

Trends Analysis: Environment



OVERVIEW

The unique, diverse natural landscapes and resources of the Columbia Basin-Boundary region are the foundation for many aspects of well-being. These landscapes provide ecological resilience, biodiversity, land to grow food, clean air and water, and they are a foundational piece of our economic, social, and cultural well-being.

Blair Altman photo

OVERVIEW CONTINUED

The indicators included are intended to provide an overall description of the well-being of the regional environment. They identify trends that are positive, and highlight areas of decline that need improvement. This type of environmental data can help prioritize issues that need our attention, contribute to our understanding of the effectiveness of environmental initiatives, and allow us to identify achievements that should be celebrated. The following indicators in this report shine a light on the state of the environment in the Columbia Basin-Boundary region:

- Air Quality;
- Snowpack;
- Glacier Extent;
- Stream Health;
- Wildfires;
- Species at Risk;
- Invasive Species;
- Threatened Ecosystems;
- Bears Destroyed;
- Mountain Caribou Population;
- Watershed Stewardship Groups;
- Cutblocks;
- Protected Areas; and
- Wetlands.

These indicators are presented in detail below, including a description of what is measured and its importance, as well as current data and trends where available.

AIR QUALITY

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

The air quality indicator tracks annual *average hourly readings of fine airborne particulates* (referred to as $PM_{2.5}$) from monitoring stations in the region. Data are acquired from the BC Ministry of Environment's [air data archive](#) and processed using Ministry of Environment guidelines.¹

Sources of fine particulate matter include wildfires, residential wood burning, agriculture, and unpaved roads. High concentrations of $PM_{2.5}$ can have negative effects on human health and the environment. Because the particles are small enough to enter the deepest part of human lungs, $PM_{2.5}$ can cause respiratory problems and contribute to cardiovascular disease. Fine particulates can also impair visibility, and affect the climate.²

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

In 2014, the annual average particulate matter readings were higher at two stations when compared to 2013 (Castlegar, Nelson) and lower at two (Grand Forks, Creston). One additional station was also added at the Golden Helipad, replacing the Golden Hospital station. A comparison of average daily readings (see

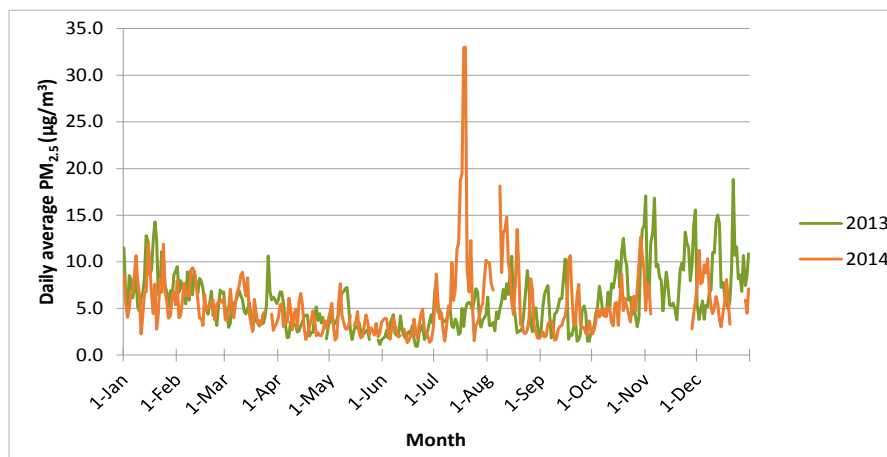


Figure 1) shows that differences between the two years were most pronounced during the summer, when readings were generally higher in 2014, and early winter, when readings were generally lower. These differences can likely be attributed to the relatively active wildfire season experienced in

Figure 1: Daily average $PM_{2.5}$ readings ($\mu\text{g}/\text{m}^3$) in 2013 and 2014, average of Castlegar, Creston, Golden, and Nelson stations¹

¹The Threatened Ecosystems indicator was updated June 30, 2017 to correct an error found in the earlier version.

2014, and the relatively mild start to the 2014/2015 winter, which would have affected the amount of smoke being produced from residential wood-burning appliances. [Environment Canada climate data](#) shows that heating degree daysⁱⁱ in the communities included in the calculation for **Figure 1** were about 7% lower for November and December 2014 as compared to the same months in 2013.³

The Nelson station recorded the lowest annual PM_{2.5} levels in the region, at 4.0 micrograms per cubic metre in 2014. The highest readings recorded in Castlegar, though caution should be exercised when comparing Castlegar readings to the remainder of the region as the Castlegar station uses new technology that is not yet in place at other sites. New instruments tend to record higher PM_{2.5} levels than older instruments. All annual average values were below the provincial air quality objective of 8.0 (see **Figure 2**).

