

# On the Edge

## British Columbia's Unprotected Transboundary Species

By Michelle Connolly  
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Animals and plants do not recognize the political and administrative boundaries that separate and fragment their habitat.



# Introduction

British Columbia has the highest number of species of any province in Canada, but these species are showing alarming signs of distress. According to the B.C. Conservation Data Centre at least 1,918 species or distinct populations of wildlife in British Columbia are now at risk,<sup>1</sup> and significant portions of some ecosystems have already been lost. For example, 95 per cent of B.C.'s Garry oak ecosystem is gone,<sup>2</sup> as is 90 per cent of grasslands in the Okanagan.<sup>3</sup>

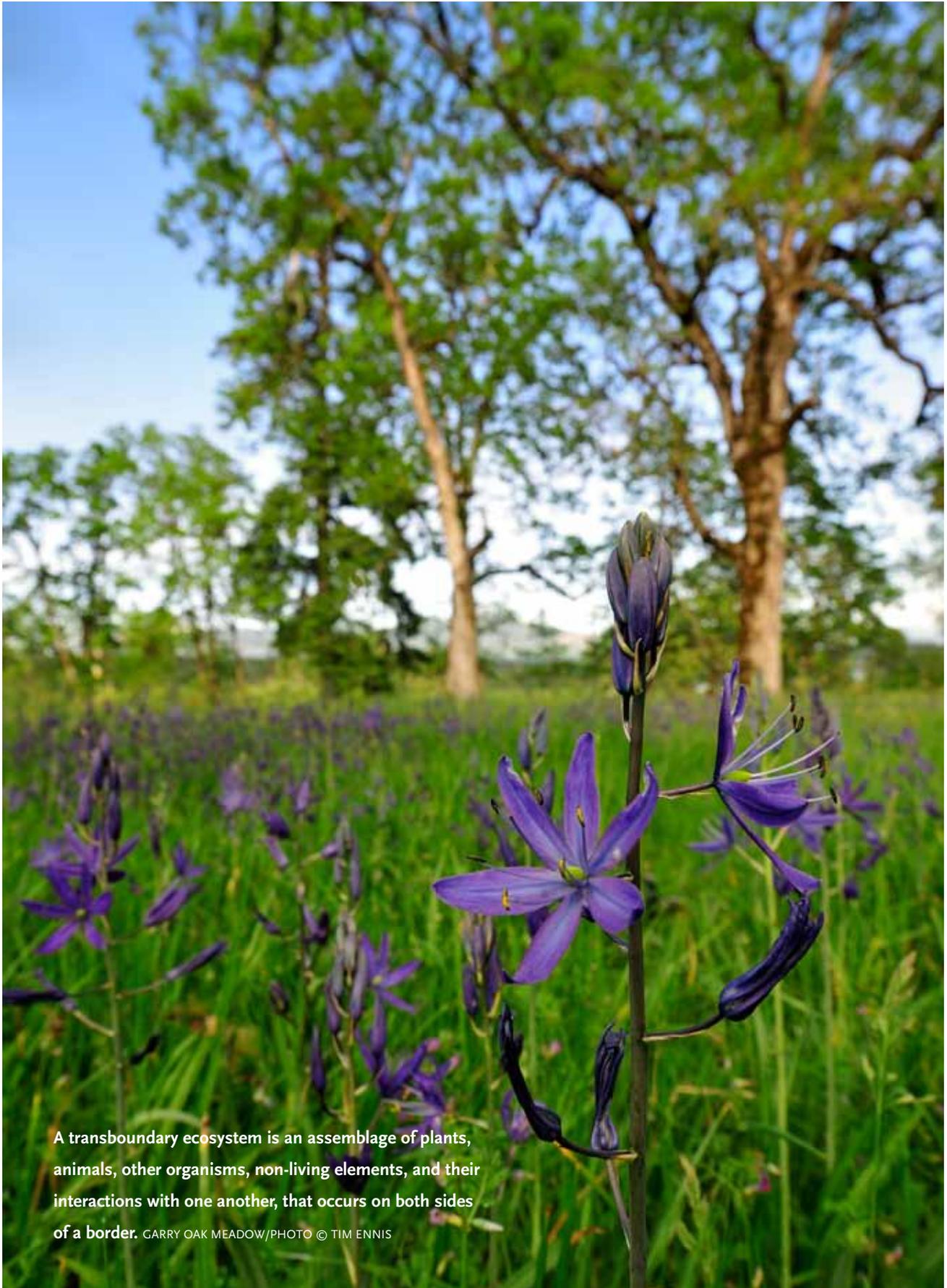
Most of British Columbia's biodiversity is shared with other jurisdictions. For example, migratory birds spend only part of the year in B.C., wolves and bears travel into and out of B.C., while numerous plant species occur both inside and outside of B.C. and spread seed and pollen across B.C.'s borders. Thus the 'range' of most of B.C.'s species (i.e. the area in which those species occur) is not restricted to the province. These species are known as transboundary species. They make up 96 per cent of B.C.'s total biodiversity, and without them B.C. would be biologically degraded.

Animals and plants do not recognize the political and administrative boundaries that separate and fragment their habitat.<sup>4</sup> These boundaries segregate ecosystems and split the habitat of species into different parts that are often managed by different governments with very different goals in mind. Uncoordinated management of ecosystems and species across political and administrative borders can undermine conservation. For example, one jurisdiction might be attempting to maintain a particular species by creating parks or other legal protections for it, while a neighbouring jurisdiction may allow continued exploitation of the species (e.g., hunting) or destruction of its habitat right up to the border.

The long-term viability of transboundary species necessitates the persistence of continuous and connected range across borders. The degradation or loss of range across borders can so fragment habitat that the remaining pieces are too small to be viable. Scientists believe that as climate change progresses, the importance of continuous ranges to transboundary species will increase (e.g., the maintenance of migratory "corridors" will be crucial to allow for the northward and upward movement of both species and ecosystems in response to changing habitat conditions). Thus the long-term persistence of viable wildlife populations and habitats depends upon effective protection that transcends administrative boundaries.<sup>5</sup>

This report describes the great importance of transboundary ecosystems and species in B.C., the alarming number of such ecosystems and species that are at risk, and the need for greater protections for them – both internally in B.C. and via improved collaboration with neighbouring jurisdictions.

**“...If a wolf were to pause on the boundary of Waterton Lakes National Park at the Canada/United States border, a single step could take her from being protected under the U.S. *Endangered Species Act* (ESA), to being federally protected in a Canadian national park, to being shot without restriction by a private landowner.”<sup>6</sup>**



A transboundary ecosystem is an assemblage of plants, animals, other organisms, non-living elements, and their interactions with one another, that occurs on both sides of a border. GARRY OAK MEADOW/PHOTO © TIM ENNIS

# What are transboundary ecosystems and species?

Species can be transboundary in a number of ways:

- A species might be migratory, spending some of the year in B.C. and other times in sometimes far-away places (e.g. Bobolinks spend the winter in South America, while Monarch butterflies winter in California).
- Individuals of a species may simply move from B.C. into a neighbouring jurisdiction (e.g. a Grizzly bear whose home range includes parts of both B.C. and Montana).
- A species might exchange genetic material across one of B.C.'s borders in other ways, such as via pollen or seed flow (e.g. Antelope-brush seeds are spread across the border by the Great Basin pocket mouse and by various birds).
- A species that once occurred across a border may have become separated into isolated populations because of human settlement and development along the border – thus although its range is still partly inside and partly outside B.C., the gene flow between the populations on different sides of the border may have been eliminated (e.g. Northern spotted owls in B.C. are disconnected from their U.S. counterparts).

This report focuses on transboundary ecosystems and species we share with our neighbouring jurisdictions – Alaska, Washington, Idaho, Montana, Alberta, Yukon and Northwest Territories

A transboundary ecosystem is similarly an ecosystem (i.e. an assemblage of plants, animals, other organisms, and non-living elements, and their interactions with one another) that occurs on both sides of a border. This report focuses on transboundary ecosystems and species we share with our neighbouring jurisdictions – Alaska, Washington, Idaho, Montana, Alberta, Yukon and Northwest Territories – although many of the recommendations here will equally apply to migratory species that travel further afield.

Figure 1: Number of transboundary and non-transboundary species in major wildlife groups in B.C.

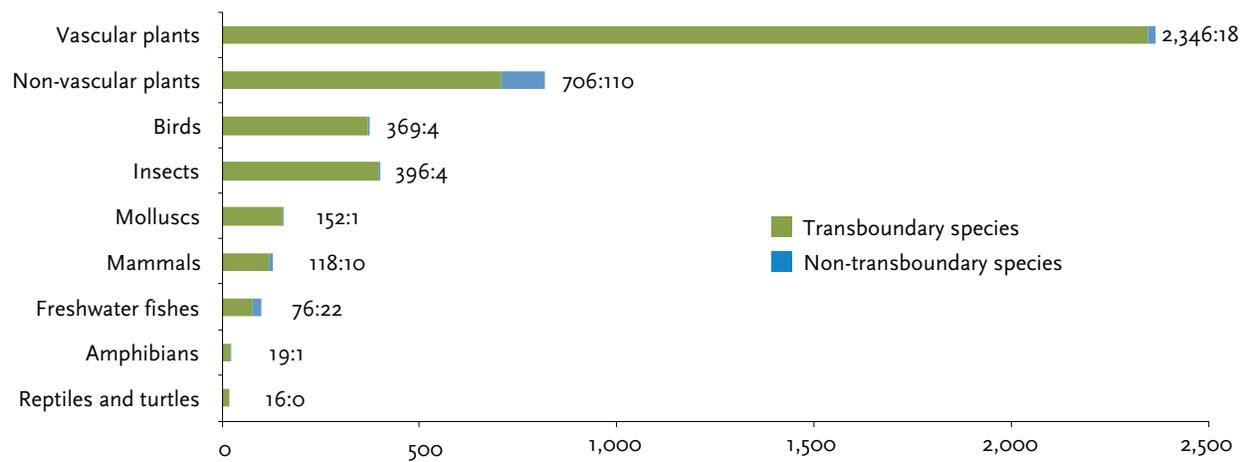


Figure 2: Example of what a typical northern and southern peripheral species range might look like



The vast majority of B.C.'s known species are transboundary. Of B.C.'s 4,373 recognized species, 4,202 (96 per cent) share range with at least one of our neighbouring jurisdictions.<sup>7</sup> Transboundary species dominate all major plant and animal groups in the province (Figure 1). For example 99 per cent of vascular plants in B.C. (such as trees and shrubs) are transboundary.<sup>8</sup> High numbers of transboundary species are also found among amphibians (95 per cent), birds (98 per cent), and mammals (92 per cent).

