



2022

IMMINENT THREAT ASSESSMENT FOR SPOTTED OWL CAURINA SUBSPECIES

(Strix occidentalis caurina)



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Introduction

Assessment Trigger

On October 25, 2022, Ecojustice, on behalf of their client the Wilderness Committee, wrote to the Minister of Environment and Climate Change requesting that he recommend to the Governor in Council (GiC) the making of an emergency order for the protection of Spotted Owl *caurina* subspecies (hereafter, the Spotted Owl) putting forth the position that logging within draft critical habitat (CH) in British Columbia (B.C.) poses an imminent threat to the species' survival and recovery.

A previous imminent threat assessment was completed in response to an October 14, 2020 letter from Ecojustice, on behalf of their client the Wilderness Committee, that was focused on threats to the three remaining wild individuals in the Spuzzum and Utzlius watersheds (Annex III). To address those threats, the Government of British Columbia established a one-year deferral of forest harvesting, under Part 13 of the *Forest Act*. The deferral was extended for an additional year and currently expires February 28, 2023. If the deferral is not extended or replaced with some other form of prohibition on forest harvesting, those threats will once again materialize for any resident Spotted Owls remaining in those areas. This document does not include a detailed updated analysis of the threats to the remaining wild individuals that would resume if that logging deferral is not renewed. This assessment instead focuses on new or evolving threats to the species' survival and recovery across its range, associated with ongoing loss of draft CH. It also evaluates threats to Spotted Owls in the captive breeding facility in Langley, B.C..

HOW THIS DOCUMENT IS DESIGNED

The present assessment has been developed to help the Minister form an opinion on whether the Spotted Owl, a species listed as Endangered under the *Species at Risk Act* (SARA), is facing an imminent threat to its survival or recovery. The assessment takes into account the population and distribution objective provided in the draft updated *Recovery Strategy for the Spotted Owl caurina subspecies (Strix occidentalis caurina) in Canada* (produced by Environment and Climate Change Canada [ECCC], and currently undergoing internal review) "to recover the Spotted Owl in Canada by restoring a stable population of at least 250 mature individuals distributed within a connected network of habitat representative of all three sub-regions within the species' historical Canadian range, and linked to the larger population in the U.S.A." It also takes into consideration the best information available on the species' biology and ecology, as well as on the threats to its survival or its recovery. In addition to the publicly available information, including that provided by the Wilderness Committee (Hobbs 2019), ECCC received information from provincial government staff.

This document consists of three parts:

Part 1: Information on the species

Provides the species' characteristics, Canadian range, population parameters, habitat quality and quantity, status, threats and population and distribution objectives.

Part 2: Information on the new or evolving threat

Provides the best available information on the threats.

Part 3: Assessment of threats

Provides an assessment of the threats to the survival and/or recovery of the Spotted Owl.

Part 1: Information on the species

1.1 Species Characteristics

The Spotted Owl is a medium-sized owl averaging 45 cm in length and 90 cm in wingspan. Plumage is dark overall with brown feathers patterned by small pale spots over most of the body. The tail has white horizontal bars and there are no "ear" tufts. Eyes are large, dark brown and are set within lighter brown facial disks (Forsman 1981; Gutiérrez *et al.* 1995). Age classes can be identified by differences in plumage characteristics. Juveniles <5 months old are identified by visible down feathers. Sub-adults (1-2 years old) and adults (>2 years) may be differentiated based on tail feathers; sub-adults have pointed tail feathers with white tips whereas adult tail feathers are rounded and usually mottled in colour (Forsman 1981). Males and females have similar plumage but females are ~15% larger (Blakesley *et al.* 1990; Gutiérrez *et al.* 1995).

1.2 Canadian Range

The species' range in Canada is restricted to the province of B.C. Within B.C., the species' historical range extends from the U.S.A. border north ~200 km to Carpenter Lake, and ~160 km from Howe Sound in the west to the Cascade Range in the east (Figure 1). Within this range, there are three ecological sub-regions that differ in their mean annual precipitation and corresponding habitat characteristics: the wet 'Maritime', moist 'Sub-maritime', and dry 'Continental'. Permanent range contraction occurred historically within the Lower Mainland and Lower Fraser Valley, where habitat was lost to human development (Chutter *et al.* 2004).

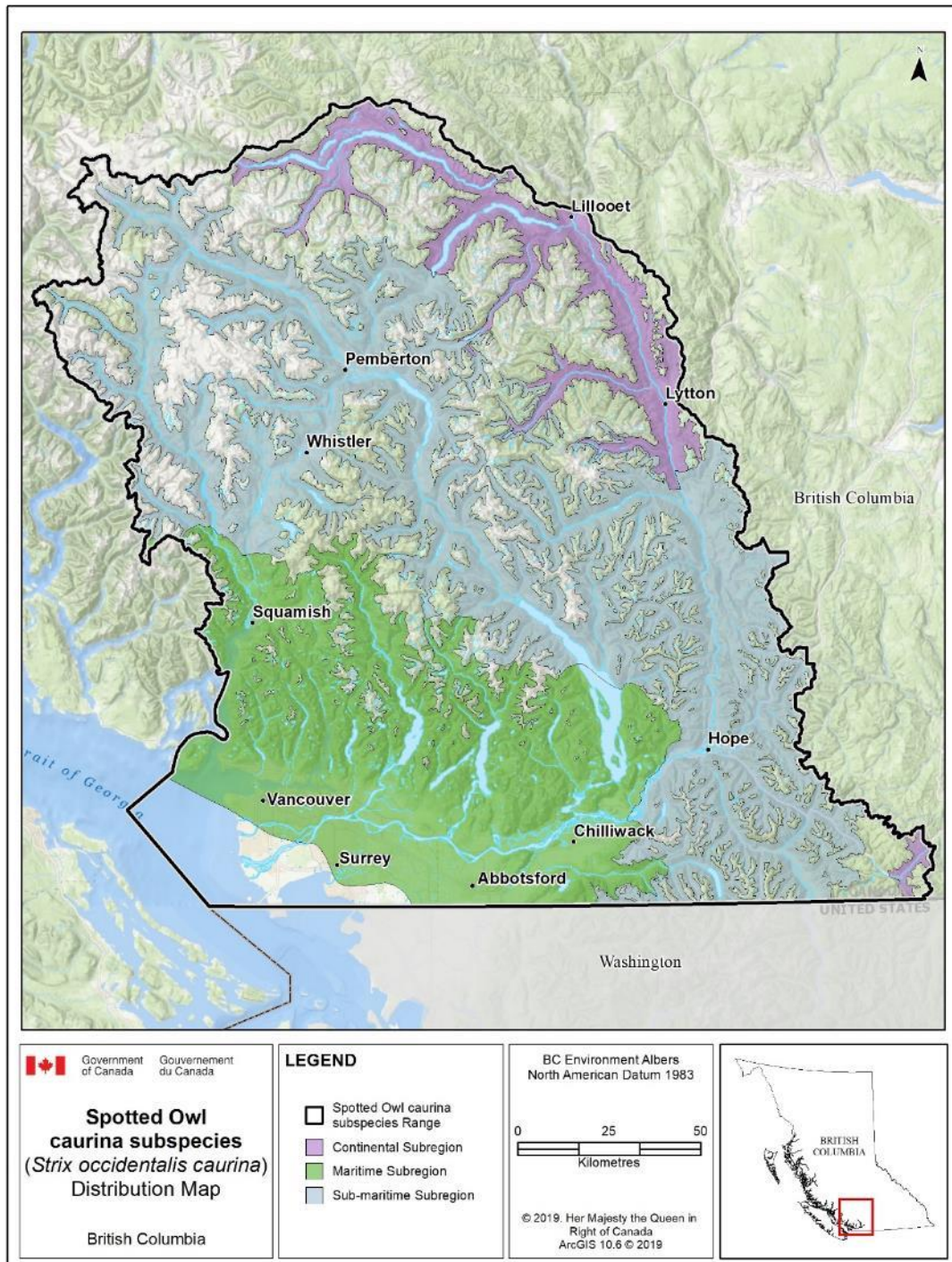


Figure 1. Approximate historical distribution of the Spotted Owl in B.C.

1.3 Population Parameters (global and Canadian)

The global population of Spotted Owl ('Northern' or '*caurina*' subspecies) was estimated at roughly 6000 breeding pairs in the late 1980s (Thomas et al. 1990), with the bulk of the population (>90%) occurring in the U.S.A. (COSEWIC 2008). Local population declines were observed at 11 demographic study areas within Washington, Oregon, and California between 1985 and 2013, with an overall annual rate of decline of 3.8% (Dugger et al. 2015). With a 6000-pair starting population and a 3.8% annual decline from 1985-2019, the global population would now be estimated at ~1600 pairs. Declines have been most pronounced within sites in Washington, Oregon and B.C., and less pronounced in California (Blackburn and Godwin 2003; Dugger et al. 2015).

Before European settlement, the Spotted Owl population in Canada likely did not exceed 500 potential breeding pairs (Blackburn et al. 2002). In 1991, it was estimated at fewer than 100 potential breeding pairs (Dunbar et al. 1991; Dunbar and Blackburn 1994) and by 2002 it had declined further to fewer than 33 (Blackburn and Godwin 2003). Surveys of 10 previously occupied sites in 2019 and 2020 found one pair and one single owl at two sites, both north of Hope, B.C. (J. Gillis pers. comm. 2019 and 2020); the reproductive pair was in the Spuzzum Creek watershed and the single owl was located in the nearby Utzlius Creek watershed. In July 2022, only the female in the Spuzzum Creek watershed was detected in the wild (Scott Barrett pers. comm. 2022). This represents an ~99% decline from historical levels, with Canada now supporting <0.01% of the global wild population (of ~1600 pairs).

In addition to the one known bird remaining in the wild, there were 33 individuals housed in a captive breeding facility as of July 2022 (Scott Barrett pers. comm. 2022). In August 2022, three of the captive-raised owls were released into the Anderson/Utzlius and Spuzzum Wildlife Habitat Areas (WHAs) in the Fraser Canyon, part of Spô'zêm First Nation's traditional territory, bringing the total number of owls in the wild to four¹ (Figure 2). However, one of the males released in the Anderson/Utzlius Creek WHAs was struck by a train in early November 2022, and was returned to captivity for veterinary care (Scott Barrett pers. comm. 2022). The combined wild and captive population has been relatively static since 2004, with the wild population continuing to decline (partly as a result of individuals being taken into the captive breeding program) and the captive population beginning to grow (Figure 3).

¹ <https://news.gov.bc.ca/releases/2022LWRS0056-001572>

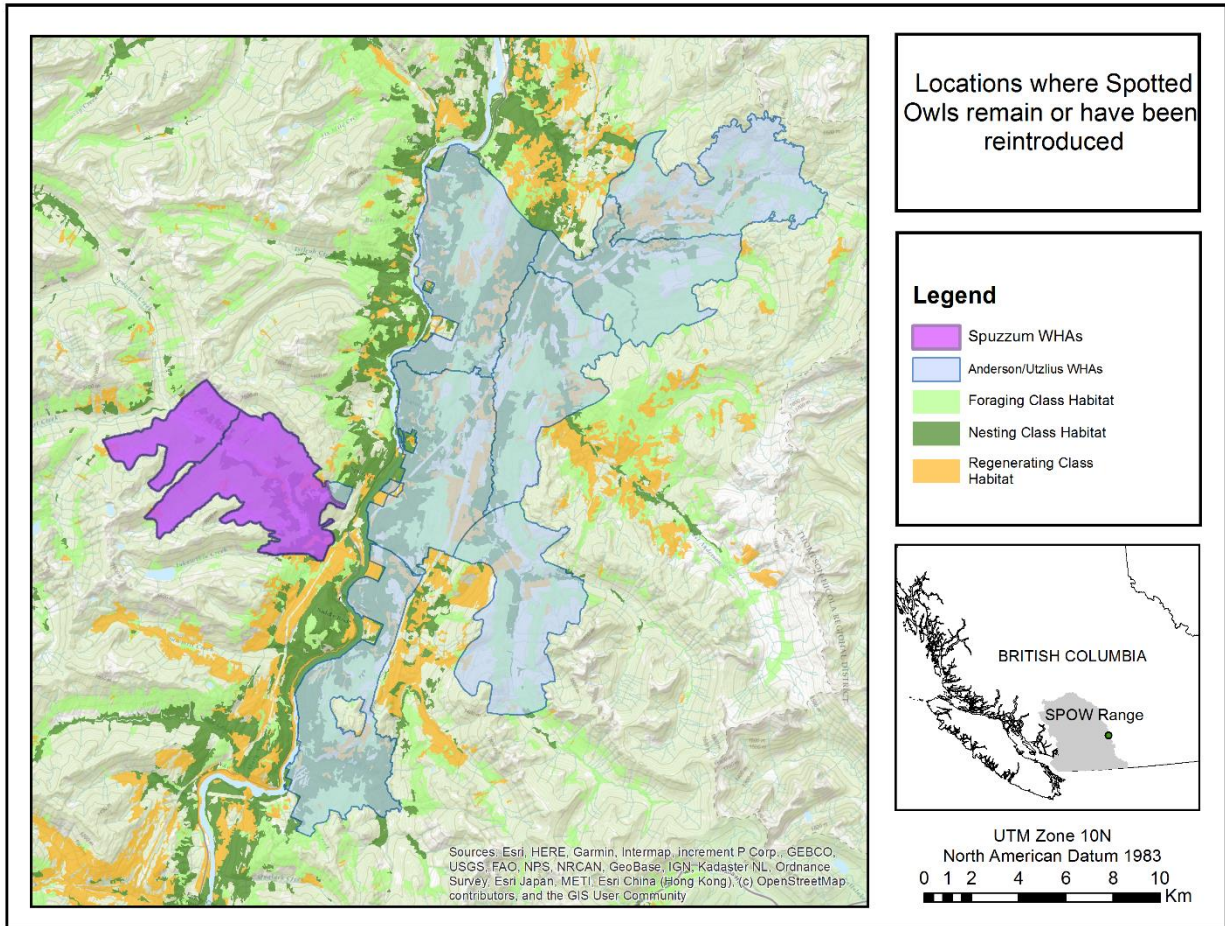


Figure 2. The areas supporting the three Spotted Owls currently known in the wild in Canada.