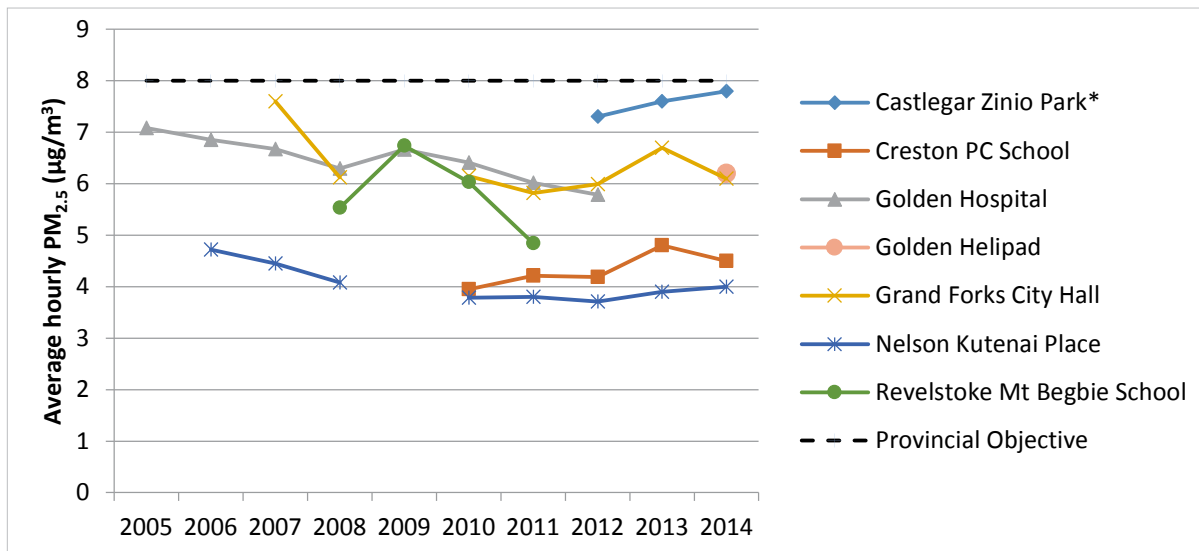


Figure 2: Annual average hourly PM_{2.5} readings (µg/m³) at monitoring stations in the region¹ (*The Castlegar station relies on new technology that typically records higher readings)

SNOWPACK

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

The snowpack indicator uses percent of normal snowpack data from data collected through snow surveys, an automated or manual process of collecting snow data at the same time and place. Snow surveys are conducted by the BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO) at various locations across the Columbia Basin-Boundary region. Percentages are based on calculations done by FLNRO of snow water equivalents, which measure the amount of water, if melted, contained within a snowpack. Snowpack data was retrieved from FLNRO's 2016 Water Supply and Snow Survey Bulletins.⁴

Snow accumulation is an important contributor to the volume and timing of stream flow in the Columbia Basin-Boundary region. In the Columbia Basin 65% of precipitation falls as snow.⁵ Between 1956 and 2005 the Columbia Basin snowpack declined 20% at sites in the northern Basin and 24% at southern sites.⁵ The amount of snowfall is determined by weather conditions, and with the continued progression of climate change, snowfall patterns are expected to change.⁶ Projections for the Columbia Basin-Boundary region are that warmer weather will shift winter precipitation from snowfall to rain, with the greatest effects expected at lower elevations. Less precipitation as snowfall can have serious implications for tourism and ski industries, and can change stream flow dynamics to drive earlier spring peak flows and lower summer flows.^{6,7}

ⁱⁱThe 'heating degree day' is a measure of the number of degrees Celsius that a daily mean temperature is below 18°C. It can be used to estimate heating requirements for buildings.

WHAT ARE THE CURRENT CONDITIONS?

FLNRO provides detailed snowpack data collection and analysis dating back multiple decades.⁴ Since 1997, FLNRO has provided a Water Supply and Snow Survey Bulletin recording trends at a Basin level.⁴ The snow survey bulletins provide a snapshot picture of snowpack in 2016 that are based off of percent of normal using historical data, which can be used in future reports as a baseline measurement.