#### Peripheral species: a special kind of transboundary species

Some transboundary species in B.C. have ranges that are mostly outside of the province. These species are considered to be “peripheral”, meaning that 10 per cent or less of their range is in B.C. and the rest is outside of B.C. These species are sometimes called “edge” species or “peninsular.” One example of a peripheral species is the sage thrasher; only the northern tip of this bird's range extends into B.C.'s southern Similkameen and Okanagan valleys, while the rest of its range stretches southward Arizona. Although B.C. has both northern<sup>9</sup> and southern peripheral species (Figure 2), this report focuses on southern peripherals because they make up a large proportion of species at risk in B.C. For example, the four “hotspots” of species at risk in B.C., namely the south Okanagan, south Vancouver Island, the south mainland coast and the Rocky Mountain trench,<sup>10</sup> all contain a high proportion of peripheral transboundary species at risk whose ranges are mostly south of the Canada–U.S. border. This report refers to peripheral transboundary species as simply peripheral species or populations.

Figure 3: A mature, coastal forest in southern B.C. with transboundary species at risk

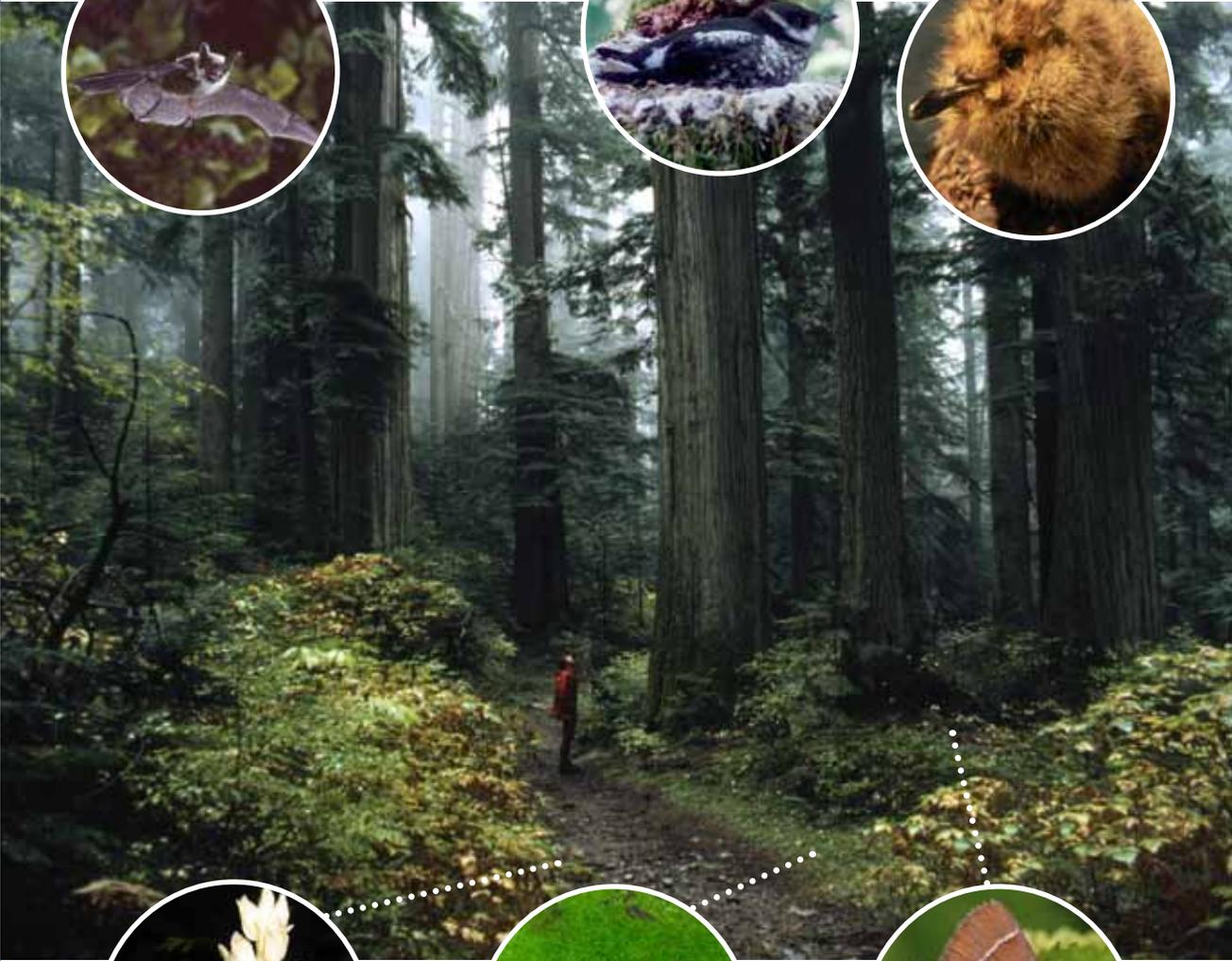
The transboundary species represented in this figure – Keen’s myotis, marbled murrelet, coastal giant salamander, phantom orchid and Johnson’s hairstreak butterfly – are representative of the species using mature coastal forests that are transboundary and at-risk in B.C.

Were we to lose these species, the ecosystem left behind would be very different from what we see today.

Keen’s myotis bat



marbled murrelet and chick



phantom orchid



coastal giant salamander



Johnson’s hairstreak butterfly

PHOTOS BY SUE FOX, MERLIN TUTTLE, TOM HARMER, IAN LANE, HUGH GRIFFITH, DANE BLAKELY SPRINGMEYER.

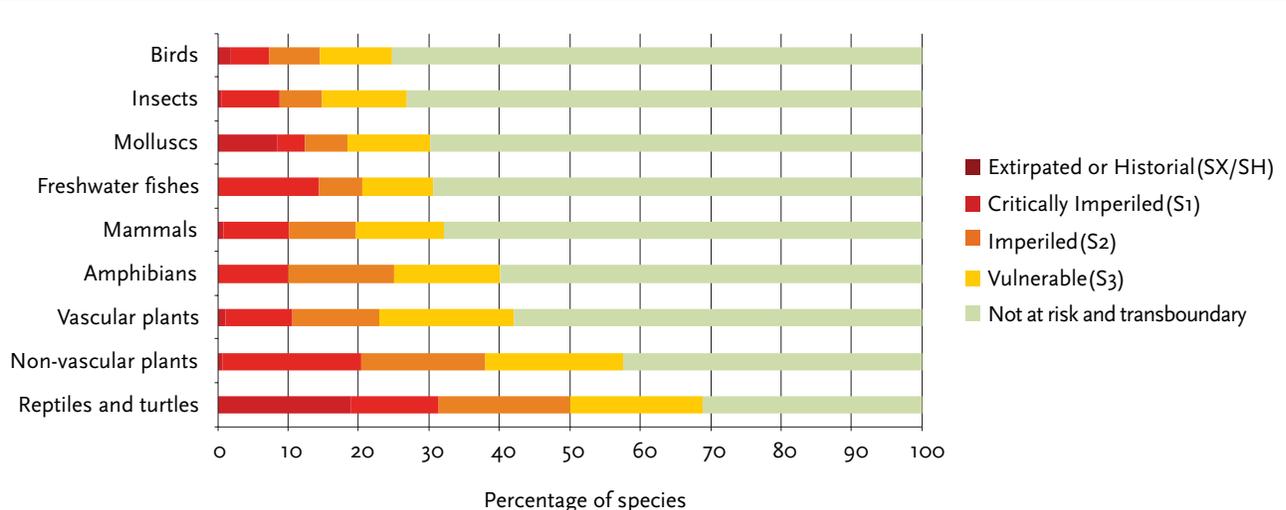
# How are transboundary ecosystems and species doing in B.C?

Two of the four most endangered transboundary ecosystems across all of Canada occur in B.C.

Not only are the majority of B.C.'s plants and animals transboundary, but a significant number of them are also at risk of disappearing from the province, or have already been eliminated.

Forty-two per cent of transboundary species in B.C. are at risk. Broken down by wildlife group, 68 per cent of B.C.'s reptiles and turtles are both transboundary and either at risk or already lost from B.C., as are 40 per cent of amphibians and 32 per cent of B.C.'s mammals (Figure 4).<sup>11</sup> Losing these transboundary species from B.C. would dramatically reduce the diversity within major wildlife groups in B.C., weakening and degrading the ecosystems in which they occurred.

Figure 4: Percentage of species by major wildlife group that are both transboundary and at risk of disappearing from B.C.