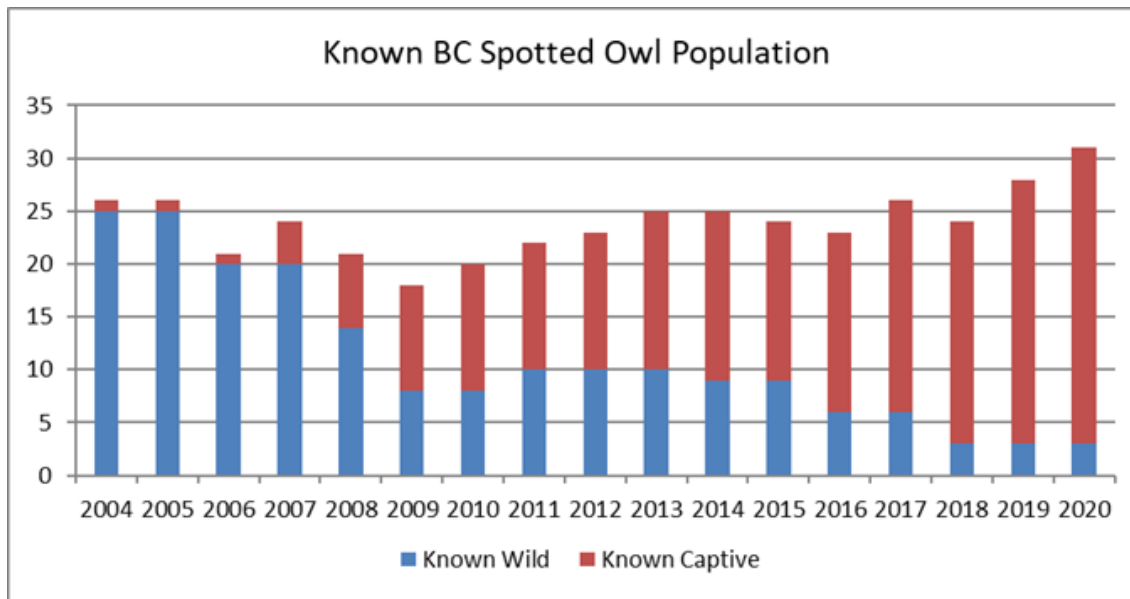


Figure 3. Known Spotted Owl population in Canada from 2004 to 2020 (Government of B.C. 2020).

1.4 Habitat Quality, Quantity, and Configuration

Habitat attributes

Nesting, roosting, escape and foraging

Spotted Owls establish territories for nesting and foraging within mixed-coniferous forests characterized by an uneven-aged cohort of trees; a multi-layered, relatively closed canopy; numerous large trees with broken tops, deformed limbs, and large cavities; and numerous large snags and accumulations of logs and downed woody debris (Thomas et al. 1990; USDI 1992). These structural attributes provide: protective cover from predators and inclement weather; structures for nesting and roosting; and characteristics that support abundant and accessible prey (Blackburn et al. 2009). In moist parts of the range west of the Cascade Range, these attributes are found exclusively within old-growth forests. In drier parts of their range east of the Cascades, Spotted Owls have also been observed in younger stands where structural complexity was created by fire, wind events, or disease factors such as root rot or mistletoe infections (Dunbar and Blackburn 1994; Buchanan et al. 1995). Spotted Owls are non-migratory, and so reside on their home range year-round. Nesting pairs may re-use the same nest each year or use alternate nest sites (Gutiérrez et al. 1995).

Breeding Spotted Owls may experience stress, reduced reproductive output, and disrupted nesting behaviours when exposed to acute, action-generated noise within their nesting areas (Wasser et al. 1997, Hayward et al. 2011, USFWS 2020). To successfully carry out breeding functions Spotted Owls also require nesting areas to be free of acute noise during the breeding season. The impacts of acute, action-generated noises need to be interpreted in the context of the ambient sound levels that the owls would otherwise be accustomed to within their breeding territory (i.e., pre-existing, continuous/recurrent sounds such as water flow or steady traffic). Acute, action-generated noises that increase sound levels by over 20 db above ambient conditions are considered significant enough to impact nesting functions (USFWS 2020). Impacts on nesting functions are also expected if overall sound levels (regardless of ambient conditions) exceed 90 db. Examples of activities that can result in action-generated noises that would exceed these thresholds include operation of large machinery, use of chainsaws, blasting, operation of large engines and engine brakes, and operation of motorized recreational vehicles (USFWS 2020).

Dispersal

Dispersal occurs primarily in juveniles, although some adults will disperse after being displaced from their original territory due to habitat disturbance or Barred Owl competition (Jenkins et al. 2021). Like resident Spotted Owls, dispersing individuals require available prey and security features. Old-growth and mature forests (i.e., the same forests that support nesting/roosting and foraging) are therefore understood to provide ideal conditions (reviewed in Buchanan 2004). Where no habitat capable of supporting foraging and security exists between two natal patches, dispersal success between those patches is likely to be reduced (i.e., mortality during dispersal, or failure to disperse from natal patch), ultimately reducing long-term patch occupancy and population stability. Safe movement/dispersal is best supported by nesting/foraging quality habitat located either within year-round forested habitat patches (enabling within-patch dispersal) or in between those patches. Spotted Owls may traverse forested habitat in other seral stages during dispersal; however it is not yet clear what other habitat

attributes/configurations may contribute to dispersal success (Buchanan 2004). Research will be required to evaluate drivers of dispersal success in Canada and determine whether additional habitats in younger forests should be identified as important for supporting safe movement.

Habitat configuration

Landscape configuration

In order for a stable Spotted Owl population to exist within a landscape, habitat must be configured such that it can support all critical life functions (breeding, roosting, foraging, and safe movement/dispersal) for the entire population. This requires patches of forested habitat capable of supporting the year-round needs of breeding pairs and resident individuals, as well as an overall configuration of both the year-round habitat patches and seasonally-used dispersal habitat that maximizes survival/success of dispersing individuals. Spotted Owls must feed and escape predation in order to survive dispersal, and, in moving through areas that lack foraging resources and security features, dispersing individuals are expected to incur an increased energetic/survival cost (Lamberson et al. 1994; Buchanan 2004; Sutherland et al. 2007; Marcot et al. 2013; Conlisk et al. 2020). Overall population stability is therefore most likely when a landscape includes not just large, closely-configured habitat patches to support year-round occupancy, but also habitat occurring in between year-round patches that provides foraging and security opportunities for dispersing birds.

Home range configuration

Within suitable landscapes, areas that adult/resident Spotted Owls occupy year-round are represented as home ranges. Home ranges can be occupied by unpaired resident birds, or by a breeding pair. A certain amount of habitat must be present in these areas in order to support nesting, roosting, and foraging life history functions. Further, this habitat must not be too fragmented, so that it can be accessed without excess energy expenditure and/or exposure to predation (Carey et al. 1992; Courtney et al. 2004; Sutherland et al. 2007). The mean area of habitat estimated to support a resident Spotted Owl home range varies between sub-regions: Maritime – 3010 ha, Sub-maritime – 2224 ha, Continental – 1907 ha (Chutter et al. 2004; Sutherland et al. 2007). In locations with contiguous mature or old-growth forested habitat, these numbers also represent minimum home range sizes. Home ranges become larger as habitat is more fragmented (Carey et al. 1992). The maximum areas across which the abovementioned habitat amounts can occur and thus an energetically-viable home range can be sustained within Canada are estimated at 11,047, 7258, and 6305 ha in the Maritime, Sub-maritime, and Continental sub-regions, respectively (Sutherland et al. 2007). In contiguous habitat, adjacent home ranges may overlap up to 25% (Sutherland et al. 2007). During the breeding season, pairs concentrate their activities within a smaller area of their home range, in close vicinity to the nest grove. In Canada, most breeding season activities are estimated to occur within ~500 m of the nest tree (Blackburn et al. 2009).

Habitat patch configuration

Due to a combination of both natural and anthropogenic disturbances, remnant Spotted Owl habitat in Canada exists in a range of patch² sizes, from large contiguous expanses to patches <1 ha in size. A patch's size may impact whether it can provide functional habitat for a Spotted Owl. Ten hectares has been estimated by experts within Canada as the minimum habitat patch size within which preferred prey can persist and thus Spotted Owls can successfully forage (reviewed in Sutherland et al. 2007). In addition to absolute size, the irregularity of a patch may also impact its utility for Spotted Owls. Research from Pacific Northwest forests has shown that microclimate (including humidity and solar exposure) can be impacted up to ~100 m from an edge (Kremsater and Bunnell 1999). These impacts may be particularly pronounced for species of fungi and lichens, which are often adapted to the cooler, moister, darker conditions associated with interior forest (Crockatt 2012; Gauslaa et al. 2018). Spotted Owls in Canada feed disproportionately (>40% of diet) on Northern Flying Squirrels (*Glaucomys sabrinus*; Horoupian et al. 2004), which in turn feed preferentially on fungi and lichens associated with coniferous forested habitats (Carey 1991; Carey et al. 1992; Waters and Zabel 1995). In small or highly-irregular forest habitat patches with high edge-to-interior ratios, the conditions necessary to sustain foraging resources for Northern Flying Squirrels may not exist. Competitors (of Spotted Owls) that are better-adapted to foraging within diverse habitats may also over-exploit preferred prey species in openings and along edges, further reducing prey availability for Spotted Owls in small or irregular habitat patches (Wilson and Forsman 2013; Wiens et al. 2014).

Classification of habitat for the Spotted Owl

In B.C., habitat is classified according to its suitability for Spotted Owl using attributes from provincial Vegetation Resources Inventory (VRI) mapping. The suitability of VRI polygons is classified based on whether they contain all attributes necessary to support all life functions, including nesting/roosting, or only the subset of attributes necessary to support foraging (Sutherland et al. 2007). 'Nesting' quality habitat is found in old, tall, low-elevation stands and 'foraging' quality habitat is found in mature, moderately tall stands and may extend further upslope. These habitat types double as safe movement / dispersal habitat, with safe movement / dispersal being best supported in landscapes containing contiguous corridors of mature-old forest (Buchanan 2004).

Availability of habitat

Although the area of habitat with the correct VRI characteristics to support Spotted Owl is >530,000 ha, much of this habitat does not meet the patch size, quality and configuration requirements to support all life functions. In order to support a recovered population of >250 mature individuals, a specific subset of habitat with the necessary configuration to support all life functions for a population >250 mature individuals must be currently available or possible to restore within the 50-year recovery timeframe. Based on the configuration of regenerating and existing Spotted Owl habitat (see section 1.8), it is considered to be within the scope of biological and technical feasibility to achieve a connected network of habitat sufficient to support

² A discrete area of habitat.

≥250 mature individuals within 50 years. However, in order for this outcome to be realized, ongoing loss of this habitat must be halted.

Current use of habitat

Currently, there are only three Spotted Owls known to remain in the wild in Canada: a wild female and released male in the Spuzzum Creek watershed and one male that was released within the nearby Anderson / Utzlius Creek WHAs (Figure 2). Spotted Owls were detected regularly in these areas since 1994 (B.C. CDC 2019). Nesting was observed at Utzlius Creek between 1997 and 2017, and at Spuzzum Creek between 2017 and 2020 (B.C. MFLNRORD unpublished survey data). The remaining habitat within these sites is characterized as old-growth mixed coniferous forest.

1.5 Threats to the Species

The Spotted Owl threat assessment completed for the recovery strategy (Table 1) is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system, and was completed on the scale of the species' historical range. The assessment was completed by a panel of provincial government and independent species experts from B.C. in March 2018. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. For purposes of this threat assessment, only present and future threats are considered.

Based on IUCN threat evaluation criteria, the overall range-wide threat impact for the Spotted Owl in Canada is assessed as 'very high' (based on the combined impact values of the applicable threat categories³). There is one threat that is assessed as 'very high' impact, one that is assessed as 'high' impact, three threats that are assessed as 'medium' impact, six threats that are assessed as 'low' impact, and numerous threats that were evaluated as having 'negligible' or 'unknown' impacts, within the 10-year IUCN assessment timeframe (Table 1). A detailed description of these threats is found in Annex I.

There are six threats to the survival of the current wild population of three owls: roads and railways and problematic native species are 'very high' impact; logging, mining, recreational activities, and persecution (collecting terrestrial animals) are 'high' impact. Persecution, which is a very high threat in the Spuzzum Creek watershed, does not apply to the historical range unless owls are present and their location is publicly known.

³ See https://www.natureserve.org/sites/default/files/natureserveconservationstatusfactors_apr12.pdf

Table 1. Standardized threats assessment for the Spotted Owl (range-wide).