Snowpack data for 2016 demonstrated a higher than average snowpack for winter, but a lower than normal snowpack in the spring (see **Table 1**). Lower than average snowpack in the late spring indicate an earlier than normal spring season melt due to above average temperatures and below average precipitation. These results may indicate that the effects of climate change are already being observed in the Columbia Basin-Boundary region, or may be a result of strong El Nino conditions that were observed this year.⁴ El Nino events typically bring warmer than normal winter and early spring temperatures to BC, as well as variable precipitation patterns.

Basin	Percent of normal							
	Jan 1	Feb 1	Mar 1	April 1	May 1	May 15	June 1	June 15
Upper Columbia	106%	102%	104%	99%	75%	70%	63%	29%
West Kootenay	109%	101%	106%	107%	69%	44%	35%	20%
East Kootenay	105%	99%	98%	99%	42%	12%	8%	1%
Boundary	112%	114%	115%	106%	63%	55%	16%	5%

Table 1: 2016 percent of normal snowpack for four regions in the Columbia Basin⁴

GLACIER EXTENT

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator measures the *20-year change (1985-2005) in the extent of all glaciers in the Basin Boundary region*. ‘Extent’ refers to the amount of land that is covered by glacial ice. Data for this indicator were provided by researchers at the University of Northern British Columbia, who have completed a remote-sensing based inventory of all glaciers in Western Canada.⁸ Additional analysis by the Selkirk Geospatial Research Centre provides supplementary information. Glaciers provide essential flow and storage services in Columbia Basin-Boundary region watersheds. As glaciers recede, so do the resilience of our aquatic ecosystems in the face of the shifting precipitation patterns that are anticipated with climate change.⁹ The contribution of glaciers to regional streamflow patterns is also an important local economic driver; hydroelectric generation potential, especially in the late summer, will very likely be affected by the recession of glaciers.¹⁰ Changing streamflow patterns associated with glacial melt may result in increased water supply in the short term, followed by supply decrease in the long term.¹¹ Understanding changing streamflow dynamics caused by decimated glacial volume is critical for managing future water supply, and will challenge current methods for water management.

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

On average, the extent of glaciers in our region dropped 14% over the period from 1985 to 2005. That's an average rate of change of 0.7% per year. The trend for this region is more pronounced than the average for Western Canada—11% over the entire study period, or 0.6% per year. The rate of glacial melt is higher in certain parts of the region. Glaciers in the south are receding the fastest, while glaciers in the north are receding the slowest (see **Figure 3**).

Research suggests that glacier size is an important factor affecting rates of recession. In our region, one of the smaller glaciers, the New Denver glacier, is receding at an extreme rate. Over the period 1999 to 2010, the extent of the New Denver glacier dropped by 54%, a rate of almost 5% per year.¹⁴

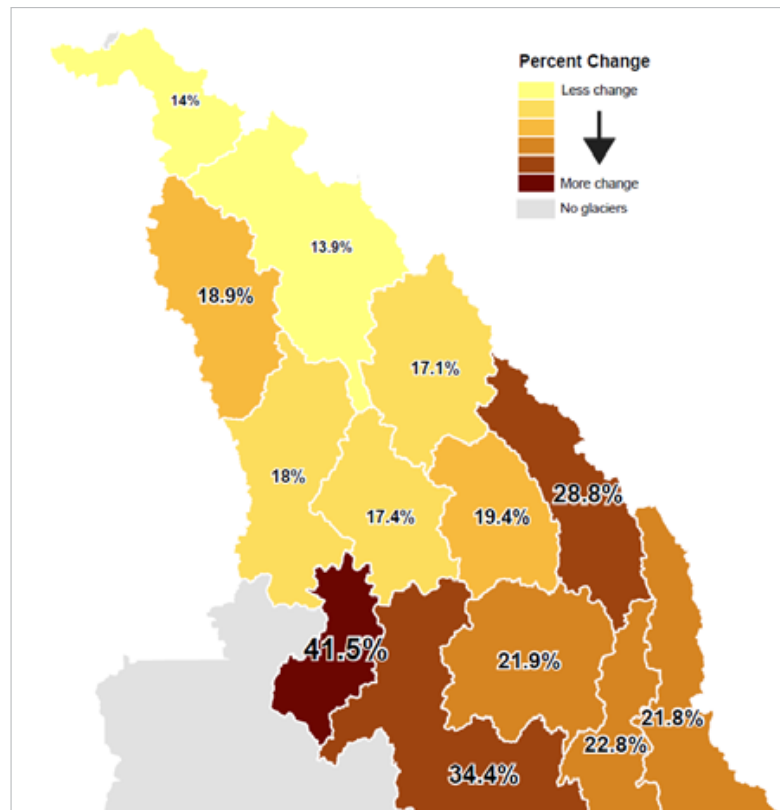


Figure 3: 1985-2005 change in extent of Basin Boundary glaciers, by major watershed^{12,13}

