Victoria, BC.
<<http://www.env.gov.bc.ca/conservationframework/index.html>> [Accessed June 30, 2010]
- Ministry of Environment. 2010c. Approved Wildlife Habitat Areas. B.C. Min. Environ., Victoria, BC. <<http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html>> [Accessed April 18, 2011]
- Ministry of Forests. 1995. Biodiversity guidebook.
<<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/biotoc.htm>> [Accessed December 13, 2010]
- Ministry of Forests. 2001. Forest health conditions. 2000. Aerial overview survey summary.
<<http://www.for.gov.bc.ca/hfp/health/overview/2000table.htm>> [Accessed January 11, 2011]

- Ministry of Forests, Lands and Natural Resource Operations. 2011a. Mountain pine beetle. <http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/> [Accessed September 13, 2011]
- Ministry of Forests, Lands and Natural Resource Operations. 2011b. The Wildlife Tree Committee of British Columbia. <<http://www.for.gov.bc.ca/hfp/values/wildlife/WLT/index.htm>> [Accessed September 13, 2011]
- Ministry of Water, Land and Air Protection. 2004. Flammulated Owl (*Otus flammeolus*) in Accounts and Measures for Managing Identified Wildlife – Accounts V. 2004. Victoria, BC. <<http://www.env.gov.bc.ca/wld/frpa/iwms/accounts.html>> [Accessed June 28, 2010]
- NatureServe. 2009. NatureServe Explorer: an online encyclopedia of life [web application]. Version 7.1. Arlington, Va. <<http://www.natureserve.org/explorer/>> [Accessed Oct. 24, 2009]
- Partners in Flight British Columbia and Yukon. Wildlife Tree Stewardship Program for the Okanagan Similkameen 2007 Summary. <<http://www.pifbcyukon.org/ArchivedNews.html>> [Accessed Sept. 12, 2011]
- Province of British Columbia. 1982. Wildlife Act. [RSBC 1996]: Chapter 488. Queen's Printer, Victoria, BC. <<http://www.bclaws.ca/>> Reynolds, R.T. and B.D. Linkhart. 1984. Methods and materials for capturing and monitoring Flammulated Owls. Great Basin Natural. 44:49–51.
- Province of British Columbia. 1995. Biodiversity Guidebook, Forest Practices Code of British Columbia. B.C. Min. For. and B.C. Environ., Victoria, B.C. ix + 99 p.
- Reynolds, R.T. and B.D. Linkhart. 1987a. Fidelity to territory and mate in Flammulated Owls. Pages 234–238 in R.W. Nero, R.J. Clark, R.J. Knapton, and R.H. Hamre, eds. Biology and conservation of northern forest owls. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. RM-142.
- Reynolds, R.T. and B.D. Linkhart. 1987b. The nesting biology of Flammulated Owls in Colorado. Pages 239–248 in R.W. Nero, R.J. Clark, R.J. Knapton, and R.H. Hamre, eds. Biology and conservation of northern forest owls. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. RM-142.
- Reynolds, R.T., R.A. Ryder, and B.D. Linkhart. 1989. Small forest owls. Pages 131–143 in National Wildlife Federation Scientific and Technical Series No. 12. Washington, DC.
- 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, and T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology, Ithaca, NY.
- Roberts, G. and A. Roberts. 1995. Distribution, habitat selection, and densities of Flammulated Owls (*Otus flammeolus*) in the Cariboo-Chilcotin. Unpublished report for B.C. Min. For., Cariboo Forest Region, Williams Lake, BC.
- Smith, D.M. 1986. The practice of silviculture. 8th ed. John Wiley and Sons, Inc.
- van Wagtenonk, J.W. 1985. Fire suppression effects on fuels and succession in short-fire-interval wilderness ecosystems. Pages 119–126 in J.E. Lotan, B.M. Kilgore, W.D. Fischer, and R.W. Mutch, tech. co-ords. Proc. Symp. and workshop on wilderness fires. U.S. Dep. Agric. For. Serv., Intermountain Res. Sta., Ogden, UT. Gen. Tech. Rep. INT-182.

- van Woudenberg, A.M. 1992. Integrated management of Flammulated Owl breeding habitat and timber harvest in British Columbia. M.Sc. thesis. Univ. British Columbia, Vancouver, BC.
- van Woudenberg, A.M. 1999. Status of Flammulated Owl in British Columbia. Wildlife B.C. Min. Environ., Lands and Parks, Wildlife Branch, Victoria, BC. Work. Rep. No. WR-95. 41 pp.
- Waterhouse, M. 1996. Distribution and habitat selection by Flammulated Owls in the Cariboo Forest Region of British Columbia. Cariboo For. Reg., Williams Lake, BC.
- Westfall, J. and T. Ebata. 2008. 2007 summary of forest health conditions in British Columbia. B.C. Min. For. Range, Victoria, BC.
<http://www.for.gov.bc.ca/ftp/HFP/external/!publish/Aerial_Overview/2007/Aerial%20OV%202007.pdf> [Accessed June 30, 2010]
- Yasuda, S. 2001. California Partners in Flight Coniferous Bird Conservation Plan for the Flammulated Owl. <<http://www.prbo.org/calpif/htmldocs/species/conifer/flowacct.html>> [Accessed June 30, 2010]

Personal Communications

Ted Antifeau, Wildlife Biologist, B.C. Ministry of Forests, Lands and Natural Resource Operations, Nelson, BC

Marc-Andre Beaucher, Wildlife Biologist, Creston Valley Wildlife Management Authority, BC