Threat #	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
1.2	Commercial & industrial areas	Low	Small	Extreme	High
1.3	Tourism & recreation areas	Low	Small	Extreme	High
2	Agriculture & aquaculture	Negligible	Negligible	Extreme	High
2.1	Annual & perennial non-timber crops	Negligible	Negligible	Extreme	High
2.2	Wood & pulp plantations	Negligible	Negligible	Extreme	High
2.3	Livestock farming & ranching	Negligible	Negligible	Slight	High
3	Energy production & mining	Low	Small	Extreme	High
3.1	Oil & gas drilling	Negligible	Negligible	Moderate	Low
3.2	Mining & quarrying	Low	Small	Extreme	High
3.3	Renewable energy	Negligible	Negligible	Extreme	High
4	Transportation & service corridors	Medium	Restricted	Extreme	High
4.1	Roads & railroads	Medium	Restricted	Extreme	High
4.2	Utility & service lines	Medium	Restricted	Extreme	High
4.4	Flight paths	Negligible	Negligible	Negligible	High
5	Biological resource use	High	Large	Extreme	High
5.1	Hunting & collecting terrestrial animals	Negligible	Negligible	Negligible	High
5.2	Gathering terrestrial plants	Negligible	Negligible	Negligible	High
5.3	Logging & wood harvesting	High	Large	Extreme	High
6	Human intrusions & disturbance	Low	Restricted	Slight	High
6.1	Recreational activities	Low	Restricted	Slight	High
6.2	War, civil unrest & military exercises	Negligible	Negligible	Negligible	High

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d
7	Natural system modifications	Medium	Restricted	Extreme	High
7.1	Fire & fire suppression	Medium	Restricted	Extreme	High
7.2	Dams & water management/use	Negligible	Small	Negligible	High
8	Invasive & other problematic species & genes	Very High	Pervasive	Extreme	High
8.1	Invasive non-native/alien species/diseases	Negligible	Negligible	Negligible	High
8.2	Problematic native species/diseases	Very High	Pervasive	Extreme	High
8.3	Introduced genetic material	Negligible	Negligible	Negligible	High
8.4	Problematic species/diseases of unknown origin	Unknown	Unknown	Unknown	Unknown
8.5	Viral/prion-induced diseases	Unknown	Unknown	Unknown	Unknown
8.6	Diseases of unknown cause	Unknown	Unknown	Unknown	Unknown
9	Pollution	Negligible	Negligible	Negligible	High
9.1	Domestic & urban waste water	Negligible	Negligible	Negligible	High
9.2	Industrial & military effluents	Negligible	Negligible	Negligible	High
9.3	Agricultural & forestry effluents	Negligible	Negligible	Negligible	High
9.5	Air-borne pollutants	Negligible	Negligible	Slight	High
9.6	Excess energy	Negligible	Negligible	Negligible	High
10	Geological events	Negligible	Negligible	Moderate	High
10.3	Avalanches/landslides	Negligible	Negligible	Moderate	High
11	Climate change & severe weather	Unknown	Unknown	Unknown	Unknown
11.1	Habitat shifting & alteration	Unknown	Unknown	Unknown	Unknown
11.2	Droughts	Unknown	Unknown	Unknown	Unknown
11.3	Temperature extremes	Unknown	Unknown	Unknown	Unknown
11.4	Storms & flooding	Unknown	Unknown	Unknown	Unknown

^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 threat 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); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

^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%; Negligible < 1%).

^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%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

^d **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 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.

Limiting Factors

Spotted Owl populations naturally have low fecundity and low juvenile survivorship rates that are offset by high survivorship of adults. Inter-annual variation in these processes are less critical in large populations and across large spatial scales. However, effects of low recruitment on population growth rate may be exaggerated because of the small population and its fragmented distribution. The small remaining gene pool may also result in inbreeding depression.

1.6 Status

Federal protection

The Spotted Owl has been listed as Endangered under Schedule 1 of SARA since 2003. SARA includes general prohibitions that make it an offence to kill, harm, harass, and capture the species, and to damage or destroy the species' residence. For Spotted Owl and other non-migratory birds, the general prohibitions only apply to federal lands unless an order is made to extend the application to non-federal lands.

SARA defines residence as: "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating". A draft residence description for Spotted Owl (Environment Canada 2005) defines a residence as any nest tree occupied by a Spotted Owl within the last six years and/or any occupied roost tree. There are currently two known nest locations that fit this description. Although nesting has not been observed in the wild since 2020, if the Spuzzum Creek female pairs with one of the released males, it is possible that another residence could be found during the 2023 breeding season. In the Spuzzum Creek watershed, Spuzzum Indian Reserve 1 and 1A⁴ overlap with the lowest (easternmost) reaches of the watershed, but the previous nesting locations were further east, on provincial Crown land.

Provincial protection/management

The species is referred to as Northern Spotted Owl in B.C.. The province does not have stand-alone species at risk legislation. The *B.C. Wildlife Act* (1996) prohibits hunting, taking, trapping, wounding or killing the species, and makes it an offence to possess, take, injure, molest or destroy the species' nest while occupied.

The majority of the species' habitat is found on provincial Crown land in B.C. Some of the species' habitat is afforded some measure of protection where it overlaps with provincial parks, protected areas, and ecological reserves, and with designations under the *Forest and Range Practices Act* such as Old-Growth Management Areas (OGMAs), Ungulate Winter Ranges (UWRs), and WHAs.

Some of these designations were made specifically to protect the species' habitat. Most of the Spotted Owl WHAs (including those falling within Spuzzum and Utlzius Creek watersheds) are Long Term Owl Habitat Areas (LTOHAs), which are "managed to achieve 100% Spotted Owl

⁴ "Federal lands" under SARA include "reserves and any other lands that are set apart for the use and benefit of a band under the [Indian Act](#)".

habitat conditions by conserving existing habitat, creating additional habitat, or enhancing habitat to improve quality for foraging and/or nesting” (Josh Malt, pers. comm. 2020). The harvesting for ‘habitat enhancement’ (General Wildlife Measure #4), that is permitted within LTOHA WHAs, involves adhering to retention targets and criteria with the aim of maintaining existing Spotted Owl habitat attributes and allowing others to develop more quickly than under natural succession.

The suite of areas managed or protected to support Spotted Owl are collectively referred to by the province as the Spotted Owl Management Plan (SOMP). SOMP has undergone two iterations since its inception and the current version is SOMP2.

Using provisions under Part 13 of the provincial *Forest Act*, the Government of B.C. has temporarily deferred forest harvesting in the Spuzzum and Utzlius Creek watersheds until February 28, 2023.

1.7 Recovery Objectives

The population and distribution objective for the Spotted Owl comes from the most recent draft of an amended recovery strategy. This constitutes the best information available as of the date of this threat assessment.

To recover the Spotted Owl in Canada by restoring a stable population of at least 250 mature individuals distributed within a connected network of habitat representative of all three sub regions within the species’ historical Canadian range, and linked to the larger population in the U.S.A.

The population component of the objective has been carried over from the 2006 recovery strategy. The connectivity and representation components, which were identified as priorities within the 2006 recovery strategy, were added to the updated objective.

Distribution objective

The distribution component of the current objective calls for a connected network of habitat representative of all three sub-regions within the species’ historical Canadian range (see Figure 1), and linked to the larger population in the U.S.A.

Long-term population objective

Recognizing the significant work that will be required to recover the species from its current state, the population objective has an associated timeline of at least 50 years. The 50-year objective is to restore a stable population of at least 125 pairs (250 mature individuals).

Short-term statements

Recognizing the long-term nature of the overall population objective, the following short-term statements are provided:

1. Maintain sufficient CH needed to achieve the population and distribution objective *and* immediately cease human-caused threats where Spotted Owls are detected (i.e., if owls are found outside of, or released captive-bred owls move to areas outside of existing protected areas).

2. Re-introduce at least 50⁵ captive-bred Spotted Owls to the wild within 10 years (by 2032), with at least 10 released individuals surviving to become resident adults.
3. Complete annual Barred Owl surveillance at sites occupied by Spotted Owls and/or where reintroductions are planned, and remove all Barred Owls that are detected.

History of Recovery Efforts

Federal Actions

In 2006, Environment Canada (EC) posted the first federal recovery strategy for Spotted Owl, comprised of the provincial strategy (*Recovery Strategy for the Northern Spotted Owl [Strix occidentalis caurina] in British Columbia*) plus a federal addition containing a partial CH identification, on the Species at Risk Public Registry. Within that strategy, EC committed to working cooperatively with the province of B.C. and other interested parties and stakeholders to post a draft action plan, including a full identification of CH, by June 2007.

Work has progressed and a draft of an amended federal recovery strategy has now been prepared. This draft includes identification of CH and labels the portions of CH in B.C.'s SOMP2 as 'core CH' and the remainder as 'potential future CH'. In this draft, the 'potential future CH' does not comprise part of the formal proposed CH identification. This draft amended recovery strategy is undergoing final preparation for public posting and comment (as a 'proposed' recovery document).

Provincial / Federal Agreements

In 2006, the federal and provincial governments agreed that B.C. would implement the following measures to address threats facing the Spotted Owl, which had a population of 22 known individuals at the time:

- Initiate measures to re-build Spotted Owl populations. These measures include captive breeding and release, moving spotted owls to new locations, increasing food sources for spotted owls, and managing competing species such as barred owls;
- Evaluate and revise existing Spotted Owl management areas to ensure they better protect owls. This will be a collaborative effort working closely with staff in the ministries of Environment and Forests and Range, the Federal Government, First Nations and forest licensees; and
- Continue detailed, site-by-site analysis in consultation with Environment Canada to provide an appropriate amount of habitat protection in areas where the 2005 survey reported spotted owls.

In February 2021, Canada and British Columbia announced the intention to address Spotted Owl protection and began negotiations on a comprehensive 'nature agreement' to facilitate improved progress and cooperation across a suite of nature-related objectives. A variety of actions could be considered, ranging from more habitat protection to improved cooperation on species at risk recovery (including Spotted Owl), to action and investments to protect or conserve 400,000-1.3 million hectares of high quality old growth forests.

⁵ This number is derived from current projections by the provincial government (B.C. MFLNRORD 2021) but is subject to adjustment following the pilot phase of the reintroduction (2021-2025), based on the actual annual reproductive output of captive pairs and the survival outcomes of released individuals.

Provincial Actions

Habitat protection, enhancement and stewardship

Management planning

In 1997, the first SOMP was developed with a goal of stabilizing and improving the population over the long-term, without exceeding a 4% reduction in the timber harvesting land base (THLB) (i.e., SOMIT 1997). SOMP established 21 Special Resource Management Zones (SRMZs) that included pre-existing protected areas as well as Crown forest land. Within the SRMZs that fell outside protected areas, 67% of the habitat was to remain suitable for the Spotted Owl, while the remaining 33% was eligible for harvest using specific prescriptions.

In 2009, an updated version of SOMP ('SOMP2') was released, which involved transferring most SRMZs into Long Term Owl Habitat Areas (LTOHAs; managed for Spotted Owl conservation) and Managed Future Habitat Areas (MFHAs; managed for forest harvest with consideration for long-term Spotted Owl habitat development), adjusting some managed area boundaries, and creating updated harvesting guidelines/designations (Blackburn et al. 2009; Government of B.C. 2009a). The requirement to limit impacts on the THLB to <4% remained, so there was no increase in the area managed for Spotted Owl recovery under the new plan. In 2012, the LTOHA and MFHA areas under SOMP2 became legally-designated Wildlife Habitat Areas (WHAs) with General Wildlife Measures (GWMs). Thirty-two WHAs are now in place to provide a measure of protection to areas large enough to support one or more breeding pairs of Spotted Owls (Government of B.C. 2019). Within the LTOHA WHAs, forest harvest is largely prohibited, and within the MFHA WHAs, harvest is permitted subject to conditions.

Additional regulatory measures

In addition to WHAs, other provincial and local government designations⁶ offer some measure of protection for Spotted Owl habitat. Approximately 230,000 ha of Spotted Owl habitat falls within these combined provincial and local government designated areas. The majority (212,000 ha) of this habitat met ECCC's CH identification criteria, and has been labelled 'core CH' in the current draft amended recovery strategy.

In February 2021, in response to threats to survival of the species represented by the three remaining wild individuals in the Spuzzum and Utzlius watersheds (Annex III), the Government of British Columbia established a one-year deferral of forest harvesting, under Part 13 of the *Forest Act*. The deferral was extended for an additional year and currently expires in February 2023.

⁶ Provincial/Municipal/Regional Parks, Protected Areas, Recreation Areas and Ecological Reserves; Conservancy Areas; Metro Vancouver Watersheds; UWRs; OGMAs; and National Wildlife Areas. These forms of habitat protection do not necessarily qualify as effective protection of critical habitat under SARA. Such a determination can only be made following a Critical Habitat Protection Assessment (Environment and Climate Change Canada 2016).

Active population management

In 2007, the provincial government established a combined population management program comprised of captive breeding and Barred Owl removal, following the recommendations of the Spotted Owl Population Enhancement Team (an arm's-length independent panel). In initiating the captive breeding program, the provincial government captured a subset of the remaining wild individuals to allow a small wild population to persist (McCulligh 2019). The program released the first three captive-bred owls in August 2022. One released male was subsequently returned for veterinary care after being struck by a train. There are 31 individuals currently in captivity (Scott Barrett pers. comm. 2022). Release locations will be aligned with operational Barred Owl control (B.C. MFLNRORD 2021).

From 2007-2021, a total of 188 Barred Owls were removed from active (i.e., currently occupied) Spotted Owl territories and from proposed Spotted Owl re-establishment sites (Gillis and Waterhouse 2020; J. Gillis pers. comm. 2021). This effort reduced the number of detected Barred Owls overall, but as of 2016 had not been sufficient to overcome local re-colonization rates, meaning that annual removals were required to maintain Barred Owl absence. Predictive modelling by Yackulic et al. (2019) showed that in most study areas in the U.S.A., the probability of Spotted Owl persistence is projected to increase with increasing habitat condition, suggesting that in areas where habitat protection occurs and thus habitat condition improves over the long term, the level of investment in Barred Owl removals can be reduced over time.

In spite of the provincial government's significant efforts, the Spotted Owl population has not yet recovered, and its status remains precarious.

1.8 Habitat Requirements (CH)

The Spotted Owl requires habitat for nesting, roosting, foraging, and dispersal/safe movement. A subset of mature and old-growth stands already possess the attributes required to support these functions, and some previously-disturbed habitat has the potential to acquire the necessary attributes within the 50-year timeframe needed to meet the population and distribution objective. A portion of this habitat has been formally verified by the provincial government (through inclusion in its SOMP2 areas) and is considered by the provincial government to have a very high likelihood of supporting Spotted Owl recovery. The remainder has not been formally verified by the provincial government; this verification process is outlined within the schedule of studies to complete the identification of CH, within the draft recovery strategy. A 400m area surrounding nesting areas must also be protected from acoustic disturbance during the breeding season in order to ensure that acoustic disturbance does not result in loss of breeding habitat function.

The draft CH being identified to support Spotted Owl recovery is currently comprised of two formal subtypes:

1. **Core CH:** habitat that either already possesses, or will develop (within a 50-year period), the features required by the owls to successfully nest, roost, forage and move safely, where it overlaps with SOMP2.
2. **Acoustic CH:** habitat surrounding nesting areas that functions to maintain the acoustic environment within those areas during the breeding season.