Research on glaciers in British Columbia, including in the Columbia River Basin, is ongoing. Researchers from the University of Northern British Columbia are working with universities in Alberta and Washington State, and with scientists from the federal government to record recent glacier retreat and glacial health. New findings regarding current trends and conditions will be released in the coming years. For more information regarding this project, please visit their [website](#).¹⁵ Recent reports note that as of 2013 there are 1,787 glaciers in the Columbia Basin region, covering 1,593 km.^{2,5}

STREAM HEALTH

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator uses an *assessment of the stress level of aquatic benthic invertebrate communities as a proxy for the health of the Columbia Basin-Boundary region watercourses*. Data are sourced from eight community-led water quality monitoring programs that collectively report on 35 sites on rivers and streams. To ensure comparability of results, each program uses the same nationally-endorsed sampling protocol which is provided by the Canadian Aquatic Biomonitoring Network. For more information on these programs, or to view data, visit the Columbia Basin Watershed Network's [website](#).¹⁶

Benthic invertebrates are organisms that live at the bottom of lakes and streams (e.g., aquatic worms, snails). Benthic communities are sensitive to environmental change. Therefore, the abundance and distribution of certain species can indicate a change in water quality or the overall health of a watercourse. Many communities in the Columbia Basin-Boundary region are concerned about water quality in the lakes and rivers that provide water for drinking, irrigation, and recreation, among other uses. Trends in the stress level of benthic invertebrate communities can help decision-makers understand the impact of human-induced change on our watersheds.

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

Current stream health assessment results vary from watershed to watershed, and even from site to site on the same stream. The majority of sites (51%) were determined to be “Potentially Stressed” during their last assessment (see **Figure 4**), indicating that the composition of their benthic invertebrate communities was mildly divergent from the composition of the benthic community that would be expected if that site were

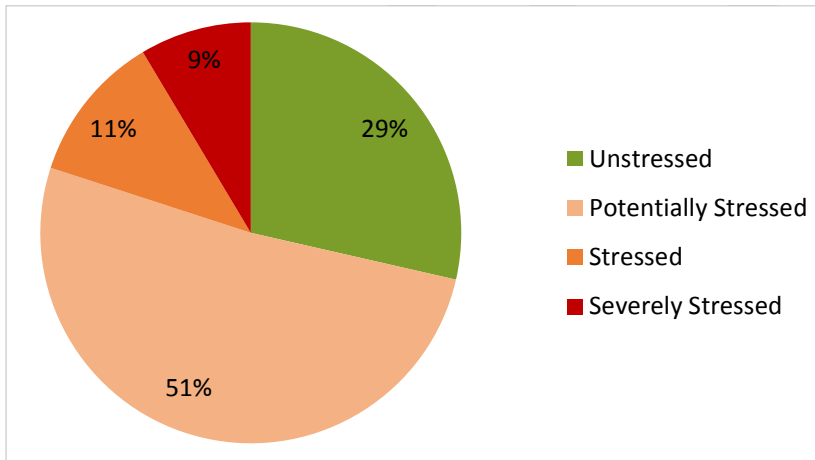


Figure 4: Stress level of benthic invertebrate communities from the last assessment of 35 monitoring sites in the Columbia Basin-Boundary region¹⁸

experiencing minimal pressure from human activities. From a regional perspective, a short-term trend in stream health is not clear. Of the sites that have undergone multiple annual assessments, 11 show an increase in stress level between their first and last assessment, 8 show a decrease, and 12 show no change. Trends for individual monitoring sites can be viewed online using the [Digital Basin](#).¹⁷

WILDFIRES

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator measures the area burned each year by wildfires, based on [records](#) of fires since 1919 from the Wildfire Management Branch of FLNRO.¹⁹ The area burned from year to year is highly variable and is closely correlated with both temperature and precipitation.²⁰ Therefore, data have been analysed using a 10-year moving average, which measures the average area burned over the previous 10 years.