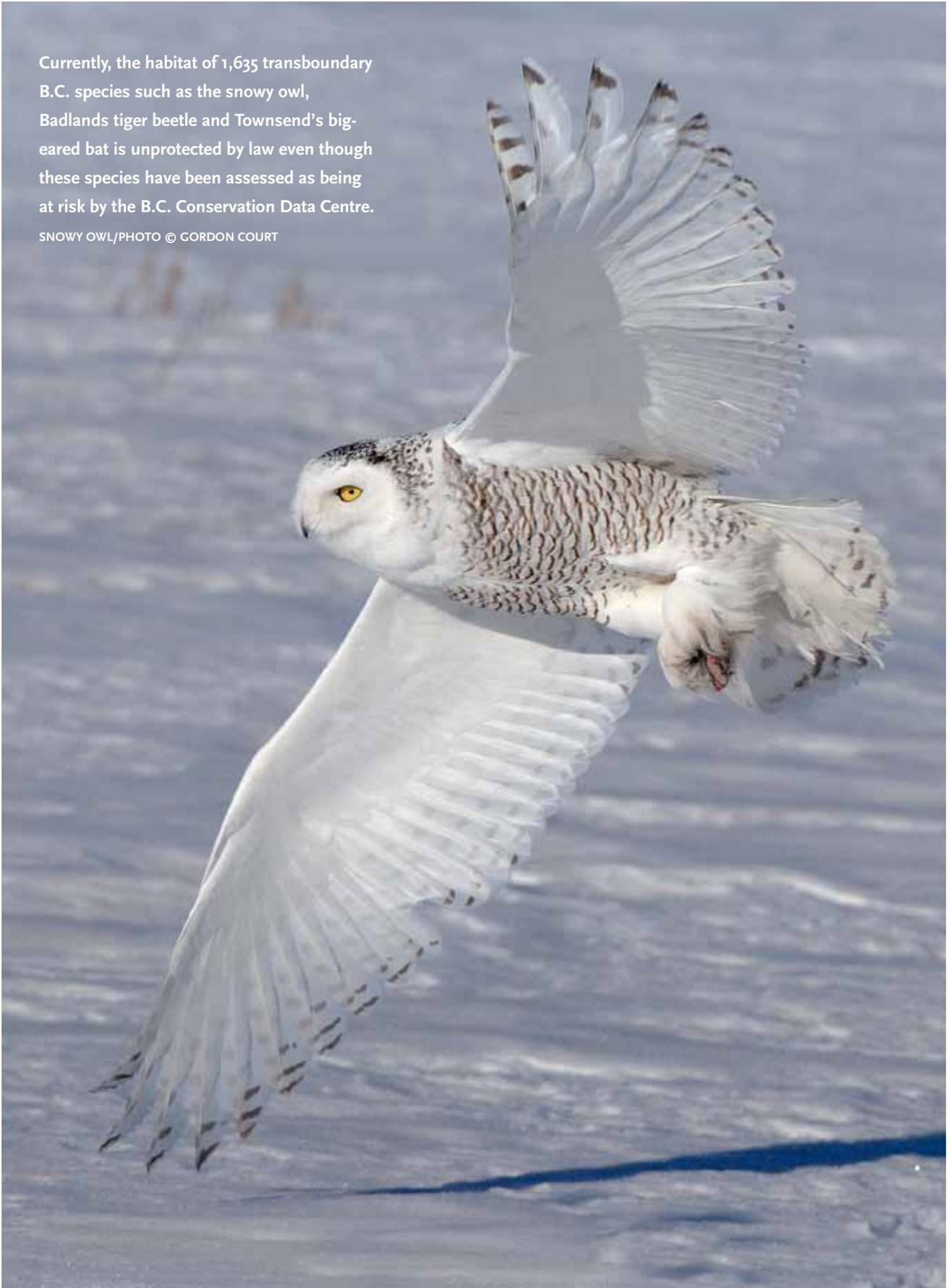
And it is not only individual transboundary species, but also entire transboundary ecosystems that are at risk in B.C. In fact, two of the four most endangered transboundary ecosystems across all of Canada occur in B.C., the antelope-brush/needle and thread grass ecosystem in the southern interior (discussed in Appendix 1 of this report) and the Garry oak woodlands of the south coast.<sup>12</sup> Both of these ecosystems are nationally unique and contain high numbers of species at risk, including many transboundary species.<sup>13</sup>

Carnivores such as grizzly bear (as well as cougar, black bear, wolverine, fox and wolf) that once covered much of western North America have collapsed to the northern and western edges of their historic ranges, making B.C. one of the last refuges for these animals.



Currently, the habitat of 1,635 transboundary B.C. species such as the snowy owl, Badlands tiger beetle and Townsend's big-eared bat is unprotected by law even though these species have been assessed as being at risk by the B.C. Conservation Data Centre.

SNOWY OWL/PHOTO © GORDON COURT



# Why should we protect transboundary ecosystems and species?

Many transboundary ecosystems and species in B.C. are at risk, and it will be necessary to more thoughtfully and sustainably plan and carry out human activities if we are to keep them. But why does it matter if we lose these species from B.C., if they also occur elsewhere? There are many reasons to be concerned with the decline and loss of B.C.'s transboundary plants and animals. This section lists six.

## 1. To maintain fully functioning and healthy ecosystems

Healthy, functioning ecosystems are made up of an assemblage of species, both transboundary and non-transboundary. Ecosystem functioning reflects the collective life activities and interactions of plants and animals and the effects these activities – such as feeding, growing, moving, excreting waste – have on the physical and chemical conditions of their environment.<sup>14</sup> Most ecosystem processes are driven by the combined biological activities of many species.<sup>15</sup>

Interactions within ecosystems are tremendously complex. Ecologists do not yet understand them well enough to predict with accuracy which species an ecosystem can stand to lose and which it cannot, or whether any species loss would have unforeseen negative effects on those ecosystems. Each species we allow to disappear represents a gamble, we can't really predict all the consequences to an ecosystem. Were we to lose all of B.C.'s transboundary species at risk – which make up 41 per cent of B.C.'s biodiversity – many of our ecosystems could become severely degraded. If we proceed incautiously, we may not know the effects of our choices until it is too late.

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## 2. To maintain critical ecosystem services that sustain our communities

Just as the healthy functioning of ecosystems relies upon full assemblages of species – both transboundary and non-transboundary – so too does the provision of ecosystem services. Ecosystem services are the benefits that healthy ecosystems provide to humans.<sup>16</sup> These include the products we receive from ecosystems (e.g. food, fibre, clean air and water), the benefits we receive from ecosystem processes (e.g. nutrient cycling, water purification, climate regulation), as well as non-material benefits (e.g. recreation and aesthetic benefits).<sup>17</sup>

Studies have documented that the loss of biodiversity can result in a decline in ecosystem services.<sup>18</sup> When species are lost, the benefits provided by a complete, functioning ecosystem are weakened. The services are extremely valuable to us and to our children and grandchildren, and it is unethical for us to deny future generations these essential values.

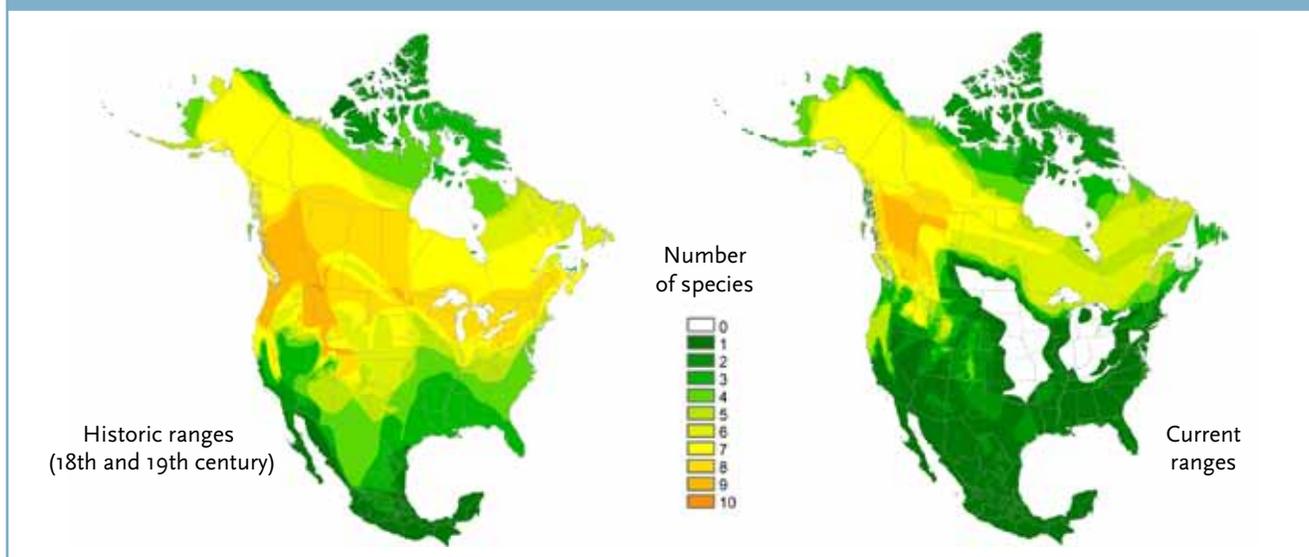
Although it is difficult to look at these benefits in terms of dollars and cents, studies have estimated services from wetland ecosystems provide \$232 million annually in Metro Vancouver alone,<sup>19</sup> while temperate forests are said to provide \$2,000 in services per hectare per year.<sup>20</sup> In many cases we do not know how to artificially generate the services ecosystems provide, even if we had infinite money with which to attempt it. Clearly, good fiscal management of B.C. starts with maintaining the full range of services that ecosystems currently provide for free.

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## 3. To maintain species whose range has already shrunk mainly into B.C.

Many species have already collapsed to the edge of their historic range in North America.<sup>21</sup> For example, carnivores such as grizzly bear, black bear, wolverine, fox, wolf and cougar that once covered much of western North America have collapsed to the northern and western edges of their historic ranges, making B.C. one of the last refuges for these animals.<sup>22</sup> Figure 5 shows the number of species of North American carnivores and ungulates whose ranges have contracted, based on a study comparing the historic (18<sup>th</sup> and 19<sup>th</sup> century) ranges of these animals with their current ranges.<sup>23</sup> (Appendix 1 discusses wolverine in more detail).

Figure 5: Range contractions of North American carnivores and ungulates





The fisher is a small mammal in the weasel family, and is ranked as vulnerable by the B.C. Conservation Data Centre. Fishers were extirpated from Washington State in the mid 1900s due to over-trapping and habitat loss.<sup>32</sup> After genetic studies found that the best source population for fisher reintroductions in Washington was B.C.,<sup>33</sup> 49 fishers from B.C. were released into the Olympic Peninsula from 2008 to 2010 by the Washington Department of Fish and Wildlife.<sup>34</sup> Although fishers are widespread in Canada, this reintroduction demonstrates that their conservation in B.C. is also valuable to jurisdictions where they are at risk.