A third subtype is described in the draft recovery strategy and will be considered for addition to core CH following verification by the provincial government:

3. **Potential future⁷ CH:** habitat that either already possesses, or is expected to develop (within a 50-year period), the features required by the owls to successfully nest, roost, forage and move safely, where it does not overlap with SOMP2.

Areas containing draft CH for the Spotted Owl are presented in Figures 4-9. Within these areas, draft CH is identified wherever a set of critical biophysical features and attributes occur (see Annex II). Activities likely to result in the destruction of that CH through compromising one or more of the critical biophysical attributes are outlined in Annex II.

⁷ There is no biological difference between core and potential future CH and both would be required in order to fully support the population and distribution objective for Spotted Owl. For the purposes of evaluating threats to the recovery of the species, both core and future potential future CH have been determined by ECCC to constitute the best available scientific information.

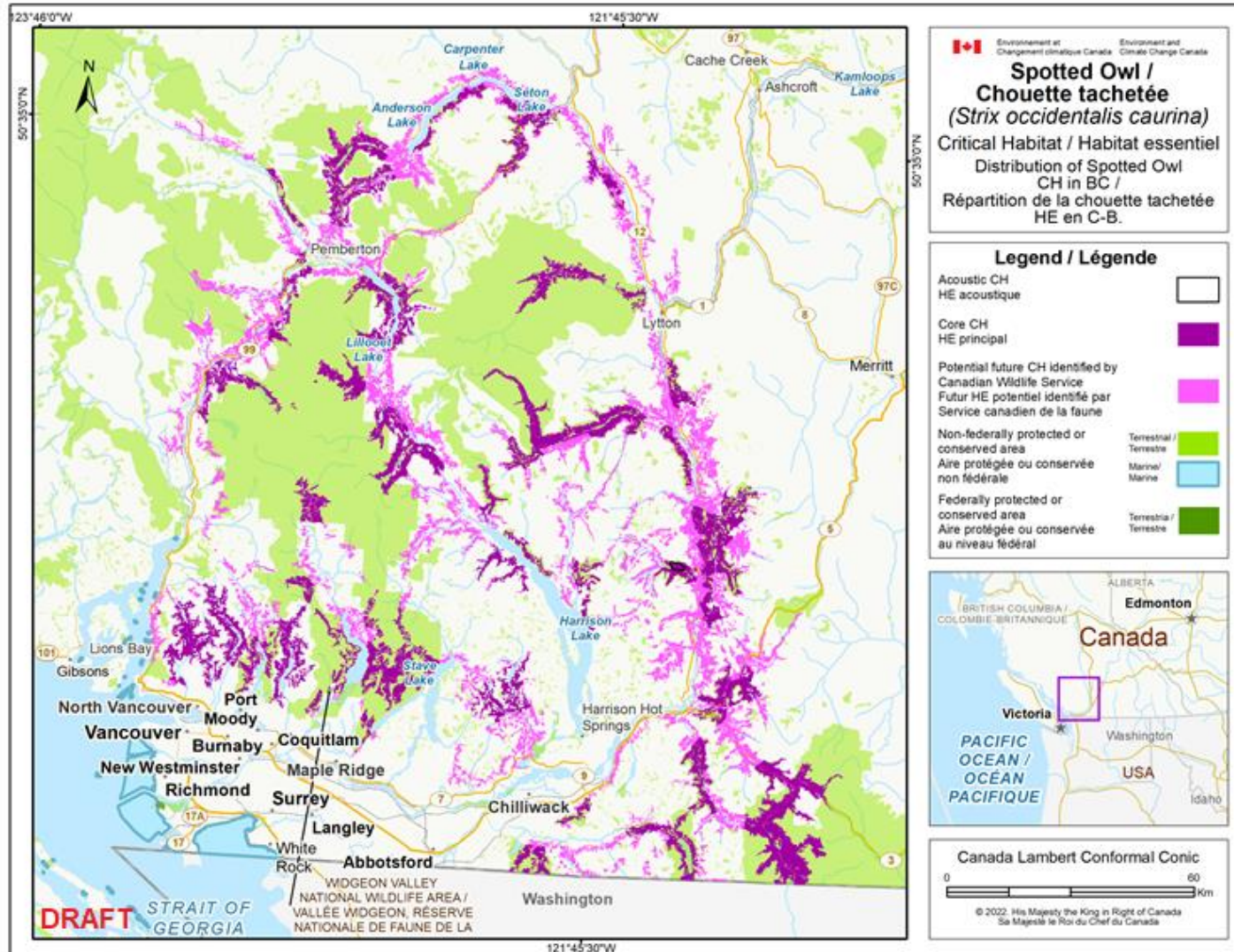


Figure 4. Overview of the draft core and potential future CH for the Spotted Owl within B.C. included in the draft amended recovery strategy. Core CH is represented by the dark purple polygons and potential future CH is represented by the light purple polygons, where the criteria and methodology are met. The area below the hatched line is the U.S.A. land base.

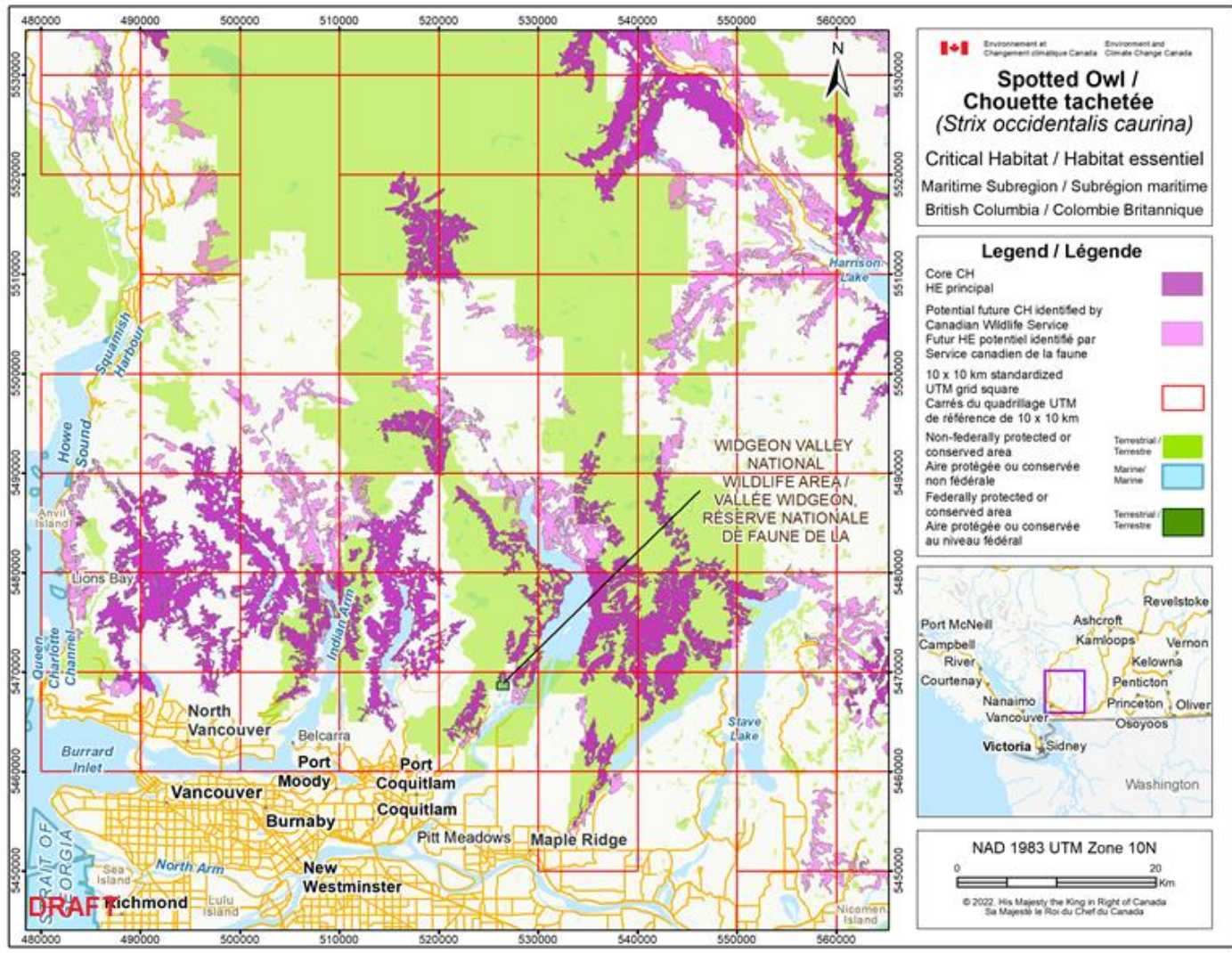


Figure 5. Draft CH for the Spotted Owl within the Maritime sub-region is represented by dark purple (core) and light purple (future potential) shaded polygons where the criteria and methodology are met. The 10 km x 10 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing CH.

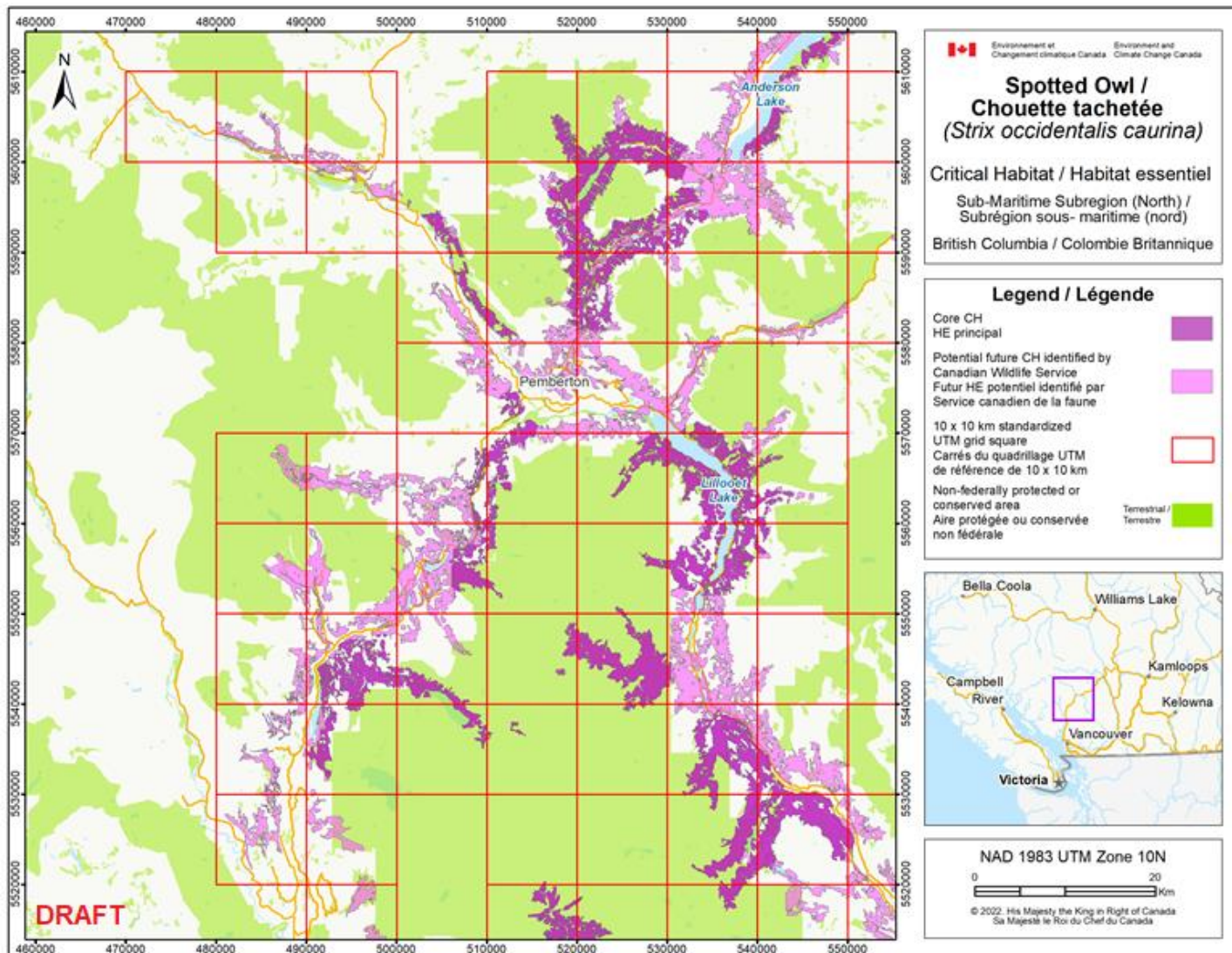


Figure 6. Draft CH for the Spotted Owl within the northern Sub-maritime sub-region is represented by the dark purple (core) and light purple (potential future) shaded polygons where the criteria and methodology set out in this section are met. The 10 km x 10 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing CH.