Wildfires can cause economic, social, cultural, and environmental losses by destroying buildings, forests, heritage sites, or even communities. They can cause respiratory problems, affect water quality in community watersheds, close transportation routes, and in the worst cases, result in loss of life. Due to the significant risks associated with wildfire, in recent years, Community Wildfire Protection Plans have been prepared for most communities in the region. These plans include an assessment of the forests immediately surrounding the communities. The risk of catastrophic fire in forests that have high fuel loads can be mitigated through fuel reduction treatments. Those high risk areas around our communities have been mapped, and options to treat those areas to reduce the hazards have been described. However, many communities struggle to implement the necessary treatments due to lack of funding and staff resources.

While wildfires pose some risk, they also have ecological importance. Wildfires have occurred naturally for centuries and contribute to increased biodiversity and ecosystem resilience.²¹ Fire acts as a disturbance regime that stimulates the development of various successional stages, and promotes a wide variety of native plants and animals. Fire is important for the survival of many species, including the black backed woodpecker whose habitat is relatively restricted to burned forests.²² Prescribed fires have been a management technique used by forest managers who recognize the importance of fires to ecosystems. Therefore, it is important to balance the competing demands for public safety and ecosystem health through the management of wildfires and prescribed burning, especially in increasingly populated regions.

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

The 10-year moving average shows that the area burned per year decreased significantly once provincial fire suppression efforts began in earnest following World War II (see **Figure 5**). Visit the [Digital Basin](#) for detailed data tables and interactive maps.²³ An analysis of historic fires shows that, since 1919, of the 28 communities found in our region, 24 have had a large wildfire (at least five hectares) come within two km

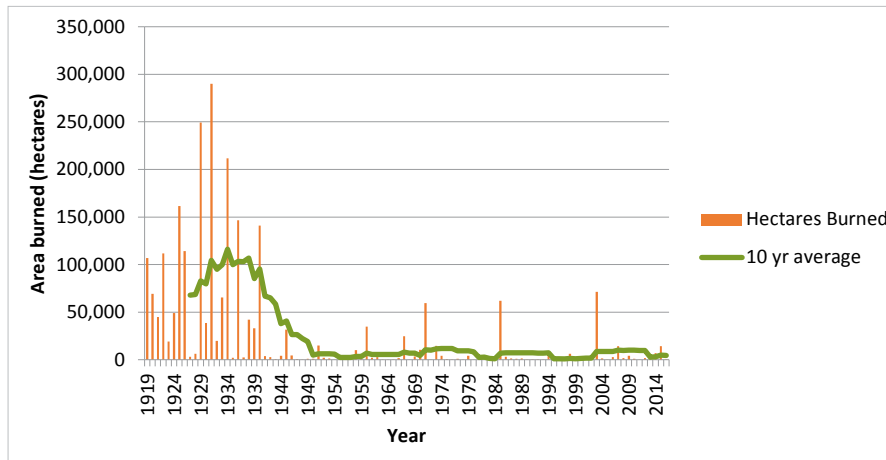


Figure 5: Area burned by wildfires in the Columbia Basin-Boundary region 1919 - 2016, with a 10 year moving average¹⁹

of their municipal boundaries. Of the four municipalities that are not on this list, Invermere and Radium Hot Springs have both had large fires within five km of their boundaries, and Silverton and New Denver have areas identified as having a high probability and high consequence of wildfire in the immediately surrounding area.²⁴

Looking at the data collected for 2016, there has been a dramatic decrease in wildfires in comparison the previous two years (see **Figure 6**). This is likely a result of precipitation patterns throughout the summer season, active wildfire suppression, and may also be associated in part by the increased fines for wildfire