FISHER/PHOTO © GLEN AND REBECCA GRAMBO

B.C. is one of the few places in the world where intact large-predator systems, including large carnivores and their prey, still exist in viable numbers. Studies on large carnivores such as wolves,<sup>24</sup> coyotes<sup>25</sup> and jaguars<sup>26</sup> have demonstrated the negative ecosystem-wide consequences associated with their decline or loss. For example, a study in the Greater Yellowstone Ecosystem demonstrated that the loss of wolves and grizzly bears resulted in unnaturally high populations of moose, which so altered the ecosystem as a result of over-browsing that migrant bird populations declined as a consequence.<sup>27</sup> This is just one example of the important effect of large carnivores on the entire ecosystem and food chain<sup>28</sup> and the profound change their removal can have on ecosystems.

Ensuring the persistence of healthy transboundary species populations in B.C. may be important to their recovery in other jurisdictions. Some well-known species have been brought back from the brink of extinction through the reintroduction of individuals taken from transboundary source populations found elsewhere. For example, the giant panda, California condor and whooping crane were all reduced to the edge of their ranges before recovery efforts were begun to reintroduce them to other parts of their former ranges.<sup>29</sup> And sometimes peripheral populations are the only populations healthy enough to provide animals for reintroduction into areas from which they have disappeared.<sup>30</sup> Bighorn sheep, for example, taken from healthy populations at the peripheral northern edge of their range in B.C., have been used in reintroductions to areas of the western United States.<sup>31</sup>

Many of these species and ecosystems are now at risk and are likely to disappear from B.C., as they have from other parts of North America, unless B.C. provides adequate protection for them. B.C. is in a unique position to make an international contribution by refusing to let its species disappear and then assisting other jurisdictions as they try to restore their own degraded ecosystems.

#### 4. To maintain genetically unique peripheral populations

Individuals in peripheral populations often have different and unique genetic composition, because they have had to adapt to more extreme environmental conditions than those present in the centre of their range.<sup>35</sup> These distinct traits can be important to adapting to environmental change.<sup>36</sup> For example, populations of Lodgepole pine near the northern boundary of its range have significant differences in seed size and shape that allows them to disperse further than the seeds of Lodgepole pine near the centre of its range.<sup>37</sup> This trait may help northern peripheral Lodgepole pine populations expand northward when global warming creates conditions that are not habitable for this species in the southern part of their range.

Peripheral populations in southern B.C. have already adapted to local conditions and so provide a source of genetic variation upon which further natural selection may act.<sup>38</sup> For this reason, peripheral populations have high conservation value<sup>39</sup> and present an important opportunity to conserve rare genetic units<sup>40</sup> that may become essential to a species' long-term survival. Conservation depends upon protecting the genetic variability present throughout the range of a species,<sup>41</sup> and it has been argued that the loss of genetically distinct populations within a species is at least as important a problem as the loss of entire species.<sup>42</sup>



Bighorn sheep, taken from healthy populations at the peripheral northern edge of their range in B.C., have been used in reintroductions to areas of the western United States.

BIGHORN SHEEP/IAN  
MCALLISTER PHOTO

#### 5. To help species adapt to global warming

There is now unambiguous and ample evidence that global warming is reshuffling the geographic distributions of plant and animal species worldwide.<sup>43</sup> While it is important to mitigate global warming by reducing the world-wide emission of greenhouse gases, it is now clear that global warming has begun and so it is important to also adapt to it.

As noted by the Intergovernmental Panel on Climate Change (IPCC) in their fourth assessment report on the impacts of global warming on ecosystems, it will be necessary to maintain and enhance resilience (i.e. the coping capacity) of ecosystems and species to help them survive global warming: "A primary adaptation strategy to global warming and even current climate variability is to reduce and manage the other stresses on species and ecosystems, such as habitat fragmentation and destruction, over-exploitation, eutrophication, desertification and acidification... In addition to removing other stressors it is necessary to maintain viable, connected and genetically diverse populations. Although connectivity, genetic diversity and population size are important current conservation goals, climate change increases their importance... Finally, mitigation strategies are very likely to become substantially more effective when they are implemented over larger regions and across national borders."<sup>44</sup>

Global warming is producing range shifts of species and ecosystems.<sup>45</sup> In B.C., this means that species are projected to move northward and upward (i.e. up mountain sides) as the climate warms.<sup>46</sup> To allow species and ecosystems to successfully adapt, we will have to ensure they will be able to move successfully into new habitat.<sup>47</sup> This will require maintaining landscape connections across the border from the U.S. and into B.C. to act as 'corridors' to allow for such movement of both species and ecosystems.<sup>48</sup> In this age of global warming, protecting future patterns of species and ecosystem distribution is just as important as protecting present patterns.<sup>49</sup>

Peripheral populations in southern B.C. are likely to be key sources for this movement of species and ecosystems, because they are already at the northern edge of the species' range. As described above, peripheral populations also contain unique genetic variability that will help them adapt and evolve.<sup>50</sup> Thus species survival, and by extension ecological integrity, in the face of global warming is likely to depend on peripheral populations,<sup>51</sup> as these populations are likely to be the best suited to establishing themselves in the new habitats created by warming temperatures in B.C.<sup>52</sup>

## 6. To fulfil national and international commitments

British Columbia has committed both nationally and internationally to protect biodiversity within B.C. In 1992 and 1993, Canada signed and then ratified the United Nations *Convention on Biological Diversity* (the CBD).<sup>53</sup> While recognizing that each country has sovereign rights over its own biological resources, the CBD affirmed that the conservation of biodiversity is a “common concern of humankind” and that each country is responsible for conserving biodiversity.<sup>54</sup> British Columbia, as part of the Canadian delegation, actively participated in the negotiations for the CBD and supported Canada’s ratification of it.<sup>55</sup>

The CBD requires each country that ratifies it, as far as possible and as appropriate, to “establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity”, to “promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings”, and to “develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations.”<sup>56</sup> The CBD also recognizes the more general international legal obligation that countries have “the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States.”<sup>57</sup> British Columbia accepted these commitments and responsibilities when it supported Canada’s ratification of the CBD.

In order to help implement the CBD in Canada, in 1996 the federal, provincial and territorial governments, including the B.C. government, signed the *National Accord for the Protection of Species at Risk*.<sup>58</sup> Under the Accord, each signatory agreed that “species do not recognize jurisdictional boundaries and cooperation is crucial to the conservation and protection of species at risk”. Each signatory agreed to, “establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada” that will:

- Provide an independent process for assessing the status of species at risk;
- Legally designate species as threatened or endangered;
- Provide immediate legal protection for threatened or endangered species;
- Provide protection for the habitat of threatened or endangered species; and
- Emphasize preventive measures to keep species from becoming at risk.

Thus B.C. has committed, on both the international and national stages, to protect biodiversity in the province. However, as is set out in Part 5, B.C. has not lived up to these commitments.



Species survival, and by extension ecological integrity, in the face of global warming is likely to depend on peripheral populations, as these populations are likely to be the best suited to establishing themselves in the new habitats created by warming temperatures in B.C.

YELLOW MONTANE VIOLET/  
JEFFIFER HERON PHOTO

Habitat loss and degradation is the greatest short-term threat to B.C.'s biodiversity, affecting 86 per cent of B.C.'s species at risk. The effects of global warming are predicted to increase the vulnerability of species disappearing from B.C.

NORTHERN SPOTTED OWL/ART WOLF PHOTO



LYNX CUB

# Current protections for transboundary ecosystems and species in B.C. are inadequate

Despite the importance of transboundary ecosystems and species, their increasingly imperilled status, and B.C.'s commitments to protect biodiversity in the province, current protections in B.C. are woefully inadequate. Habitat loss and degradation is the greatest short-term threat to B.C.'s biodiversity, affecting 86 per cent of B.C.'s species at risk.<sup>59</sup> The effects of global warming are predicted to increase the vulnerability of species to extinction.<sup>60</sup> Yet neither of these threats has yet been directly – let alone adequately – addressed for more than a tiny proportion of B.C.'s transboundary species.

## Inadequate legal protections

In Canada, the federal and provincial governments both have jurisdiction over the protection of species at risk. The federal government passed the *Species at Risk Act (SARA)* in 2002, and it provides automatic protections for listed aquatic species (such as fish), for listed migratory birds, and for listed species on federal lands (such as national parks). However, just 1 per cent of B.C.'s area is federal lands.<sup>61</sup> Thus for all species other than aquatics or migratory birds, SARA leaves primary responsibility for species protection to the province.

Yet B.C.'s laws for protecting species at risk are wholly inadequate. Species at risk in B.C. are regulated through a patchwork of legislation, such as the *Wildlife Act* and the *Forest and Range Practices Act (FRPA)*. However, the *Wildlife Act* only lists 4 species as threatened or endangered, and even for them it does not require their habitat to be protected. And although 72 species at risk are listed under the FRPA, this law requires biodiversity protections to not “unduly reduce the supply of timber” and a policy of 1 per cent maximum impact of habitat protection on the logging rate has been imposed.<sup>62</sup>

Despite the importance of transboundary ecosystems and species, their increasingly imperilled status, and B.C.'s commitments to protect biodiversity in the province, current protections in B.C. are woefully inadequate.

There is no legislation in B.C. to protect the vast majority of species at risk in the province, including the 1,801 transboundary species at risk.