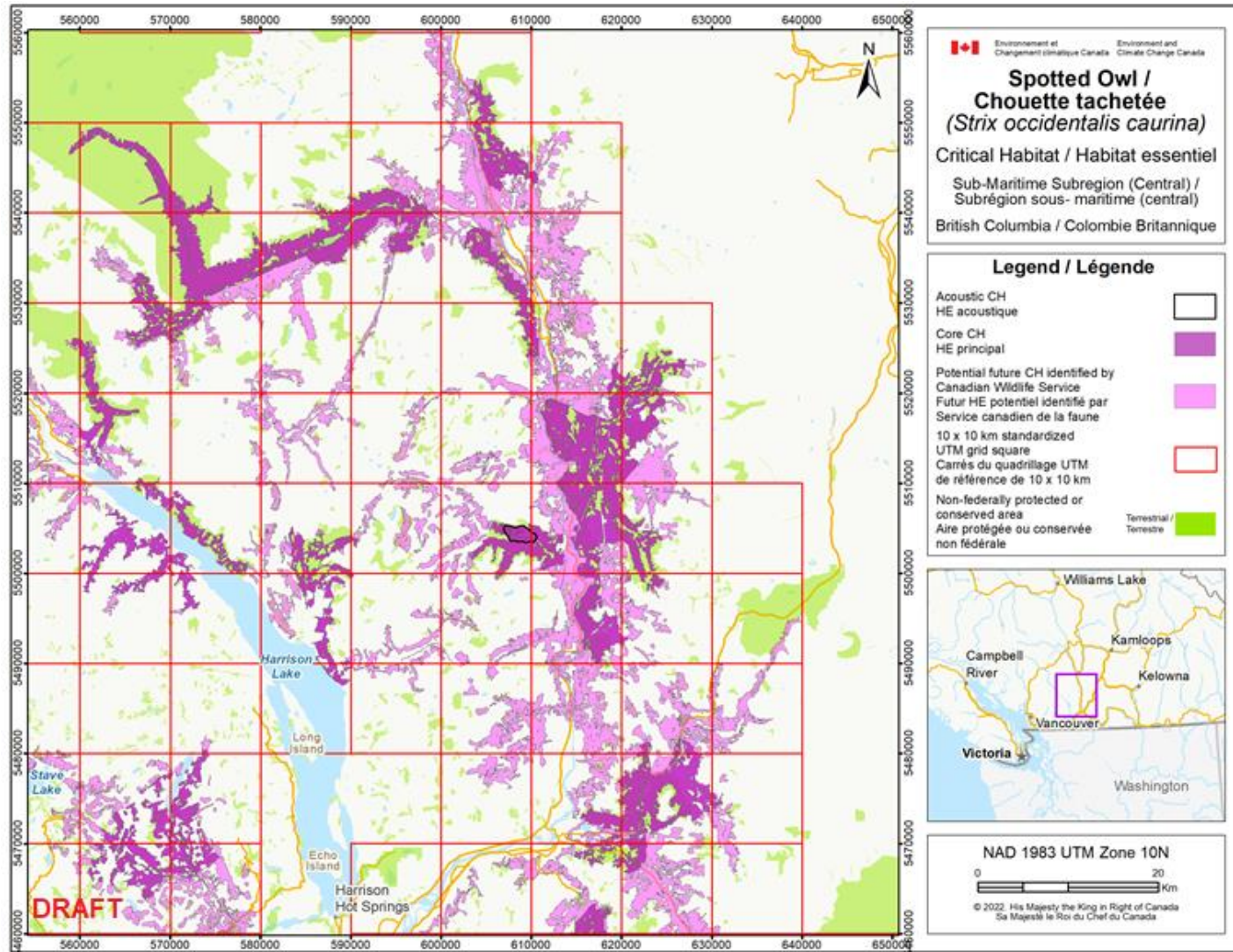


Figure 7. Draft CH for the Spotted Owl within the central portion of the Sub-maritime sub-region is represented by the dark purple (core) and light purple (potential future) shaded and black outlined (acoustic) polygons where the criteria and methodology are met. The 10 km x 10 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing CH.

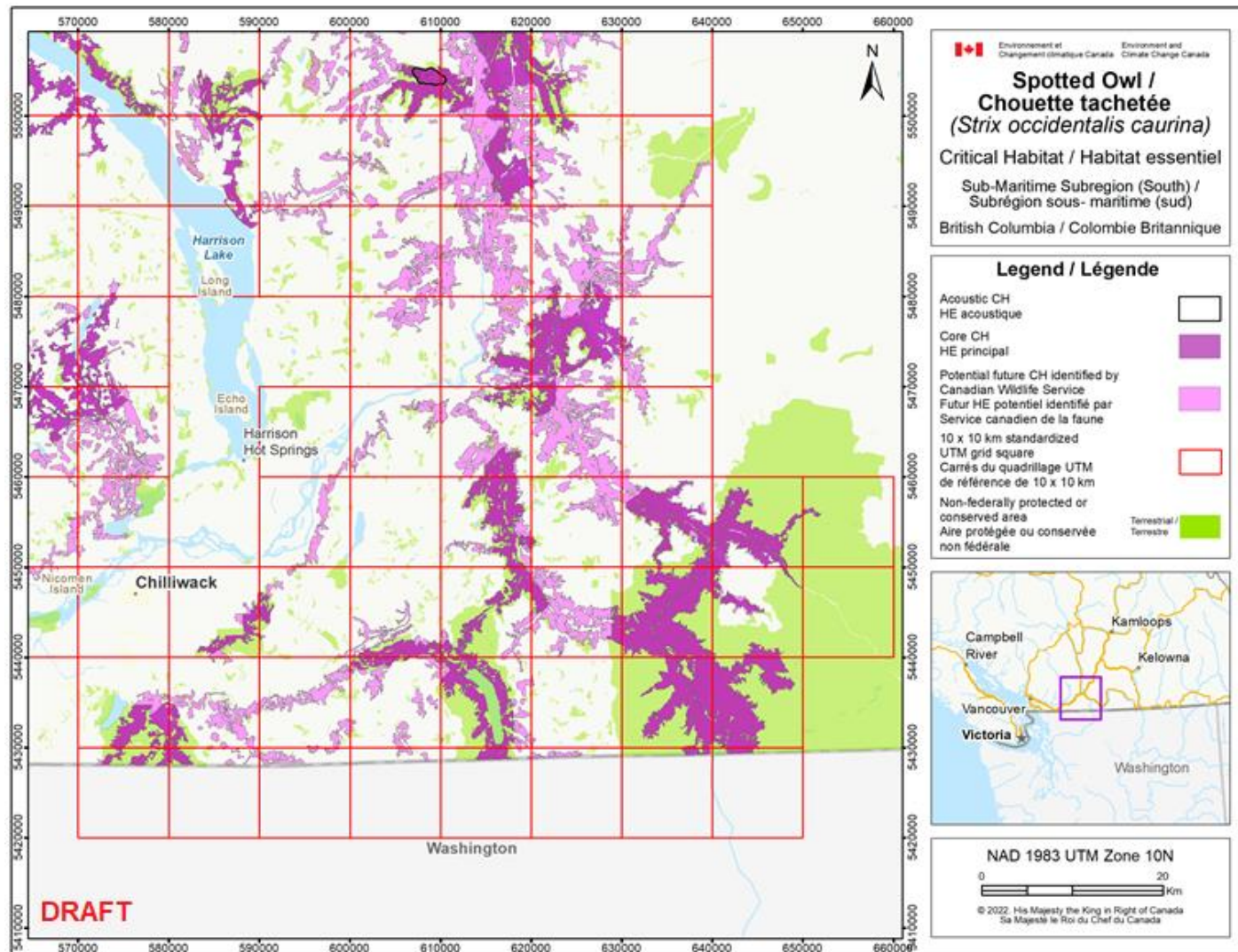


Figure 8. Draft CH for the Spotted Owl within the southern portion of the Sub-maritime sub-region is represented by the dark purple (core) , light purple (potential future) shaded and black outlined (acoustic) polygons where the criteria and methodology are met. The 10 km x 10 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing CH. The hatched line in the southern extent of the map is the border with the Continental U.S.A.

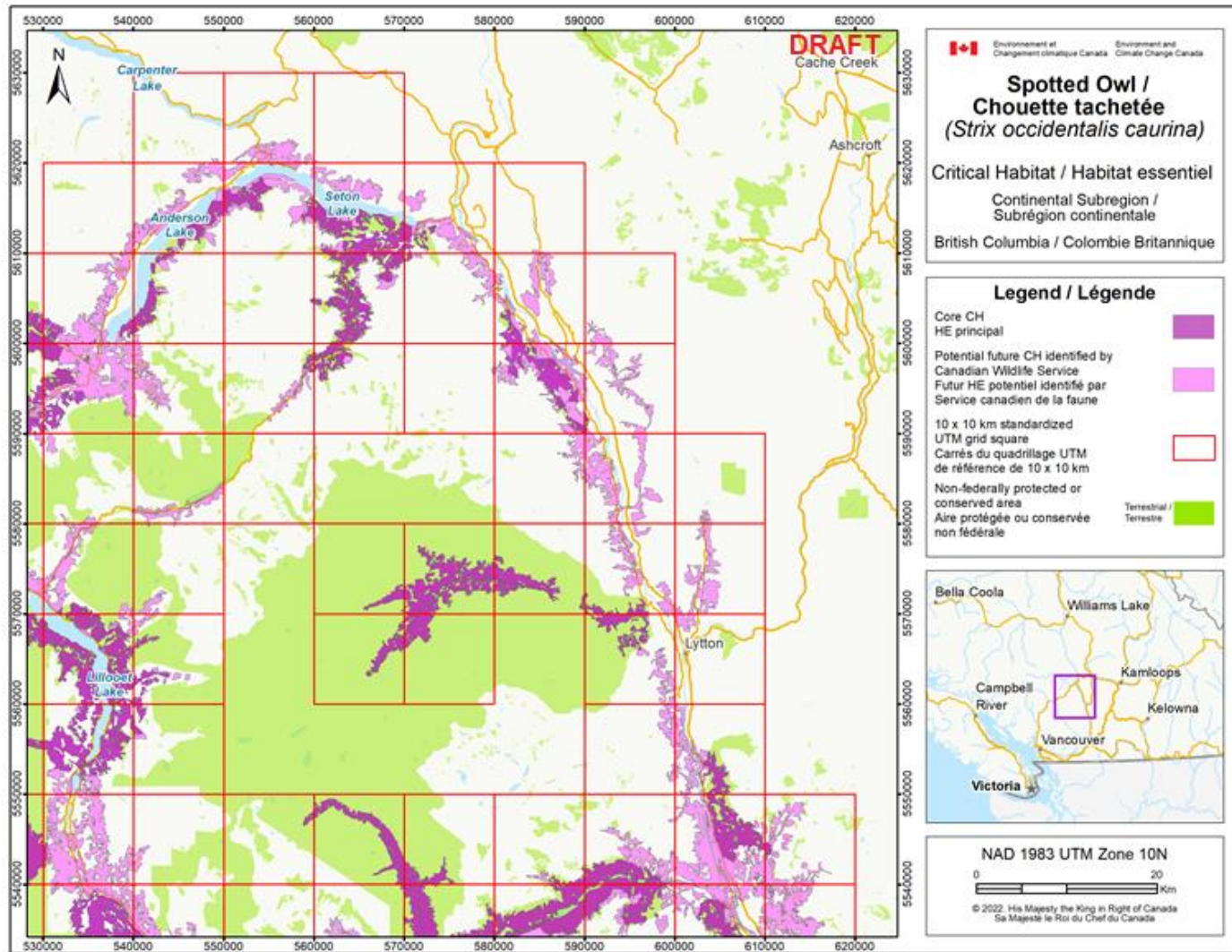


Figure 9. Draft CH for the Spotted Owl within the Continental sub-region is represented by the dark purple (core) and light purple (potential future) shaded polygons where the criteria and methodology are met. The 10 km x 10 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing CH.

Part 2: Information on the new or evolving threat

This section was informed by provincial data and correspondence with staff of the provincial government.

Information on whether cutting associated with any of the permits summarized below is currently underway was not available. Information on current resource road closures caused by washouts after severe flooding was provided by provincial government staff on November 8, 2022. Some of these washouts have the potential to temporarily restrict access to some of the cutblocks presented in this summary; however, until more information on the severity of each washout (and thus timelines for restoring access) and on potential alternative access routes to cutblocks is received, ECCC cannot evaluate the impact on the harvesting potential for these blocks within a one-year timeframe.

In addition, there are likely relevant cutblocks included in B.C. Timber Sales' (BCTS') future sales schedules for the Chinook and Kamloops business areas⁸, but this spatial data was not available (BCTS⁹ is a provincial government agency that manages approximately 20% of the province's harvest volume of Crown/public timber, generating revenue for the provincial government.)

Logging and Wood Harvest and Roads Threats:

The timber harvesting land base (THLB¹⁰) is the area of provincial Crown forested lands where timber harvesting is both legal (subject to forest management objectives and requirements) and economically feasible¹¹. The B.C. THLB is divided into 38 Timber Supply Areas (TSAs). Draft core and potential future CH for Spotted Owl is located within three TSAs: Soo, Fraser, and Lillooet. The provincial Chief Forester determines the volume of timber that can be harvested each year within a given TSA; this is termed the Annual Allowable Cut (AAC). The AAC for each TSA is apportioned across the various tenures held within that area. In the Soo, Fraser, and Lillooet TSAs, >90% of the AAC is split across Forest Licences and BCTS Timber Sale Licences where:

- Forest Licence holders, including BCTS, are authorized to harvest up to their allocated volume within the boundaries of their approved Forest Stewardship Plan (FSP). They must still apply for cutting permits before harvesting; however, cutting permit applications associated with approved FSPs *must* be approved so long as the application meets regulatory content requirements;
- BCTS auctions off its allocation in the form of pre-designated cutblocks. After winning a block at auction, the successful bidder must apply for a cutting permit, which will pass through a series of approval steps; and
- The timing of harvest is dictated by the step that the application is in within the approval process, as well as operational requirements. The majority of cutblocks included in the data provided by B.C. staff are planned to be harvested prior to November 1, 2023. In

⁸ See <https://www2.gov.bc.ca/gov/content/industry/forestry/bc-timber-sales/tsl>

⁹ See <https://www2.gov.bc.ca/gov/content/industry/forestry/bc-timber-sales>

¹⁰ In some cases, licensees may harvest outside the THLB provided they abide by applicable restrictions (e.g., general wildlife measures associated with WHAs). A thorough analysis of potentially operable areas outside of the THLB was not possible due to time constraints.

¹¹ See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/timber-tenures/community-forest-agreements/provincial_guide_for_the_preparation_of_information_packages_and_analysis_reports_for_area-based_tenures_jun_2021.pdf for details.

some cases the planned harvest date has already passed; the licensee may have decided to postpone harvest, or harvesting may be complete but the dataset has not yet been updated.

Provincial government staff provided information on active and pending cutblocks, as well as road building activities. Tables 2 and 3 summarize the areas of draft core CH and potential future CH overlapping with these authorizations.

Table 2. Summary of overlap between commercial forestry cutblocks and draft CH.