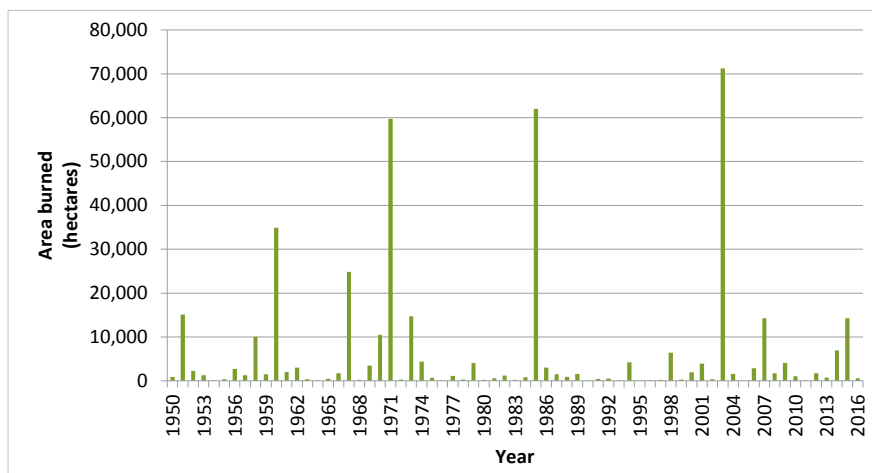


Figure 6: Area burned by wildfires in the Columbia Basin-Boundary region 1950-2016¹⁹

violations by the Province early this year. Fines associated with fire restrictions under the Wildfire Act have tripled from \$345 to \$1,150.²⁵

RDI's 2013 annual poll of residents found that 47% of respondents agree that wildfire is a threat to their community, while 22% disagree, and 30% neither agree nor disagree.²⁶ The continued build-up of forest fire fuels combined with a

projected increase in area burned in the near future due to climate change suggests that fires are a more immediate threat than is perceived by residents in our region.²⁰ It is possible that the threat is underestimated because evidence of fire, and the reminder of its threat, fades with forest regeneration. However, the longer an area goes without burning, the greater the risk of a damaging fire.

For more information on the safe use of fire in the backcountry, please refer to the BCWildfire Services [website](#)²⁷, as well as the FireSmart Homeowners [Manual](#)²⁸.



Kamala Melzack photo

PROTECTED AREAS

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator tracks the *percent of public land in the region that is protected as a national park, provincial park, ecological reserve, national wildlife area, provincial protected area, or by private land conservation organizations (Non-governmental Organizations -NGOs)*. Habitat destruction is a leading threat to biodiversity worldwide, and protected areas provide landscapes that guard against this destruction. Protected areas also provide us with recreational opportunities, clean air and water, spiritual rejuvenation, and reference ecosystems for long-term research and monitoring.

This indicator uses the Biogeoclimatic Ecosystem Classification (BEC) system to assess the degree to which different ecosystems are protected. The BEC system identifies 16 different zones within BC that share similar ecological characteristics. 'Bio' refers to the biological nature of the ecosystem, 'geo' refers to the classification of the soils and geology and 'climatic' identifies the predominant climate factors in which the ecosystem exists. The BEC zones in the Basin include Engelmann Spruce - Subalpine Fir (ESSF - 49% of the land base), Interior Cedar – Hemlock (ICH - 28%), Montane Spruce (MS - 9%), Interior Mountain Heather Alpine (IMA - 7%), Interior Douglas Fir (IDF - 6%), Ponderosa Pine (PP - 1%) and Sub-Boreal Spruce (SBS - 0.2%). Data for this indicator was retrieved from The Government of British Columbia (BC)^{29,30} and the NGO Conservation Areas Database.³¹ The data presented here is different from what is currently represented on the Digital Basin, however the Digital Basin will be updated in the future.

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

With more than 13,000 km² of land is protected under a variety of jurisdictions and management regimes, the system of protected areas in the Columbia Basin-Boundary region comprises an assortment of different conservation types (see **Figure 7**), covering different BEC zones (see **Figure 8**). We are fortunate that four of the seven terrestrial National Parks in BC are found within the Columbia Basin-Boundary region (Yoho,