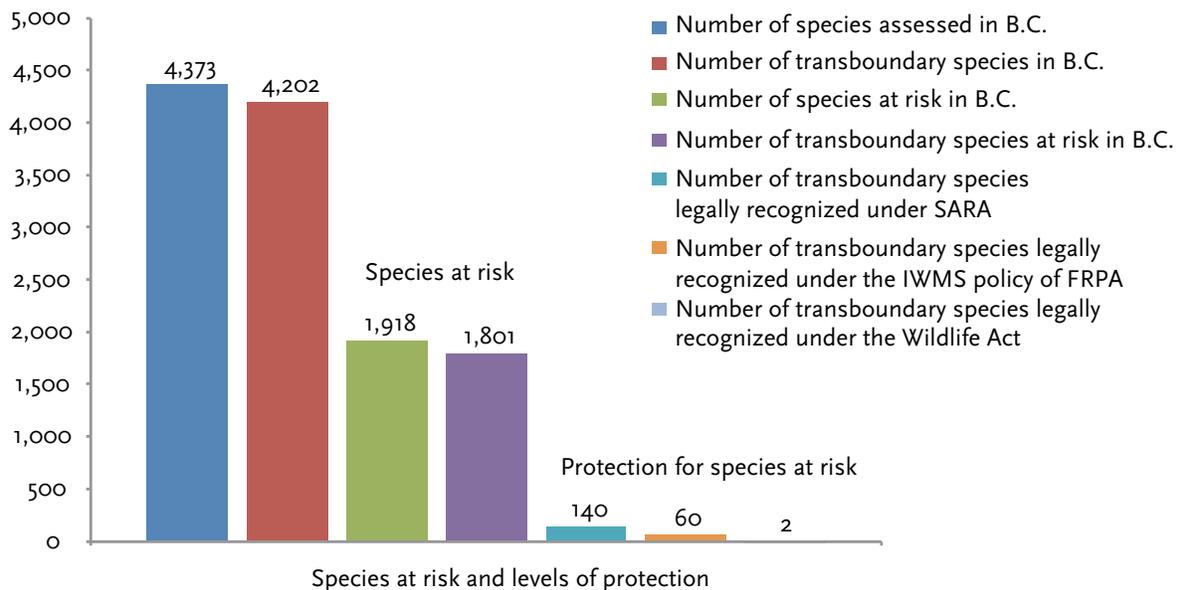
BEHR'S HAIRSTREAK/  
JENNIFER HERON PHOTO



Thus there is no legislation in B.C. to protect the vast majority of species at risk in the province, including the 1,801 transboundary species at risk. For example, only 9 per cent<sup>63</sup> of transboundary species at risk have any kind of legal protection under the federal *Species at Risk Act* (SARA), and/or the FRPA and/or the *Wildlife Act* (Figure 6).<sup>64</sup> In addition, B.C.'s current system of parks and protected areas does not adequately protect B.C.'s species at risk.<sup>65</sup> A 2003 study, for example, showed that parks and protected areas do not overlap with areas that have the majority of B.C.'s species at risk, such as in the south Okanagan and south Vancouver Island.<sup>66</sup> As a result, the habitat of 1,635 transboundary B.C. species such as the snowy owl, Badlands tiger beetle and Townsend's big-eared bat is unprotected by law even though these species have been assessed as being at risk of extinction.

Figure 6: Levels of legal protection for transboundary species at risk in B.C.

Note that the sum of the number of species protected under each of SARA, FRPA and the Wildlife Act is larger than the total number of different species with any legal protection because many species are protected under more than one piece of legislation.



B.C.'s lack of adequate legal protections for species at risk is further highlighted by comparison to neighbouring jurisdictions. In particular, in the U.S. the federal *Endangered Species Act* (ESA)<sup>67</sup> applies to all lands in that country, including state and private lands, and all endangered wildlife species are automatically protected from 'take', which includes killing, harming or significant habitat modification or degradation<sup>68</sup> (and individual states can then add stronger protections on top of the ESA).<sup>69</sup> Thus legal protections for species at risk in neighbouring U.S. jurisdictions are significantly stronger than in B.C.

## Peripheral populations are being de-prioritized

The large and growing number of ecosystems and species at risk in B.C. has led the B.C. government to seek ways to prioritize efforts to protect them. One such suggestion<sup>70</sup> is to prioritize species according to "global responsibility," which refers to the proportion of their global range or population that occurs in B.C. Under this prioritization scheme, endemic or near-endemic species that are at risk (i.e. species at risk that only or mostly occur in B.C.) would receive a higher priority for conservation, but transboundary species at risk that are peripheral (i.e. species which occur in B.C. but the majority of whose range is south of the Canada–U.S. border) would receive a lower priority.

Given the extremely limited resources the B.C. government dedicates to species at risk conservation, if this approach is used to prioritize species for conservation resources, it is unlikely that peripheral transboundary species will get much, if any, conservation action. Thus, under any scheme that prioritizes based on global responsibility, there is the risk that many peripheral species are likely to effectively be 'written off' when it comes to conservation efforts in B.C. Yet as described above, peripheral species are extremely important to B.C. since they make up a significant component of B.C.'s southern ecosystems. If these peripheral species are written-off, many British Columbians will face the risk of losing the important benefits they receive from these species and the functioning ecosystems in which they occur.

This is especially significant when one considers that 71 per cent of B.C. residents live in four regional districts whose biodiversity is largely peripheral, greatly at risk and predominantly transboundary; Metro Vancouver, Fraser Valley, Capital and Central Okanagan (Figure 7).<sup>71</sup> Ninety-six per cent of the species at risk occurring in these four regional districts are also transboundary,<sup>72</sup> and many are also part of peripheral populations. The residents of Metro Vancouver, Fraser Valley, Capital and Central Okanagan regional districts are therefore currently benefiting directly from the ecosystem services provided by numerous transboundary species at risk. Thus the long-term effect of de-prioritizing transboundary species at risk for access to conservation resources is to expose some of B.C.'s most densely populated areas (and the people who live in these areas) to a disproportionate loss of necessary ecosystem services.

In these regional districts, the vast majority of at-risk species (96 per cent) are also transboundary.

Figure 7: Regional Districts of Metro Vancouver, Fraser Valley, Capital and Central Okanagan



We do not know which species, if any, an ecosystem can stand to lose. Thus, prioritization of which species will receive conservation action is a dangerous proposition; it risks unforeseen losses of ecosystem function and ecosystem services. If prioritization is to be done nonetheless, doing so based on political boundaries instead of ecological principles is especially risky. A more biologically meaningful approach to prioritization could involve prioritizing with the goal of maximizing ecosystem functionality. For instance, one might give priority to umbrella species like woodland caribou whose needs encompass those of many other species, or keystone species like grizzly bears and other apex predators which have a disproportionate impact on the functioning of ecosystems they are part of, or ecosystems already near the edge of their tolerance for disturbance and degradation. These factors will be much more difficult to assess than the location of a species' range relative to a clear jurisdictional boundary, but responsible stewardship of our natural resources demands that we rise to this challenge.

B.C. has already witnessed the loss of transboundary and peripheral populations: 46 species that once existed in B.C. are now extirpated from B.C., but still persist in an adjacent jurisdiction (Alaska, Alberta, Yukon, Northwest Territories, Washington, Idaho and Montana) such as the pigmy short-horned lizard and the Viceroy butterfly.

VICEROY BUTTERFLY/PHOTO  
© ROBERT MCCAWE; PIGMY  
SHORT-HORNED LIZARD/  
PHOTO © GARY NAFIS



# Recommendations

British Columbia has many ecosystems and species in peril but currently lacks effective legislation in the province to protect them and the habitat they require in order to survive and recover. B.C. has recently shown itself to be a North American leader by tackling climate change in an innovative and timely manner – there is a tremendous opportunity to also demonstrate leadership through the creation and implementation of a new world-class law that protects B.C.’s imperilled species and ecosystems. This would help not only transboundary and peripheral species, but all ecosystems and species at risk in the province.

**RECOMMENDATION 1:** *B.C. should enact a Species and Ecosystem Protection Act (SEPA) that identifies species and ecosystems at risk and then provides for their protection and recovery, including habitat protection.<sup>73</sup>*

Transboundary (including peripheral) species make up 96 per cent of the total number of species in B.C., and are critical to the healthy functioning of ecosystems in B.C. and to the provision of essential ecosystem services, especially in the southern part of the province. Further, peripheral populations contain unique genetic characteristics and can provide the source from which species will adapt to global warming. Thus the importance of these species must be recognized.

**RECOMMENDATION 2:** *B.C. should not de-prioritize peripheral transboundary species at risk for conservation action – rather, all species and ecosystems at risk should be eligible for protection to maintain the full complement of species, ecosystems, and ecosystem services in B.C. If prioritization is used, government should prioritize conservation actions based on ecological principles rather than ecologically arbitrary political boundaries.*

In order to maintain healthy populations of transboundary (including peripheral) species, it is necessary to keep populations connected so that there can be healthy gene flow across borders and so that species are not split into isolated parts, none of which may be large enough to be viable. B.C. must endeavour to maintain such connectivity for species, or to restore it where it has been lost already.

**RECOMMENDATION 3:** *Manage species and ecosystems at the landscape level, ensuring populations of transboundary species in B.C. remain connected to populations in neighbouring jurisdictions by creating new parks and protected areas and other legal measures.*

**B.C. should enact a Species and Ecosystem Protection Act (SEPA) that identifies species and ecosystems at risk and then provides for their protection and recovery, including habitat protection.**

Ensuring connectivity will also help species adapt to global warming, in that species will generally need to move northward and upward to adapt to changing habitat conditions. This will require that human developments not completely block such movements. And as noted above, transboundary species in southern B.C. are especially important for adapting to global warming, in that they are likely to provide the source for northward movement and the genetic variability which will help the species adapt. Thus B.C. must plan for transboundary species and ecosystem survival in the face of global warming.

**RECOMMENDATION 4:** *Recognize the importance of transboundary and peripheral species for adaptation to global warming, and plan for their anticipated movements over the long term (such as 50 or 100 years).*

In addition to protecting ecosystems and species at risk within B.C., it is also necessary to more effectively coordinate protection activities with neighbouring jurisdictions. There is a rich body of experience from around the world from which B.C. can draw upon to set up the appropriate coordination agreements, to remove remaining barriers to cross-border dialogue, and to create a greater shared sense of responsibility for transboundary species. This past experience includes: research on how to effectively conduct cross-border coordination in the Crown-of-the-Continent area in south-eastern B.C.<sup>74</sup>, model action plans for conserving cross-border species developed by the North American Commission on Environmental Cooperation (CEC),<sup>75</sup> coordination agreements between countries to protect migratory species under the *Convention on the Conservation of Migratory Species of Wild Animals*<sup>76</sup>, and the 1997 Framework agreement on cooperation for protecting species at risk between Canada and the U.S. at the federal level.<sup>77</sup> Thus B.C. should improve its coordination with neighbouring jurisdictions for protecting ecosystems and species at risk, and learn from best practices in cross-border coordination undertaken elsewhere.