Status of Forestry Activities ¹²	Area of overlap (hectares) with draft CH within Planned Harvest Date					
	Core CH			Potential future CH		
	Apr. 1, 2019 – Nov. 1, 2022	Nov. 1, 2022 – Nov. 1, 2023	After Nov. 1, 2023	Apr. 1, 2019 – Nov. 1, 2022	Nov. 1, 2022 – Nov. 1, 2023	After Nov. 1, 2023
Pending cutblocks (proposed but not yet approved)	25.63 ha (4 blocks)	0 ha	0 ha	269.14 ha (33 blocks)	0 ha	0 ha
Active cutblocks (fully approved, logging not yet complete according to the data)	538.05 ha (38 blocks)	0 ha	0.18 ha (2 blocks)	560.36 ha (103 blocks)	24.21 ha (2 blocks)	1.9 ha (1 block)
THLB ¹³ , where new cutting permits for Forest Licenses with approved FSPs may be issued	16,251 ha (no planned harvest date at this time)			66,643 ha (no planned harvest date at this time)		

Table 3. Summary of overlap between resource road permits and draft CH.

Status of Road Building Activities	Length of overlap (km) with draft CH	
	Core CH	Potential future CH
Resource roads providing access to pending cutblocks (proposed, not yet approved road permit)	0.30 km	5.10 km
Resource roads providing access to approved cutblocks (fully approved road permit, not yet built according to the data and satellite imagery)	11.77 km	8.57 km

¹² Cutblocks associated with ski resorts and pipelines are not included in these tables.

¹³ Note that this is the area where harvesting may occur; it is not where harvesting will occur. The Forest Licence AAC allocation will be met through harvesting only a portion of this area. The AAC is volume-based and volume varies from stand to stand, therefore the actual area impacted will vary depending on where cutblocks are issued.

Utility and service lines threat:

Land clearing

Cutting permits associated with a master licence to cut under section 47.4 of the *Forest Act* have been issued to three pipeline proponents with project boundaries that intersect both core and potential future draft CH. These permits are currently active, so cutting may occur at any time.

For the Trans Mountain Expansion Project (TMEP), data from B.C. staff indicate that these cutting permits were issued between Sept 2015 and July 2021 but are not yet harvested. One cutblock overlaps with 39.28 ha of core CH and 10 cutblocks overlap with 50.88 ha of potential future CH. A Sowaqua Spotted Owl Mitigation Plan for the TMEP¹⁴ was prepared in response to condition 38 established by the National Energy Board and includes mitigation measures and offsets for a subset of the impacted area, within the Sowaqua WHA. This condition applies to the one cutblock that overlaps with core CH, since core CH is the portion of ECCC-identified CH overlapping with B.C.'s SOMP2 (which includes their WHAs). The full extent of current draft CH (i.e., the future potential CH) was not available for inclusion during the environmental impact assessment, so condition 38 does not apply to the cutblocks in this area.

Westcoast Energy has been issued cutting permits for six cutblocks that overlap with 5.19 ha of core CH and three cutblocks that overlap with 4.74 ha of potential future CH.

Fortis B.C. has been issued cutting permits for two cutblocks that overlap with 11.63 ha of potential future CH.

Acoustic disturbance

As noted in section 1.4, acute/action-generated noises can negatively impact Spotted Owl nesting behaviour and breeding success. The impacts of acute/action-generated noises need to be interpreted in the context of the ambient sound levels that the owls would otherwise be accustomed to within their breeding territory (i.e., pre-existing, continuous/recurrent sounds such as water flow or steady traffic). Acute/action-generated noises that increase sound levels by over 20 db above ambient conditions are considered significant enough to impact nesting functions (USFWS 2020). This consideration applies wherever breeding owls occur, including the Spotted Owl captive breeding facility in Langely, B.C.. This facility is not part of the draft CH; however, it contains the majority of the breeding population for the species, so acoustic disturbance at this location should be considered.

The Spotted Owl captive breeding facility is located in a rural landscape and is surrounded on all sides by agricultural lands or woodlands. The (private) Fort Langley Airport is approximately 2 km to the north; a railway and hydro-electric right-of-way run on its western edge; TMEP runs directly adjacent to the captive breeding facility to the south; and Highway 1 is approximately 2 km due south. There are no major roads or other large infrastructure immediately proximate to the site. Recognizing the acoustic sensitivity of this location, and the potential for the acute/action-generated noise associated with standard surface construction methods to elevate sound levels above the disturbance threshold, Transmountain Corporation is planning to employ the horizontal directional drilling (HDD) method, which is not expected to create surface noise or other disturbance adjacent to the captive breeding facility during pipeline construction (Scott

¹⁴ [UPDATED 2017-08-08 Trans Mountain Report Spotted Owl Condition 38 \(cer-rec.gc.ca\)](https://www2.gov.bc.ca/gov2/ce/rep/ce/000001/000001.htm)

Barrett pers. comm. 2022). However, HDD is not feasible if certain geotechnical conditions cannot be met, so test-drilling is required to assess the feasibility of HDD in each location where it is being proposed. Test-drilling to assess the feasibility of HDD along this section of the alignment has been occurring throughout October 2022, and was nearing completion at the time of writing. Active monitoring of sound levels and associated behavioural responses of the captive owls has been conducted (Scott Barrett pers. comm. 2022). In spite of several mitigation measures in place (e.g., acoustic barriers and shrouds) the 55-db disturbance threshold (calculated on the basis of recorded ambient noise levels + 20 db, per USFWS 2020) has been exceeded at the captive breeding facility on a number of days. Few behavioural responses have been observed; however, monitoring has been inconsistent/partial due to limited fields of view in the video monitoring systems being employed. There could also be physiological responses occurring that would not be detected through purely observational methods. Breeding centre staff have been collecting fecal samples for analysis of stress hormones, but this analysis has not yet been completed. If the test-drilling results indicate that HDD is not feasible, traditional (surface) construction methods will be employed. Based on the acoustic monitoring results from the test-drilling phase (continuous, 24-hour monitoring beginning on October 19, 2022) these construction activities are likely to result in sound levels that exceed the 55-db disturbance threshold.

Tourism and recreation areas threat:

Land clearing

Occupant licences to cut for the purposes of ski run creation and maintenance have been issued to Whistler and Blackcomb ski resorts, overlapping 45.49 ha of draft core CH and 967.52 ha of draft potential future CH. These licences have been in place since 2012; cutting within the areas authorized under these licences may occur at any time¹⁵.

Other threats:

There are several mining projects related to a variety of commodities (e.g. gold, copper, cobalt, platinum) overlapping draft core and potential future CH. Some of these projects may engage in fine scale exploratory development (e.g., clearing trees to make trails for exploration work) within the next 1-2 years; however, a preliminary analysis¹⁶ suggests there is no indication that any project will be undergoing significant construction in that timeframe.

Part 3: Assessment of Threats

According to the draft *Policy on Assessing Imminent Threats under Sections 80 and 29 of the Species at Risk Act – terrestrial species* (Sept 19, 2022 draft), a terrestrial wildlife species will be determined to be facing imminent threat(s) to its survival or recovery if the threat(s) identified

¹⁵ Ski run maintenance and expansion is relatively fine scale relative to the areas encompassed by these licences to cut. Although cutting will already have taken place within these areas since 2012, there is habitat remaining that has not been yet cut. However, it is very unlikely that cutting of all remaining habitat in these areas would occur within a one-year timeframe. Partial harvesting within these areas is a possibility.

¹⁶ A thorough analysis of mining project proposals was not possible due to time constraints.

would render its survival or recovery highly unlikely or impossible and cannot be eliminated or mitigated without immediate intervention.

The following questions, rationale, and applicable evidence are key considerations in supporting the Minister in forming an opinion on whether a wildlife species is facing imminent threat(s).

This assessment focuses on threats both to the current wild population of Spotted Owls (species' survival), as well as to the species' survival and recovery across its range, associated with threats to draft CH. It also evaluates threats to Spotted Owls in the captive breeding facility in Langley, B.C..

Question 1: Is the wildlife species facing a new or evolving human-induced threat(s) or is the impact of an existing human-induced threat intensifying?

Yes. There are proposed or approved cutting permits associated with commercial forestry, pipeline development/expansion, and ski resort expansion that could result in threats to draft CH within a one-year timeframe, so these threats are evolving and/or their impacts intensifying. Of these threatened draft CH areas, 1529 ha are at risk of complete harvest, 1013 ha are at risk of partial harvest, and an additional 83,000 ha have no currently-known harvesting plans but could have additional cutting permits issued within a one-year timeframe. Given the February 2023 expiry of the deferral on forest harvesting in the Spuzzum and Utzlius watersheds, this includes threats to the extant wild population (Annex III).

For the purposes of this assessment, threats are categorized on a continuum from very high (greatest potential) to low (least potential) on the basis of their potential to occur within a one-year timeframe (Table 4). This timeframe is used because:

1. the majority of planned harvest dates for currently-known cutblocks fall within this period;
2. it captures both cutblocks where forestry authorizations are fully in place and harvesting could occur any time after the planned harvest date, as well as potential additional cutting permits that could be issued for areas within an approved FSP (for which no further regulatory hurdles remain);
3. it makes no assumptions about the time of year when harvesting may occur (acknowledging that winter harvesting is pursued in some parts of southern B.C.); and
4. it includes the sensitive breeding period for owls in captivity (February 1st – July 31st), when acute acoustic disturbance could result in reduced productivity.

Very high – the threat may already be occurring

High – the threat has high potential to occur within a 1-year timeframe

Medium – the threat could occur within a 1-year timeframe, but there is uncertainty

Low – the threat has low potential to occur within a 1-year timeframe

Table 4. Summary of the potential for each of the threats to occur within the 1-year assessment timeframe.

Status of Activities	Potential for Threat to Occur Before November 2023
Commercial forestry - Fully approved cutblocks or roads with planned harvest dates before Nov. 2023	Very High
Pipeline and ski resort expansion – Licences to cut that are already issued	Very High
Commercial forestry - Proposed / pending cutblocks or roads with planned harvest dates before Nov. 2023	High
Commercial forestry - Cutblocks included in sales schedule for potential BCTS license, not yet sold	Medium - High
Commercial forestry - THLB ¹¹ , where new cutting permits for forest licensees with approved FSPs may be issued	Medium - High
Commercial Forestry – Fully approved cutblocks or roads with planned harvest dates after Nov. 2023	Low - Medium
Commercial forestry - Proposed / pending cutblocks or roads with planned harvest dates after Nov. 2023	Low
Mines and mineral exploration – Projects with no indications of nearing operational phase	Low

Only the threats assessed as having a high to very high potential to occur within a 1-year timeframe are included below.

Question 2: Will the impact of the threat(s) make:

a. Survival of the wildlife species highly unlikely or impossible?

b. Recovery of the wildlife species highly unlikely or impossible?

- a) Yes. Potential resumption of logging and logging-related traffic in the Spuzzum and Anderson/Utzlius areas, should the current deferral not be renewed in February 2023, will re-establish threats to the wild individuals, such that survival of the species is highly unlikely (Annex III).

The Spuzzum and Anderson / Utzlius Creek watersheds support the last three Spotted Owls known in the wild in Canada. Only one of the three owls detected in the wild during the previous assessment (Annex III) has been detected in 2022; the other two owls currently in the wild were released in August 2022. The species remains on the brink of extirpation. All remaining individuals, both those in the captive breeding program and those in the wild, are important to the survival of the species.

Each new threat that has the potential to impact the remaining individuals in the wild (e.g., new habitat destruction and disturbance) impacts the survival of the species and this will continue to be the case until the population has recovered (through a combination of successful reintroduction and continued survival/reproduction of the wild population) to a point that it is large enough to be able to withstand impacts at the individual/site level.

Survival of the individuals currently in the wild can be compromised by road and railway mortality and by habitat disturbance and destruction. Road mortality has been reported in Spotted Owls in the U.S.A. and one of the three captive-bred Spotted Owls released in August 2022 was struck by a train. Loss and fragmentation of foraging habitat can also lead to poor body condition, making Spotted Owls susceptible to starvation or predation. In habitats fragmented by forest harvest, Spotted Owls may be more likely to encounter their primary predator, the Great Horned Owl. In these fragmented habitats, they are also more likely to experience competitive pressure from Barred Owls.

At this time there do not appear to be threats that are likely to compromise survival of the captive individuals. Acoustic disturbance, such as that observed at the captive breeding facility during TMEP construction, impacts Spotted Owls through altering their breeding success, but has not been shown to impact adult survival.

- b) Yes. Threats that have a high to very high potential to occur before November 2023, notably commercial logging, pipeline construction, and ski resort expansion, will alter the amount and configuration of habitat available for Spotted Owl such that recovery within a 50-year timeframe is highly unlikely.

The current draft amended federal recovery for Spotted Owl (currently assessed as Endangered) defines the species' recovered state as being associated with an assessed status of Threatened. Moving instead to a status of Extirpated, should the survival of the remaining wild individuals be compromised, would be a move away from a recovered state.

Recovery is also defined by the population and distribution objective of *restoring a stable population of at least 250 mature individuals distributed within a connected network of habitat representative of all three sub regions within the species' historical Canadian range, and linked to the larger population in the U.S.A.* Although the area of habitat that either already possesses, or will acquire the correct VRI characteristics to support Spotted Owls within the 50-year recovery timeframe is >530,000 ha, much of this habitat does not meet the patch size, quality and configuration requirements to support all critical life functions for a recovered population of >250 mature individuals (125 pairs). A specific amount and configuration of currently suitable and regenerating habitat (416,000 ha) was selected as draft CH in order to support the population and distribution objective. This includes 125 functional home ranges (where there is currently, or will be, a sufficient amount and configuration of nesting and foraging class habitat to support an energetically viable home range), as well as a network of connecting habitat to support safe dispersal.