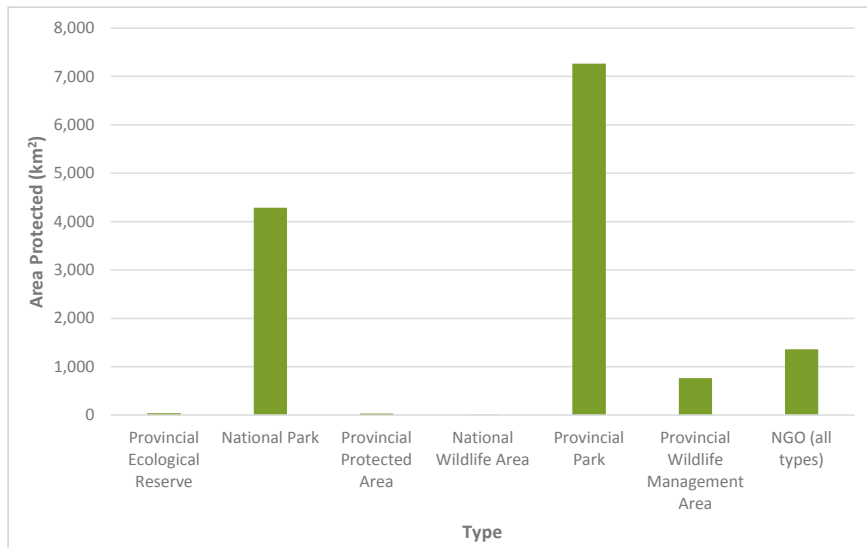


Figure 7: Area protected in the Columbia Basin categorized by conservation land type

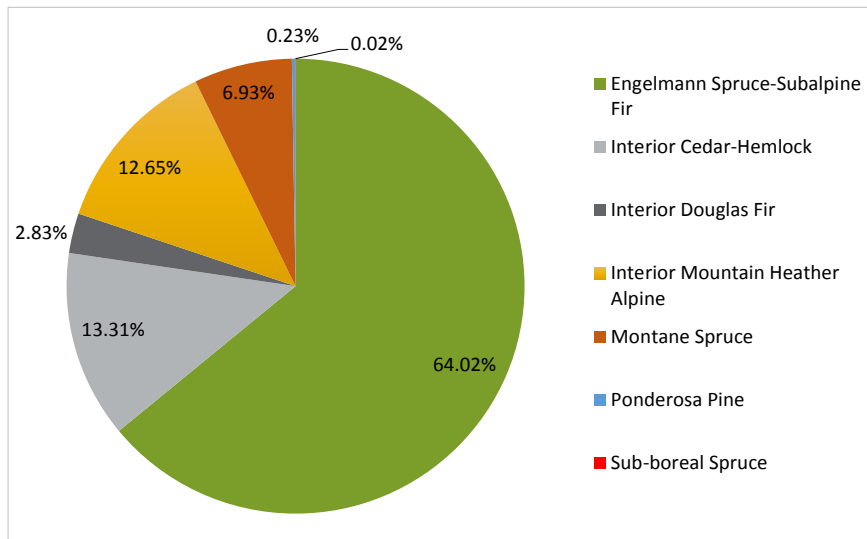


Figure 8: Percent of area protected in the Columbia Basin-Boundary region categorized by BEC zone

Kootenay, Mt. Revelstoke and Glacier National Parks). These four National Parks account for 5% of the land in the region, and contribute 22% of the total area protected. Next to Canada's national parks, BC has the largest park system in Canada. Within the Columbia Basin-Boundary region, there are numerous provincial parks, including Valhalla and Goat Range Provincial Parks, that contribute 38% of the protected area in the region. Recent changes to the provincial park system include expansions to Syringa Provincial Park (by 22.88 hectares), West Arm Provincial Park (by 1,219 hectares), and McDonald Creek Provincial Park (by 0.0075 hectares).³² Moreover, Monashee Provincial Park's management plan was recently approved in October 2014.

However, the distribution of ecosystems protected in the Columbia Basin-Boundary region is very uneven (see **Figure 8**).

Protected areas are highly

represented in the ESSF BEC zone. For example, 21% of all ESSF zones are protected, mostly by BC Parks. Conversely, only 3.4% of all PP zones are protected. Private land conservation organizations are working hard to balance disparities in ecosystem protection within the Columbia Basin-Boundary region. For example, in the protected Ponderosa Pine zone areas, parks protect only 28%, while the remaining 72% is protected by private land conservation organizations.

SPECIES AT RISK

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator measures the number of species that are red listed in the Columbia Basin-Boundary region (meaning they are extirpated, endangered, or threatened³³), and provides a summary of what types of species are most threatened, and the habitats where they are found. Data were gathered from the [British Columbia Conservation Data Centre's](#) database of species at risk, and supplemented with additional research on specific species.³⁴ The diversity of plant and animal communities affects their resilience in the face of change, contributes to the balance of ecological processes, and the provision of ecosystem services. There are thousands of different species whose ranges include the Columbia Basin-Boundary region. The vast majority of these demonstrate healthy population counts. However, there are some species that are declining in numbers, or are threatened by habitat loss, disease, or competition from non-native species. An important aspect of environmental well-being is our society's concern for all native species, regardless of how well we understand the roles they play in the ecosystem.