**RECOMMENDATION 5:** *Improve coordination of conservation efforts for ecosystems and species at risk between B.C. and its neighbouring jurisdictions.*

**B.C. should improve its coordination with neighbouring jurisdictions for protecting ecosystems and species at risk, and learn from best practices in cross-border coordination undertaken elsewhere.**

NUTALLS COTTONTAIL/  
PHOTO © ROBERT MCCAWE



# Conclusion

B.C. has the most plant and animals species of any province in Canada, and most of this biodiversity is made up of transboundary species, almost half of which are already at risk of disappearing from B.C. Without transboundary species and peripheral populations, significant parts of B.C.'s biodiversity would be lost, jeopardizing the healthy functioning of many ecosystems and the provision of critical ecosystem services that sustain the wellbeing of British Columbians. If we want to maintain this biodiversity, B.C. should take new action that includes: enacting new legislation to protect ecosystems and the species they contain<sup>78</sup> and adding additional protected areas to ensure habitat connectivity and the capacity to adapt to global warming.

Moreover, any conservation policy that gives lower importance to protection of transboundary and peripheral species fails to adequately protect B.C.'s biodiversity and risks allowing ecosystem functionality to degrade, in particular in ecosystems around B.C.'s most populous areas.<sup>79</sup> Merely protecting species with most of their range in B.C. is not a sufficient safeguard against species losses and ecosystem collapse. If we are concerned with maintaining opportunities for current and future ecosystems to function well for the long-term benefit of all British Columbians, then the conservation of species that are transboundary or have only peripheral populations in B.C. is critical.<sup>80</sup>

The natural world does not operate along geopolitical lines – rather, most species and ecosystems depend upon a much larger domain for their long-term survival.<sup>81</sup> We must approach the protection of transboundary species as if there were no jurisdictional boundaries interfering with natural ranges, and thus ensure connectivity is maintained across such boundaries. While we cannot control what goes on in neighbouring jurisdictions, we can encourage good outcomes through leadership, coordination and cooperation. We must also plan for global warming, which further emphasizes the importance of cross-boundary connectivity,<sup>82</sup> as well as the critical importance of peripheral populations in southern B.C.

To maintain healthy ecosystems and the ongoing wellbeing of British Columbians today and into the future, we must provide the necessary legal and policy measures to protect B.C.'s share of the rich biodiversity endowed to us.

**Without transboundary species and peripheral populations, significant parts of B.C.'s biodiversity would be lost, jeopardizing the healthy functioning of many ecosystems and the provision of critical ecosystem services that sustain the wellbeing of British Columbians. Maintaining this biodiversity demands that B.C. takes action.**

## Flathead watershed

### The good, the bad, and the ugly side of transboundary watershed management



The Flathead watershed in B.C. contains at least eleven vertebrate species that are at-risk, including Rocky mountain tailed frogs and bighorn sheep.

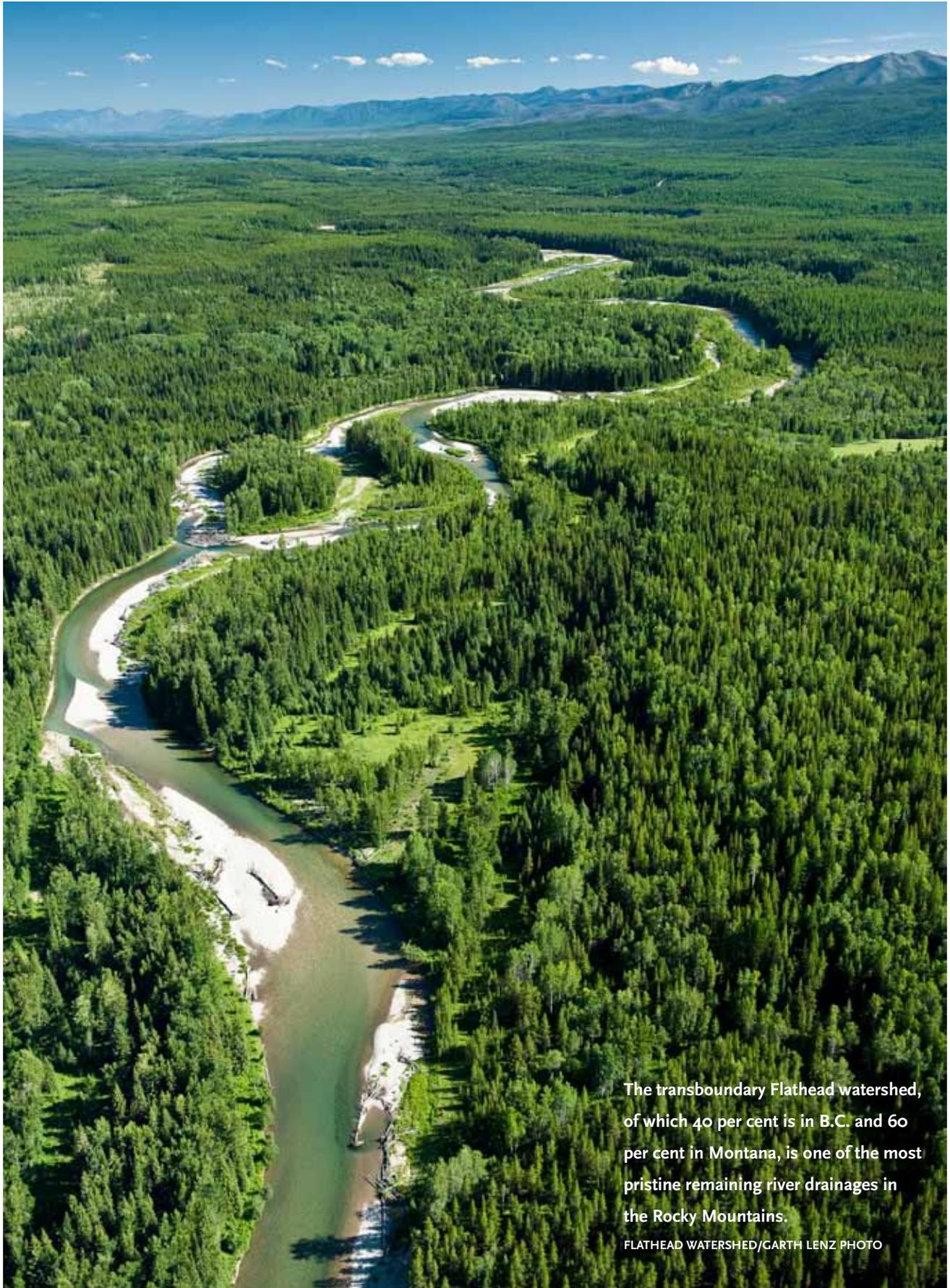
ROCKY MOUNTAIN TAILED  
FROG TADPOLES

The transboundary Flathead watershed is one of the most pristine remaining river drainages in the Rocky Mountains and possesses a unique assemblage of carnivores (including wolves, wolverines, lynx, grizzly bear and marten) and ungulates (including moose, elk and white-tailed deer) that appears unmatched in North America.<sup>83</sup> The Flathead River begins in southeast British Columbia and flows across the border into northwest Montana where it is known as the North Fork of the Flathead River. Roughly 40 per cent of this transboundary basin is in B.C., and 60 per cent is in Montana. South of the U.S. border, the river forms the western boundary of the U.S.' iconic Glacier National Park. However, north of the border in B.C., 97 per cent of the Flathead is unprotected.<sup>84</sup>

The Flathead watershed in B.C. contains at least eleven vertebrate species that are at-risk, including Rocky mountain tailed frogs and bighorn sheep, and likely other species of plants and insects.<sup>85</sup> The U.S. portion of the watershed contains six species listed as endangered or threatened under the U.S. Endangered Species Act. Wildlife biologists have noted the critical importance of the Flathead watershed to the surrounding ecosystems, describing it as the “ecological engine” of the Crown of the Continent Ecosystem (CCE), which is internationally shared by B.C., Alberta and Montana.<sup>86</sup>

These three jurisdictions each contain transboundary wildlife species that vary in abundance from one part of their range to another.<sup>87</sup> The Canadian portion of the CCE, especially B.C., is described as a supporting source, or ‘reservoir’ for populations of wildlife for the CCE, especially large carnivores and ungulates.<sup>88</sup> For example, the Flathead watershed in B.C. has the highest density of grizzly bears in interior North America.<sup>89</sup>

The CCE is a key part of the north-south corridor linking natural areas from the U.S. into Canada. As a result, the North American Commission for Environmental Cooperation (CEC) has recognized the Yukon/Yellowstone/Sierra Madre Corridor, which contains the CCE, as a “Priority Conservation Region of North America.”<sup>90</sup> Such is the importance of this north-south corridor, that the Yellowstone to Yukon (Y2Y) Conservation Initiative was created to specifically promote its protection.<sup>91</sup> We recommend that the lower third of B.C.'s Flathead River Valley be made a national park and the remainder of the Flathead and adjacent habitat become a Wildlife Management Area. (Figure 8).



The transboundary Flathead watershed, of which 40 per cent is in B.C. and 60 per cent in Montana, is one of the most pristine remaining river drainages in the Rocky Mountains.