In total there are 2542 ha of known cutblocks and 26 km of associated roads overlapping draft CH that have a high to very high potential to be at least partially harvested/constructed within a one year timeframe (core CH: 654 ha of cutblocks and 12 km of roads; potential future CH: 1888 ha of cutblocks and 14 km of roads). Of these threatened draft CH areas, 1529 ha are at risk of complete harvest and 1013 ha are at risk of partial harvest. The timber harvesting land

base covers >83,000 ha of additional draft CH, within which additional cutting and road permits could be issued¹⁷ prior to November 2023 (core CH: 16,251 ha; potential future CH: 66,643 ha). In straight area terms, 2542 ha is equivalent to the area required to support approximately one Spotted Owl home range (i.e., reducing the potential recovered Spotted Owl population by at least one pair). However, the impacts on survival and recovery associated with loss of CH cannot be interpreted on the basis of straight area. Cutblocks distributed throughout the draft CH are likely to reduce habitat patch sizes and introduce fragmentation effects within multiple home ranges, such that those home ranges may no longer be energetically viable (particularly when considering competitive pressure from Barred Owls). Cutblocks distributed through dispersal corridors are also likely to reduce foraging opportunities, increase competitive pressure from Barred Owls, and increase exposure to predators, such that successful dispersal may no longer be possible. The CH impacts associated with the threats that have a high to very high potential to occur prior to November 2023 should be considered likely to alter that critical amount and configuration of habitat such that achieving 125 pairs is no longer possible. Given Spotted Owl's requirements for features and attributes associated with old growth forests, once lost, this critical amount and configuration of habitat cannot be replaced within less than a 140-year timeframe.

In addition to critical habitat, the captive breeding program is an essential element to the recovery strategy of the species. Acoustic disturbance associated with test-drilling for TMEP adjacent to the captive breeding facility has generated noise above threshold levels on a number of days. Acoustic disturbance has the potential to compromise successful reproduction and therefore impact the species recovery (see section 1.4 and Part 2). Based on the known and predicted number of breeders, egg fertility, and hatching success, it is estimated that one year of compromised reproductive output could cost two future breeders for the captive breeding program plus up to five release candidates. However, it cannot be determined at this time that acoustic disturbance at the breeding facility would make recovery within a 50-year timeframe highly unlikely: 1) monitoring has not demonstrated that there are significant behavioural responses in the captive owls, and further testing is required to confirm physiological responses; 2) it is not possible to determine whether one year of reduced reproductive output would result in the 50-year population and distribution objective becoming unachievable; and 3) acoustic disturbance has stopped and Transmountain Corporation is planning to employ the horizontal directional drilling (HDD) method, which would mitigate the risk of acoustic disturbance. The Department will continue to monitor whether construction mitigation measures will be effective, whether Transmountain Corporation can employ alternative construction methods, and the impact of noise levels on captive owls.

¹⁷ This is the area where these permits could be issued, not the area that will be harvested. The AAC allocated to Forest Licences will be met via harvesting only a portion of this area.

Question 3: Do the threats require immediate intervention beyond existing protection measures?

Yes. There are no provincial protection measures currently in place that would prevent the threats to draft CH associated with commercial forest harvest or cutting for the purposes of recreation or for pipeline expansion from occurring before November 2023.

Although draft core CH is included within WHAs legally established for the species, as discussed in the Provincial Measures subsection, the general wildlife measures associated with MFHA WHAs for Spotted Owl allow for some ongoing forest harvesting activities. Ninety six percent of core CH overlapping with proposed or approved cutblocks is located within these 'conditional harvest' MFHAs WHAs. Although the general wildlife measures associated with 'no harvest' LTOHA WHAs generally prohibit forest harvesting, provincial decision makers have discretion to allow for some boundary adjustments to accommodate operational constraints. There are currently four authorized cutblocks overlapping 27.2 ha of draft CH within LTOHAs.

Based on available information on approvals status and planned harvest dates, the majority of the cutblocks associated with commercial forestry and pipeline and ski resort expansion that were assessed would fall into the 'high to very high potential to occur' categories. Cutting for the purposes of ski run development and maintenance within Whistler and Blackcomb is already authorized and could occur at any time. Cutting for the purposes of TMEP construction is also fully authorized and could occur at any time. Fully approved cutblocks, cutblocks that are included in the sales schedule for a potential BCTS TSL, and proposed but not yet approved cutblocks with planned harvest dates prior to November 2023 have a very high potential to be harvested within the next year, depending on licensee plans and operational considerations. Cutting permits for Forest Licensees with approved FSPs also have a high potential to be issued within the next year within the remainder of CH overlapping with the THLB. Resource road construction would precede the harvesting of each of these cutblocks.

Given that the noise associated with TMEP construction has now stopped and alternative construction methods are being considered to address the potential for acoustic disturbance, intervention is not needed at this time. However, ongoing monitoring of the situation will be required to determine whether alternative construction methods will be employed and, if so, whether they will mitigate the threat of acoustic disturbance.

Summary

Based on its assessment of the best available information, ECCC is of the view that the Spotted Owl is facing imminent threats to both survival and recovery.

Imminent threats to survival:

- The Spuzzum and Anderson / Utzlius Creek areas support the last three Spotted Owls known to remain in the wild in Canada. Two of these owls were only released into the wild in August 2022, and the species remains precariously on the brink of extirpation. Forest harvesting and associated logging-related traffic are known to negatively impact Spotted Owls through habitat loss and fragmentation, disturbance, and mortality.

- The risk of threats to the survival of the wild individuals is currently mitigated by a provincial deferral of logging in the Spuzzum / Utzlius Creek watersheds that is in place until February 28, 2023. However, should the deferral not be extended and logging and associated activities resume in the area, the threat would render the survival of the species highly unlikely.

Imminent threats to recovery:

- Although the area of CH that is likely to be harvested/cleared over the next year (1529 ha that are at risk of complete harvest, 1013 ha are at risk of partial harvest, plus additional potential cutblocks associated with approved Forest Stewardship Plans within the timber harvesting land base) accounts for a small percentage (~1%) of the overall draft CH, the impacts of the loss of this habitat on the recovery of the species extends beyond the area where the harvesting occurs. One cutblock can result in a larger surrounding area losing the attributes required to support recovery (e.g., through habitat fragmentation that reduces prey availability and increases exposure to predators and competitors). Therefore, the complete or partial logging of 2542 ha distributed in a patchwork across the draft CH would have far-reaching effects by altering the amount and configuration of habitat such that achieving >250 mature individuals would no longer be possible.
- There are currently no measures in place to address these threats, as existing provincial protection measures do not apply to any of the 2542 ha of draft CH that have a high to very high potential to be completely or partially harvested within the next year.
- Though the Department found that there is no imminent threat to recovery at this time, acute/action-generated noise in the area adjacent to the captive breeding facility has the potential to negatively impact nesting functions and reduce breeding success, reducing the number of owls that will be released over the coming years and further reducing the likelihood of recovery within the 50-year timeframe. To mitigate this impact during construction of the TMEP, Transmountain Corporation is currently examining the feasibility of employing the less-disruptive horizontal direct drilling method of pipeline construction. The timeline for the results from test-drilling are not known at the time of writing. If test-drilling results reveal that horizontal direct drilling it is not feasible, and there is no provincial authority in place to require Transmountain Corporation to delay construction until after the 2023, then acoustic disturbance during the breeding season could occur.
- Breeding centre staff have been examining the impact of acoustic disturbance on captive owls. Few behavioural responses have been observed; however, monitoring has been inconsistent/partial due to limited fields of view in the video monitoring systems being employed. There could also be physiological responses occurring that would not be detected through purely observational methods. Breeding centre staff have collected fecal samples for analysis of stress hormones, but this analysis has not yet been completed.

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ANNEXES

ANNEX I – Description of Threats from draft amended Recovery Strategy

Very High Impact Threats

IUCN 8.2 – Problematic native species

The Barred Owl is native to eastern Canada but has expanded its range westward and southward. This is hypothesized as being a consequence of human activities that either directly or indirectly resulted in the introduction of trees across the previously tree-less prairie regions of central North America, e.g., through European settlers excluding fires historically set by First Nations, suppressing wildfires, extirpating American Bison (*Bison bison*), and planting trees (Livezey et al. 2009a&b). In the 1960s Barred Owls began to overlap the range of the Spotted Owl in B.C. (Campbell et al. 1990; Dunbar et al. 1991). Barred Owls were detected at all 10 of the previously-occupied Spotted Owl survey sites visited in 2019 (J. Gillis pers. comm. 2019). They have also been detected extensively along general owl survey routes throughout the Spotted Owl's historical range. Barred Owls thrive in a variety of forest types and seral stages and have adapted to more varied food sources than have Spotted Owls (Livezey et al. 2009a&b; Wiens et al. 2014; Diller et al. 2016; Dugger et al. 2015). Barred Owls threaten the Spotted Owl primarily through competition for habitat and prey (Dugger et al. 2011). This resource competition and competitive displacement has been found to reduce Spotted Owl fecundity and recruitment, leading to overall population declines (Jenkins et al. 2021). Hybridization and predation have also been observed on rare occasions (Leskiw and Gutiérrez 1998; Kelly and Forsman 2004); however, these are not considered serious threats (USFWS 2011).

In recognition of the severity of this threat, Barred Owl control programs have been initiated within the range of both the American and Canadian Spotted Owl populations (Diller et al. 2016; Dugger et al. 2015; Gillis and Waterhouse 2020; Wiens et al. 2021). American programs have employed lethal removal and the B.C. program has employed a combination of translocation and lethal removal. Results from Barred Owl removal studies have varied with more immediate success at the southern edge of the range and slower results at the northern edge of the range. In California, the annual Spotted Owl population growth rate four years after (lethal) removals was 1.029 (increasing) on removal sites versus 0.870 (declining) on control sites (Diller et al. 2016), and in Oregon and Washington, increases in Spotted Owl occupancy and fecundity and decreases in local extinction rates were observed 4.5 years following Barred Owl removals (Wiens et al. 2021). However, a longer lag time was observed in the more northern sites in Oregon and in Washington (Wiens et al. 2021) and in B.C. (lethal and non-lethal) removal efforts have not yet been sufficient to offset Barred Owl recolonization rates, meaning that repeated removal efforts are required in order to maintain absence (Gillis 2016a&b; Gillis and Waterhouse 2020).

Diller et al. (2016) suggested that Spotted Owl populations further north may experience slower recovery following Barred Owl removal because Barred Owl populations are more well-established (so require more intensive and sustained removal efforts to overcome recolonization by floaters/dispersers) and Spotted Owl populations are too small to recover

quickly (fewer floaters/dispersers waiting to take up available territories). The supplementation of the B.C. Spotted Owl population through re-introduction may counter this effect.

Supplemental feeding of released individuals may also bolster post-release survival. Predictive modelling by Yackulic et al. (2019) showed that in most study areas in the U.S.A., the probability of Spotted Owl persistence is projected to increase with increasing habitat condition, suggesting that in areas where habitat protection occurs and thus habitat condition improves over the long term, the level of investment in Barred Owl removals can be reduced over time. Without habitat protection, a high level of investment in Barred Owl control would need to be sustained in perpetuity. It is currently unknown whether this threat can be mitigated or avoided to the extent that Barred Owl removals can be completely ceased (Bodine and Capaldi 2017). Research and adaptive management will be required to determine if and how threats from Barred Owl can be effectively addressed over the long term and thus whether a recovered Spotted Owl population can be sustained in the absence of ongoing Barred Owl control.

IUCN 5.1 – Hunting and collecting terrestrial species

With the publication of the 2020 Spuzzum nesting site via the 2020 Ecojustice petition, the owls in the Spuzzum watershed are at risk of persecution. This occurred in the U.S.A. when Spotted Owl nesting locations were discovered by the public (Ian Blackburn pers. comm. 2020).

IUCN 5.3 – Logging and wood harvesting

Logging has had severe impacts on Spotted Owl survival and distribution across its range, including through direct loss of old forest habitat (loss of nesting, roosting, and foraging habitat attributes) and fragmentation (COSEWIC 2008, Chutter et al. 2004). It continues to be an important threat to the survival of the remaining wild owls in Canada and their future recovery. The primary impact of forestry-related habitat fragmentation appears to relate to foraging energetics (reviewed in Courtney et al. 2004). As foraging patches become more dispersed following forest harvest, they may no longer be accessible within an individual's energetic budget, and so the individual may starve or be forced to disperse to a new location (Sovern et al. 2014; Jenkins et al. 2019). Further, as residual patches become smaller and more irregular, they may no longer be able to support adequate numbers of the Spotted Owls' preferred prey species. Additional impacts of logging can include noise disturbance associated with logging operations, when operations take place within 400 m of nesting areas (Wasser et al. 1997, Hayward et al. 2011, USFWS 2020). The conversion of the landscape from old-growth coniferous forest to other habitat types may also increase the exposure of Spotted Owls to their primary predator, the Great Horned Owl (Johnson 1993). Competitive pressure may also be greater within harvested landscapes as Barred Owls are better able to adapt to the more varied seral stages and food sources present in harvested landscapes than are Spotted Owls (Hamer et al. 2007; Wiens et al. 2014; Yackulic et al. 2019).

Improved forestry practices on Crown Land under the *Forest and Range Practices Act* as well as Spotted Owl-specific habitat protection initiatives under the Spotted Owl Management Plans (1 and 2) and temporary forestry deferrals in 2021 have partially reduced forestry impacts on Spotted Owl and other old forest-dependent species by requiring or promoting the retention of veteran trees, snags, and riparian areas; reducing cut block size; increasing retention area size; and providing some measure of habitat protection for tracts of old forest through the designation of WHAs, Old Growth Management Areas (OGMAs) and Ungulate Winter Ranges (UWRs) (Government of B.C. 2009b). However, a large amount of nesting and foraging class habitat within the Spotted Owl's range still falls within the unprotected portions of the Timber Harvesting

Land Base (THLB), and harvesting continues to both remove and isolate habitat within these areas.

Medium Impact Threats

IUCN 4.1 – Roads and railroads

Spotted Owl nesting habitat is located within low-land forests where there has been increasing concentration of roads for logging and other purposes. Major railway corridors also fall in these areas. Road-building and expansion results in direct and often permanent habitat loss through eliminating old forest habitat within the immediate road surface and managed right-of-way. Roads and railways also expose individuals to risk of collisions (Scott Barrett pers. comm. 2022; Forsman et al. 2002), and noise disturbance from road and rail traffic can increase individual stress levels and reduce reproductive output when it occurs near nesting areas (Wasser et al. 1997, Hayward et al. 2011) as well as potentially altering nesting behaviours (USFWS 2020). Great Horned Owls may also be more prevalent along linear corridors such as roads and railways, putting Spotted Owls at greater risk of predation when these features transect their habitat (Johnson 1993). Road-building will continue to accompany resource extraction/development activities (e.g., forest harvesting). New rail lines are not being planned within the Spotted Owl range.