FLATHEAD WATERSHED/GARTH LENZ PHOTO

Many of the species in the Flathead watershed have large area requirements and are highly mobile, interbreeding with populations in the Waterton-Glacier park complex and across the Canada–U.S. border. Thus the Flathead watershed is a true transboundary landscape that must be managed as a single ecological unit.<sup>92</sup> This will require ensuring wildlife populations in the different jurisdictions remain healthy and connected to one another, and that they can move and exchange genetic material across borders.<sup>93</sup>

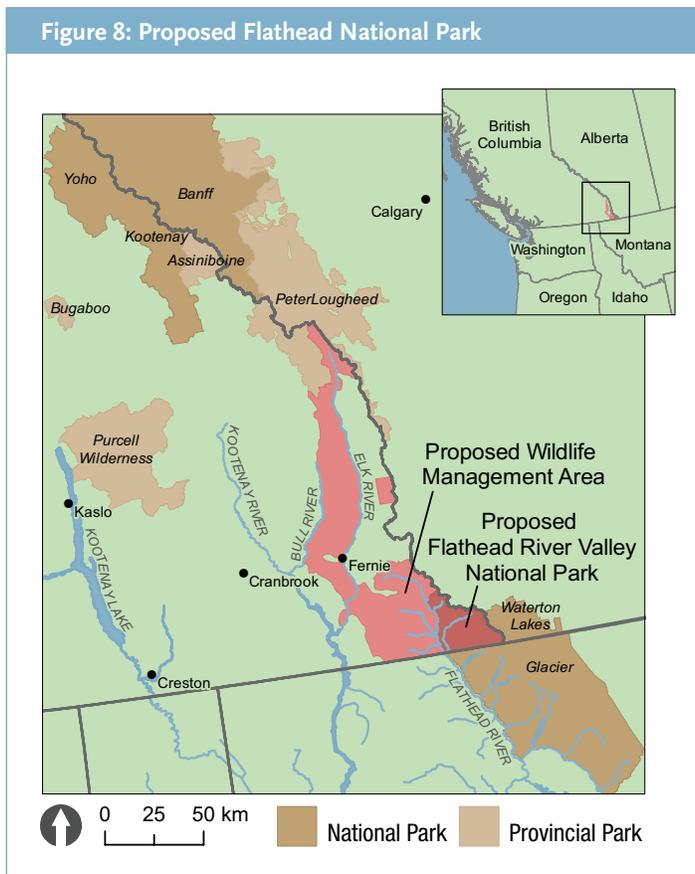
Many of the species in the Flathead watershed have large area requirements and are highly mobile, interbreeding with populations in the Waterton-Glacier park complex and across the Canada–U.S. border.

In February of 2010, the B.C. government instituted a ban on all mining and oil and gas development in the entire Flathead River Valley. Other extractive and recreational activities such as logging, road building, hunting and trapping and motorized recreation are set to continue.<sup>94</sup>

This is an important first step toward permanent protection of the transboundary Flathead and the CCE. The continued threat of habitat fragmentation due to human impacts in the Flathead and the surrounding region if not addressed could sever the connection to the protected wilderness areas to the north. Scientific studies suggest that impacts from human activity along the highway 3 corridor are creating a barrier to movement and a break in connectivity between the two World Heritage Sites in Canada’s Rocky Mountains.<sup>95</sup> Threats to connectivity in the Flathead River Valley are particularly for grizzly bear,<sup>96</sup> wolf, lynx, wolverine, fisher, marten, mountain goat and Rocky Mountain bighorn sheep – species that require habitat connectivity since individuals occupy very large home ranges and have the ability to travel great distances.

While cooperation has led to a collection of interconnected parks in the CCE, a crucial part of the landscape remains unprotected, namely the B.C. portion of the Flathead. In Montana, at-risk species and their habitat are given strong protections under the U.S. Endangered Species Act, but in B.C., species at risk receive little or no protection under a fragmented collection of weak laws and policies.

Protections for species at risk must be harmonized on both sides of the border for this transboundary landscape to continue to thrive. In the future, the Flathead could become a model for cooperation between British Columbia and our neighbours if we can agree on consistent management and overcome some of the technical problems currently hampering collaboration, such as the need for adequate funding, staffing and consistent data collection on populations and trends (including harmonized research protocols). Also needed is an agreement on collaborative monitoring, as well as the removal of barriers to collaboration, for example, simply making travel easier for ministry staff would allow for attendance at regular cross-border meetings.<sup>97</sup>



# Antelope-brush ecosystem

## South Okanagan transboundary ecosystem at risk

Dry and wet forests, alpine areas, wetlands and grasslands make up the special ecosystems of B.C. Grasslands are located mostly in the interior of the province, and provide habitat for many unique species that occur nowhere else in B.C. In the south Okanagan, grasslands have also proved to be very attractive for human settlement and development.

The antelope-brush ecosystem of the south Okanagan is one such special place that has been especially hard hit. It is technically referred to as the antelope-brush/needle and thread grass shrub steppe – a name that describes the key plants that shape this treeless landscape. As shown in Figure 9<sup>98</sup>, it occurs in B.C. and very small areas of northern Washington and Idaho,<sup>99</sup> making it a transboundary ecosystem with a very limited extent.

Many exceptional and rare species that are adapted to a very dry environment occur in this part of B.C.<sup>100</sup> The Parowan tiger beetle, Nuttall's cottontail, night snake, ground mantid and many other species at risk call this precious ecosystem home. But due to human impacts, it is now considered one of four most endangered ecosystems in all of Canada.<sup>101</sup>

**“The preservation of antelope-brush habitat in the south Okanagan is vital to the conservation of biological diversity in British Columbia ... The diversity of life in this ecosystem is nationally significant, and we have a responsibility to do what we can to conserve it.”<sup>107</sup>**

DEBBIE CLARKE PHOTO



Exceptional and rare species call the Antelope brush ecosystem home. But due to human impacts, it is now considered one of four most endangered ecosystems in all of Canada.

SUN SPIDER/VIRGILIU MARIUS  
AURELIAN PHOTO

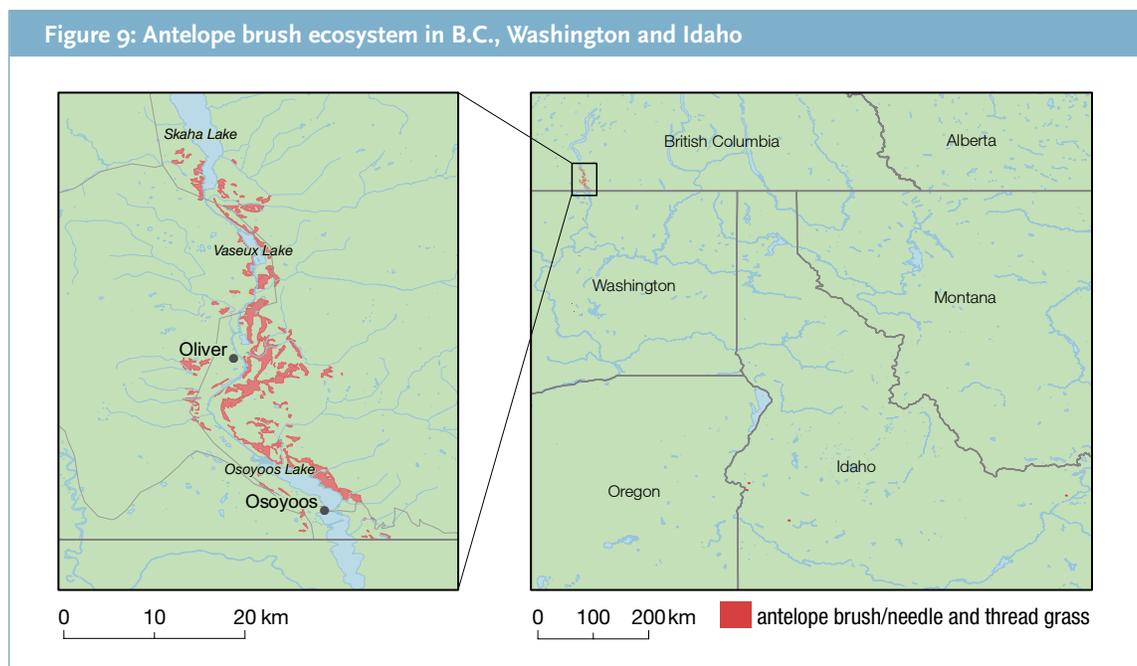


ANTELOPE-BRUSH/  
VIRGINIA SKILTON PHOTO

Over 60 per cent of the antelope-brush ecosystem in B.C. has already been lost, with estimates as low as 3,154 hectares remaining in B.C. (down from 10,050 in 1860).<sup>102</sup> Only 360 hectares are in protected areas,<sup>103</sup> and the average rate of loss between 1995 and 2001 was 90 hectares annually, attributed mostly to housing, agriculture and grazing.<sup>104</sup> As a result of such human developments, at least 88 species that lived in this ecosystem are now either gone or at risk of disappearing from B.C.<sup>105</sup>

The rarity of this ecosystem on both sides of the Canada–U.S. border makes it imperative that B.C. legally protect its share in order to ensure that this transboundary ecosystem persists in Canada, that existing cross-border connections are maintained, and to allow for the future possibility of restoring lost connections. The Okanagan Valley is a corridor for the movement of plants and animals between habitats on both sides of the border and ensuring such movements can continue will become increasingly important with global warming.<sup>106</sup>

Figure 9: Antelope brush ecosystem in B.C., Washington and Idaho



# Wolverine

## An iconic transboundary species

For many large-bodied wide-ranging species, single-jurisdiction management does not adequately protect against extinction. Such species require large areas of habitat to support populations large enough to be genetically and demographically viable, and so their management is often inherently transboundary.<sup>108</sup> Given patterns of large mammal range collapse in North America,<sup>109</sup> B.C. has a continental-scale conservation responsibility for those species that remain here.

The wolverine is one such species. It has already lost one-third of its historic range in North America. Wolverines in the U.S. and Canada move between adjoining jurisdictions regularly.<sup>110</sup> In addition to dispersing long distances and having large home ranges, wolverines exist at low densities and reproduce slowly.<sup>111</sup>

In the contiguous U.S., wolverine range has undergone a substantial contraction in the past 200 years and is now limited to north-central Washington, northern and central Idaho, western Montana, western Wyoming and California<sup>112</sup> (Figure 10). In Canada, the eastern population (in Newfoundland and Quebec) is assessed as endangered, although it is likely extirpated. The western population (west of Quebec) has been designated as special concern.<sup>113</sup> Wolverine is ranked as vulnerable in B.C., and the Vancouver Island subspecies of wolverine has already been extirpated.

B.C. is home to about 3,530 wolverines.<sup>114</sup> Genetic research suggests that there is a nearly continuous distribution of wolverines in western Canada and that some U.S. populations are peripheral to B.C.'s populations.<sup>115</sup> The same study concluded that current populations in Montana and Idaho are a result of a relatively recent expansion of wolverines from B.C. or Alberta,<sup>116</sup> meaning that gene flow between these populations is transboundary and that wolverines in the U.S. are dependent on the health of their B.C. counterparts. In fact, reintroductions to some of the lower 48 states have taken place with wolverines originally obtained from northern Canada.<sup>117</sup>

The wide-ranging wolverine has already lost one-third of its historic range in North America.

Figure 10: Current wolverine range in western North America<sup>115</sup>



Since peripheral populations are generally smaller and more susceptible to extirpation,<sup>118</sup> conservation efforts in B.C. that protect the wolverine will benefit peripheral populations in the U.S. that have experienced historical declines, and help prevent the elimination of wolverines from yet more of their historical range.<sup>119</sup> Legal protection of this fascinating species is essential for its persistence on both sides of the Canada–U.S. border.

Conservation efforts in B.C. that protect the wolverine will benefit peripheral populations in the U.S. that have experienced historical declines, and help prevent the elimination of wolverines from yet more of their historical range.

WOLVERINE/PHOTO © GLEN AND REBECCA GRAMBO



# Methods of Analysis

This Appendix describes the methods used to produce the statistics on transboundary species at risk in B.C. provided in this report, such as in Figures 1 and 4.

## 1. Taxonomic lists used to enumerate species in major wildlife groups

The complete species, subspecies, population and variety list for terrestrial mammals, vascular plants, non-vascular plants, amphibians, reptiles and turtles, birds, freshwater fish, terrestrial and freshwater molluscs and insects in B.C. was obtained from the B.C. Conservation Data Centre's (CDC) Species and Ecosystem Explorer and NatureServe.

## 2. Species exclusions

The following groups were excluded from analysis in this study.

**NO STATUS:** Species listed as 'no status' in the 'status' field of the Species and Ecosystems Explorer. 'No status' species were generally the parent species of subspecies that exist in B.C. 'No status' records were excluded so as not to double count species.

**EXOTIC OR INTRODUCED SPECIES:** Species considered 'exotic' or 'introduced' in the 'status' field of the Species and Ecosystems Explorer .

**ACCIDENTALS:** Species listed as 'accidental' in the 'status' field of the Species and Ecosystems Explorer.

**MARINE SPECIES:** Marine species were excluded from the analysis as their protection and recovery under law is the responsibility of the federal government and not of the province. These species were generally listed as 'cetacea' in the Order field by the CDC's Species and Ecosystem Explorer. Other non-cetacean marine species were simply recognized and removed.

### 3. Status rank

Provincial ranks (S1, S2 etc.) for each species were obtained from the CDC Species and Ecosystem Explorer.

Species counted as 'at-risk' included those ranked by the CDC as S1 to S3S4 (inclusive of dual ranks and rank modifiers): S1, S1?, S1B, S1B-S2N, S1B-S4N, S1N, S1S2, S1S2B, S1S2M, S1S3, S2, S2?, S2B, S2B-S4N, S2M, S2S3B, S2S3, S2S3B-S4N, S2S3N, S2S4, S2S4B, S3, S3?, S3B, S3B-S2N, S3M, S3N, S3S4, S3S4B, S3B-S4N, SH, SH?, SHB-SNAN, SX, SXB-SNAN.

Those species considered 'not at-risk' included those ranked by the CDC as higher than S3S4: S3S5, S4, S4?, S4?B, S4B, S4B-S3N, S4B-S4N, S4B-S5N, S4M, S4N, S4S5, S4S5B, S4S5B-S4N, S4S5B-S5N, S4S5M, S5, S5B, S5B-S4N, S5B-S5N, S5M, S5N, SNA, SNR, SU, SUB-S4N, SUM, SUN.

### 4. Transboundary determination

NatureServe Explorer (<http://www.natureserve.org/explorer/>) was used to look up individual species, subspecies, populations and varieties for their distribution/range in the U.S. and Canada. If the species was found in B.C. and at least one of the seven jurisdictions adjacent to B.C. (Alberta, Yukon, Northwest Territories, Alaska, Washington, Idaho or Montana) then that species was considered 'transboundary'. In the case of migratory birds, a species was considered transboundary if it were found to exist in B.C. and an adjacent jurisdiction. Thus some species that were not identified in this report as transboundary were found in B.C. and in another, non-adjacent jurisdictions.

When species were not found through a search in NatureServe Explorer, other sources of information on range were used, including:

- Guppy, C.S. and J.H. Sheppard. 2001. Butterflies of British Columbia. Vancouver, UBC Press, 414 pp.;
- USDA Plants database, <http://plants.usda.gov>;
- B.C. Herbarium database, [www.botany.ubc.ca/herbarium](http://www.botany.ubc.ca/herbarium);
- eFloras / Harvard University Herbaria, [www.efloras.org](http://www.efloras.org);
- Washington Native Plant Society (for plant lists in counties adjacent to B.C.), [www.wnps.org](http://www.wnps.org); and
- E-Flora B.C., [www.eflora.bc.ca](http://www.eflora.bc.ca).

### 5. Regional Districts

Two online resources were used to create a list of transboundary species at risk by regional district:

- CDC Species and Ecosystems Explorer; and
- Pearson, M. and M.C. Healey. 2010. Species at risk and local government: a primer for B.C. Stewardship Centre of British Columbia, Courtney, B.C. Available at [www.speciesatrisk.bc.ca](http://www.speciesatrisk.bc.ca)

# Notes

- 1 B.C. Conservation Data Centre (CDC), Species and Ecosystems Explorer, at [www.env.gov.bc.ca/atrisk/toolintro.html](http://www.env.gov.bc.ca/atrisk/toolintro.html)
- 2 Garry Oak Ecosystem Recovery Team, at [www.goert.ca/](http://www.goert.ca/)
- 3 Grasslands Conservation Council of British Columbia, Species at Risk, at [www.bcgrasslands.org/grasslands/sar.htm](http://www.bcgrasslands.org/grasslands/sar.htm)
- 4 Zbicz, D. C. and M.J.B. Green. 1999. "Status of the World's Transfrontier Protected Areas". Paper presented at the *International Conference on Transboundary Protected Areas as a Vehicle for International Co-operation*, 16-18 September 1997, Somerset West, South Africa. 22 pp.
- 5 Grant, J. A. and M.S. Quinn. 2007. Factors influencing transboundary wildlife management in the North American 'Crown of the Continent'. *Journal of Environmental Planning and Management*, 50(6): 765 – 782.
- 6 Musiani, M. and P. Paquet. 2004. The practices of wolf persecution, protection and restoration in Canada and the United States, *Bioscience*, 54(1): 50 – 60.
- 7 For the purposes of this report, a transboundary species is one that occurs in B.C. and at least one adjacent jurisdiction, namely Washington, Idaho, Montana, Alberta, Northwest Territories, Yukon and Alaska.
- 8 Figure 1 shows the number of native transboundary species relative to non-transboundary species in B.C. tracked by the B.C. CDC. For instance in B.C., 396 insects are transboundary and 4 are not transboundary. 'Vascular plants' include grasses, flowers, shrubs and trees; 'non-vascular' plants include mosses, liverworts and hornworts; 'freshwater fishes' include lampreys; and 'insects' includes an amphipod. Excluded from Figure 1 are fungi, marine species, accidentals, exotics or introduced species, and species listed as 'no status' by the B.C. CDC. For methods of analysis, see Appendix 2.
- 9 Wilson, A.G., P. Arcese and F. Bunnell. 2007. The Status of Genetic Biodiversity in British Columbia. For: The Biodiversity B.C. Technical Subcommittee for the *Report on the Status of Biodiversity in British Columbia*. September 13, 2007.
- 10 Moola, F., D. Page, M. Connolly and L. Coulter 2007. *Rich Wildlife, Poor Protection: the case for strong legal protection of British Columbia's biodiversity*. David Suzuki Foundation. At [www.davidsuzuki.org/Publications/Rich\\_wildlife\\_poor\\_protection.asp](http://www.davidsuzuki.org/Publications/Rich_wildlife_poor_protection.asp).
- 11 Figure 4 shows the percentages of known species, subspecies, populations and varieties in each wildlife group that are both transboundary and at risk. For example, eleven out of 16 species of reptiles and turtles in B.C. are considered at-risk by the B.C. CDC, but all 11 of those at-risk reptiles and turtles are also transboundary. That is, 68 per cent (11 out of 16) reptiles and turtles that occur in B.C. are both transboundary and at risk. Other wildlife groups in this figure are broken down the same way: 57 per cent of non-vascular plants are transboundary and at-risk (469 out of 816), 42 per cent of vascular plants (993 out of 2364); 40 per cent of amphibians (8 out of 20); 30 per cent of terrestrial and freshwater molluscs (46 out of 153); 30 per cent of freshwater fishes (30 out of 98); 26 per cent of insects (107 out of 400); 32 per cent of mammals (41 out of 128) and 24 per cent of birds (92 out of 373). Dual ranks are included in the first rank category (e.g. S1 includes species ranked as S1S2 and S1S3, S3 includes S3S4 species etc.). For methods of analysis, see Appendix 2.
- 12 Schluter, A. T. Lea, S. Cannings, and P. Krannitz. 1995. *Antelope-brush Ecosystems*. B.C. Ministry of Environment Lands and Parks, Wildlife Branch. Victoria, B.C. 6 pp.
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- 74 See Appendix 1 in this report on the Flathead watershed.
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The UNESCO World Heritage Committee decided that the site be listed under criteria (ii) and (iii) and requested the World Heritage Centre to write to the States Parties with respect to the Biosphere Reserve proposal. In addition, the Committee recommended that the site be eventually expanded to include the adjacent protected area in the Akamina/Kishinena, at <http://whc.unesco.org/archive/repcom95.htm#354>
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