IUCN 4.2 – Utility and service lines

As with roads, habitat clearing associated with utility and service line construction (which includes pipelines) will result in some direct habitat loss and the linear edge habitats created could impact prey populations and increase predator exposure. There is currently one major pipeline project, the TMEP, which, once fully constructed, will bisect the southern portion of the species' range. Any Spotted Owls nesting or foraging within the vicinity of utility or service lines during construction or maintenance could also be disturbed by machine noise. This noise disturbance also applies to the owls in the captive breeding centre in Langley, which is directly adjacent to the TMEP, where construction has been ongoing since October, 2022.

IUCN 7.1 – Fire and fire suppression

Within the drier Sub-maritime and Continental sub-regions, vigorous fire protection by the B.C. Forest Service between the 1960s and 1990s extended fire return intervals well beyond their historical range, creating an accumulation of woody fuels, which can lead to more intense, stand-replacing wildfires (ESTR Secretariat 2014). Within the American portion of the range, Davis et al. (2016) estimated that 191,900 ha of nesting and roosting habitat on federal lands had been lost to wildfires between 1994 and 2013, four times the amount of habitat that was harvested. A similar analysis in the Canadian portion of the species' range by the Canadian Wildlife Service using annual fire disturbance mapping from 1985 to 2015 (Hermosilla et al. 2015a&b, 2017), indicated that 47,915 ha of forests within the areas classed as suitable for the Spotted Owl has been detectably¹⁸ impacted by fire across that 30-year period, primarily within the drier Sub-maritime and Continental sub-regions, with annual burn areas as large as 4156

¹⁸ Fire impacts were significant enough to result in changes to the forest canopy that could be detected within satellite imagery.

ha. Fire impacts are expected to increase in the Spotted Owl range under climate change (reviewed in Spies et al. 2018).

Low Impact Threats

The following threats were assessed as low impact to the species at the scale of the species' historical range. The impacts of any of these threats may be more significant at a site-specific scale.

IUCN 1.1 – Housing and urban areas & IUCN 1.2 – Commercial and industrial areas

Historically (prior to the 1930s), urbanization (and associated commercial and industrial development) resulted in broad-scale loss of mixed-coniferous forests throughout the Lower Mainland (Boyle et al. 1990) as well as portions of the Lower Fraser Valley where agricultural development did not predate urbanization. However, most old forest habitat within range of these population centers has now been converted to urban areas (Chutter et al. 2004; Sutherland et al. 2007), so this is not expected to represent a significant, broad-scale threat in the next decade.

IUCN 1.3 – Tourism and recreation areas

Several large ski resorts exist within the Maritime sub-region in areas with habitat for the Spotted Owl. Expansion of resort infrastructure within existing ski areas could lead to additional, localized, habitat loss. Planning is also underway for one new ski resort in the Sub-maritime sub-region, although proposed development is largely within the footprint of an existing mine, so additional habitat impacts may be minimal. Use of provincial parks and other accessible Crown lands within all three sub-regions has also increased dramatically in the last decade (B.C. Parks 2018; J. Hirner, pers. comm. 2020), creating pressure to expand trails and park infrastructure into potential Spotted Owl habitat. Acoustic threats from helicopter activities (both industrial and recreational), particularly during breeding, may also impact Spotted Owls. However, this threat applies to a relatively small percentage of the species' range, so the overall impact is assessed as low.

IUCN 3.2 – Mining and quarrying

Mining and mineral exploration activities are uncommon in the Spotted Owl range; however, because they are exempt from the prohibitions on forest harvest under the General Wildlife Measures in WHAs (Government of B.C. 2012), such activities have the potential to cause habitat loss even in areas under timber harvest constraints. Any Spotted Owls nesting or foraging within the vicinity of mining or quarrying operations could also be disturbed by operational noise. However, this threat applies to a relatively small percentage of the species' range, so the overall impact is assessed as low.

IUCN 6.1 – Recreational activities

Backcountry recreation use has increased dramatically within Southern B.C. Visitor numbers at B.C. Parks in southern regions increased by 60% between 2007 and 2017 (B.C. Parks 2018). Recreational use of other accessible Crown lands has also increased dramatically in the last decade (J. Hirner, pers. comm. 2020). As more backcountry users visit parks and recreation areas where Spotted Owls nest, the potential for human disturbance increases. Motorized recreation, in particular, could disturb Spotted Owls nesting in the vicinity of recreational

trails/areas. However, this threat applies to a relatively small percentage of the species' range, so the overall impact is assessed as low.

Negligible and Unknown Impact Threats

Eleven individual threats or complete IUCN threat categories were classified as having a negligible impact on the Spotted Owl based on limited spatial overlap with the species' range and habitat and/or no anticipated impacts within the 10-year IUCN-CMP assessment timeframe.

A further five threats were classified as having unknown impacts within the 10-year assessment timeframe; most related to climate change. Climate change impacts could be significant, particularly within the 50-year recovery timeframe, but there remains considerable uncertainty around the direction and magnitude of climate change-mediated shifts in weather, natural disturbance, and forest health within the Spotted Owl range, as well as the likely response of Spotted Owls to those changes (reviewed in Courtney et al. 2004; Spies et al. 2018).

A comprehensive review of climate modelling research has been undertaken for the Northwest Forest Plan (in the U.S.A.), which is focused on management of old-growth forests for Spotted Owl recovery (Spies et al. 2018). Most models assessed within that review project that the region will experience warmer, drier summers and potentially warmer and wetter winters. Conditions are projected to exceed the 20th-century range of variability by the 2050s. These predictions are supported by modelling that also covers the Canadian portion of the Spotted Owl's range (Wang et al. 2016). A comprehensive analysis of Spotted Owl survival and recruitment in relation to predictors including climate (Dugger et al. 2015) found an association between climate variables and both juvenile recruitment and adult annual survival. Recruitment was lowest when conditions during the previous winter were cold and wet, and highest when the previous winter was cold and dry. Observed survival rates were higher when winters were relatively warmer and drier. Summer temperature extremes could also impact recruitment rates; the heat dome of 2021 had significant impacts on juveniles in the fledge stage (J. Gillis, pers. comm. 2021). However, given that predicted temperature and precipitation patterns under climate change could lead to both positive and negative changes to different demographic rates, it is difficult to generate an overall prediction of how Spotted Owl populations may be impacted.

When it comes to habitat impacts from climate change, lower elevation, moist vegetation zones (e.g., those within much of the Maritime sub-region in Canada) are expected to experience decreased growth and productivity, especially where tree species are already water limited during the growing season (reviewed in Spies et al. 2018). Within drier forests (e.g., those within the Continental sub-region and some portions of the Sub-maritime) most models predict an increased role of fire, including more area burned and larger patches of high-severity fire (reviewed in Spies et al. 2018; Price and Daust 2016), which will increase the rate of fire-related habitat loss, relative to past decades (e.g., see IUCN-CMP 7.1, above). A preliminary assessment of anticipated climate change vulnerability for a number of species in B.C. was conducted in 2016 (Price and Daust 2016). Although the Spotted Owl was not amongst the species assessed, other old forest-associated species with similar ranges were assessed as having moderate-high climate change vulnerability, primarily due to increased climate change-mediated natural disturbance within their old forest habitats.

Although it is difficult to predict the full magnitude of climate change-mediated impacts on Spotted Owls and their habitat, it is possible to anticipate and implement strategies for reducing/mitigating those impacts whilst contributing to national and global solutions towards climate change mitigation. Old-growth forests have the potential to buffer local warming, and

thus function as local refugia for species reliant on cooler conditions (Spies et al. 2018; Dinerstein et al. 2019). In addition, many old forests, including those known to support nesting for Spotted Owls, have reached an advanced age without being impacted by stand-destroying disturbance because they exist within areas that are naturally less prone to catastrophic disturbances such as fires (e.g., moist riparian zones, cooler/more shaded aspects; Krawchuk et al. 2020; USGS 2021; Lesmeister et al. 2021). As such, on a local level, these existing old forest patches should be less likely to experience disturbance (than the surrounding matrix) under climate change and function as microrefugia, enabling species to persist and recolonize even as average disturbance rates increase.

On a broader scale, landscapes dominated by old forests are also predicted to exhibit relatively low climate sensitivity (compared to landscapes dominated by younger forest) and act as macrorefugia (Thom et al. 2019). Within B.C., there is significant spatial overlap between the low-elevation old-forest-dominated habitat throughout the Spotted Owl range and landscapes with high predicted climate change resilience and macrorefugia potential (Beckers and Carroll 2020). In their 2016 climate change vulnerability assessment, Price and Daust recommended maintaining “sufficient old forest habitat to buffer changes in temperature and moisture and allow for dispersal” and “to maintain sufficient habitat as disturbance rate increases” as strategies to mitigate the effects of climate change for other old forest-associated species. They also recommended maintaining “landscape connectivity noting that natural landscapes provide the best opportunities for dispersal”. Ensuring protection of highly-connected networks of old-forest Spotted Owl habitat, which could function as refugia in an increasingly disturbance-prone landscape, will be an essential component of mitigating climate change-mediated disturbance and maintaining climate change resilience for Spotted Owls and other forest-dependent species (Gayton 2008; Spies et al. 2018; Thom et al. 2019; Krawchuk et al. 2020; USGS 2021; Lesmeister et al. 2021).

ANNEX II - Functions, biophysical features, and attributes of draft Spotted Owl CH and activities likely to result in its destruction from draft amended Recovery Strategy

Table A1: Functions, biophysical features, and attributes of draft Spotted Owl CH. Attributes represented within VRI mapping act as criteria for selecting core and potential future CH polygons. The presence of these attributes must be assessed at the scale of the component VRI polygon. Some or all of the attributes listed here are expected to either be present, or in the process of developing (within the 50-year recovery timeframe), within the core and potential future CH polygons; however, due to the scale of VRI, there can be some uncertainty, so on-the-ground verification of attributes is important. Minimum quantitative thresholds are from the minimum definition of ‘moderate/suitable’ habitat in Appendix 5 of Chutter et al. (2004). This should not be confused with quantitative definitions of ‘superior’ habitat (e.g., in Blackburn et al. 2009; Waterhouse et al. 2012; D’Anjou et al. 2015).

Type	Function	Biophysical features	Attributes	
			Maritime sub-region	Sub-maritime and Continental sub-regions
Core and potential future CH	Nesting	Nest trees	Large (>50 cm dbh) snags or trees with deformities (e.g., large cavities, broken tops, dwarf mistletoe infections)	Large (>30 cm dbh) snags or trees with deformities (e.g., large cavities, broken tops, dwarf mistletoe infections)
	Roosting and safe movement	Closed, multi-storey canopy to provide thermoregulation opportunities and protection from inclement weather and predators	>60% canopy closure	>50% canopy closure
			≥2 horizontal canopy layers	
	Foraging and safe movement	An open understory structure (characteristic of stands dominated by tall, large-diameter trees) to enable efficient access to prey	Canopy dominated by overstorey trees >50 cm dbh	Canopy dominated by overstorey trees >30 cm dbh
			≥19.5 m stand height	
		Accumulations of fallen trees or other CWD and shrubs to support prey.	Abundant CWD and a diverse shrub layer	

Acoustic CH	Maintenance of suitable acoustic levels within nesting areas	Anthropogenic noise level that does not interfere with life functions within nesting areas, resulting in loss of habitat availability or function.	Noise level not exceeding 90 db and/or not exceeding ambient conditions by >20 db during the Spotted Owl nesting season (February 1 st to July 31 st)
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Table A2. Description of activities likely to result in destruction of the three CH subtypes for the Spotted Owl.

Description of Activity	Description of Effect	Details of Effect
Any activity involving removal or disruption of natural vegetation and ground cover within core or potential future CH , e.g., logging and wood harvesting; road-building; residential and commercial development; deliberate setting of stand-replacing fires	Activities resulting in destruction or removal of natural vegetation and ground cover (vegetation, snags, CWD) can result in destruction of core CH through causing direct and permanent loss of the critical features and attributes required for all life functions (nesting, roosting, foraging, and safe movement).	Related IUCN-CMP Threat # 1, 4, 5.3, 7.1 The collective features and attributes of core CH take >100 years to develop and are required annually (i.e., nest trees) or year-round (i.e., roosting and foraging attributes), so cannot be removed without resulting in destruction.
Fire management activities that involve removal of snags and CWD within old forest portions of core or potential future CH	Removal of downed wood (CWD) and snags during fire management activities can result in destruction of core CH through causing direct and permanent loss of the critical features and attributes required for nesting (i.e., nest trees) and foraging (i.e., features required to support prey populations).	Related IUCN-CMP Threat # 7.1 In some cases, it may be necessary to safeguard the longer-term integrity of core CH in areas that are at high risk of catastrophic fire as a consequence of long-term fire suppression, through wildfire risk reduction practices. These may be undertaken without resulting in destruction of core CH provided that removal of irreplaceable old forest attributes such as snags and CWD is avoided.
Activities emitting sounds resulting in an overall sound level ≥ 90 db or in an increase above ambient levels by >20 db* within acoustic CH (e.g., operation of large machinery, use of chainsaws, blasting, operation of large engines and engine brakes, operation of motorized recreational vehicles)	Acoustic disturbance can result in destruction of core CH within nesting areas through displacing Spotted Owls from the habitat and/or disrupting their behaviour such that they can no longer successfully carry out nesting functions.	Related IUCN-CMP Threat # 1, 4, 5.3 Applies only during the Spotted Owl breeding season (February 1 st to July 31 st).

*See <https://citizensofeyebysreserve.com/wp-content/uploads/2022/06/MaMu-Noise-Thresholds-USFWS.pdf> for guidance on interpretation.

ANNEX III – Imminent Threat Assessment for Spotted Owl *caurina* subspecies (*Strix occidentalis caurina*) of 2020. In relation to logging within the Spuzzum and Utzlius Creek Watersheds (British Columbia). To access the document, please click on the following link: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/imminent-threat-assessments/spotted-owl-subspecies-2020.html>