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

The BC Conservation Data Center currently reports 155 species that are red listed in the Basin Boundary region. The list includes 10 birds, five mammals and five fish, and vascular plants contributing to over 60% of the listed species (see **Figure 9**).

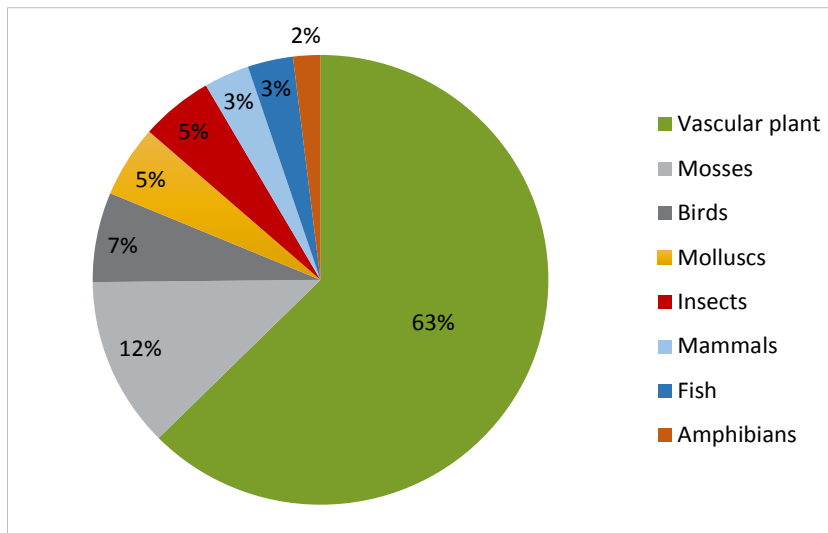


Figure 9: Percent of red listed species in the region, by type of species³⁴

There has been a 3% increase in the number of red listed species since 2014. This increase can be attributed to more species assessments having been conducted, as well as changes in species listing status. For example, in 2016 the Lambda Snaggletooth mollusc's status was changed from blue to red, and the smooth spike-primrose and the racemed groundsmoke remained on the red list but moved up in rank from S1 to S2.

The list of extirpated species does not include the millions of Steelhead, Sockeye, and Chinook salmon that used to migrate up the Columbia River prior to the construction of hydroelectric dams. These salmon runs were completely eliminated with the construction of the Grand Coulee Dam in 1941.³⁵

Red listed species tend to be found in the lowest elevation BEC zones, such as Ponderosa Pine, where the level of protection by federal or provincial parks is the lowest (see section on Protected Areas above). For example, while there is a similar number of red listed species in the high elevation ESSF zone (45 species) and the low elevation PP zone (30 species), the ESSF is almost 40 times larger.

This means that on an area basis there are more than 40 times the number of red listed species in the low elevation zones where the level of protection is the lowest (see **Table 2**).

BEC zone	Number of red listed species	Total hectares	Red listed species per 1,000km ²	Percent protected
Engelmann Spruce-Subalpine Fir	45	4,293,200	1.05	18%
Interior Cedar-Hemlock	63	2,334,400	2.70	7%
Interior Douglas Fir	55	462,300	11.90	3%
Interior Mountain Heather Alpine	17	635,500	2.68	25%
Montane Spruce	34	770,200	4.41	12%
Ponderosa Pine	30	106,300	28.22	4%
Sub-boreal Spruce	11	12,000	78.57	No data

Table 2: Protection of BEC Zones and concentration of red listed species in the Columbia Basin-Boundary region³⁴

THREATENED ECOSYSTEMS

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator tracks the number of red listed ecosystems found within each Biogeoclimatic subzone in our region. Data were acquired from the [BC ecosystem explorer](#).³⁴ A red listed ecosystem is an ecological community that is extirpated (no longer exists in BC), endangered (facing imminent extirpation), or threatened (likely to become endangered if measures are not taken to protect what remains) in BC. By learning which ecosystems in a given area are red listed, we can learn to identify and protect these ecological communities.

WHAT ARE THE CURRENT CONDITIONS?

In the Columbia Basin-Boundary region, most red listed ecosystems are found in the Interior Cedar-Hemlock and Englemann Spruce-Subalpine Fir zones (see **Figure 10**). On the [Digital Basin](#), you can click on your area of interest, and it will tell you how many red listed ecosystems have been identified within that subzone, and a link to the list of ecosystems is provided.³⁶

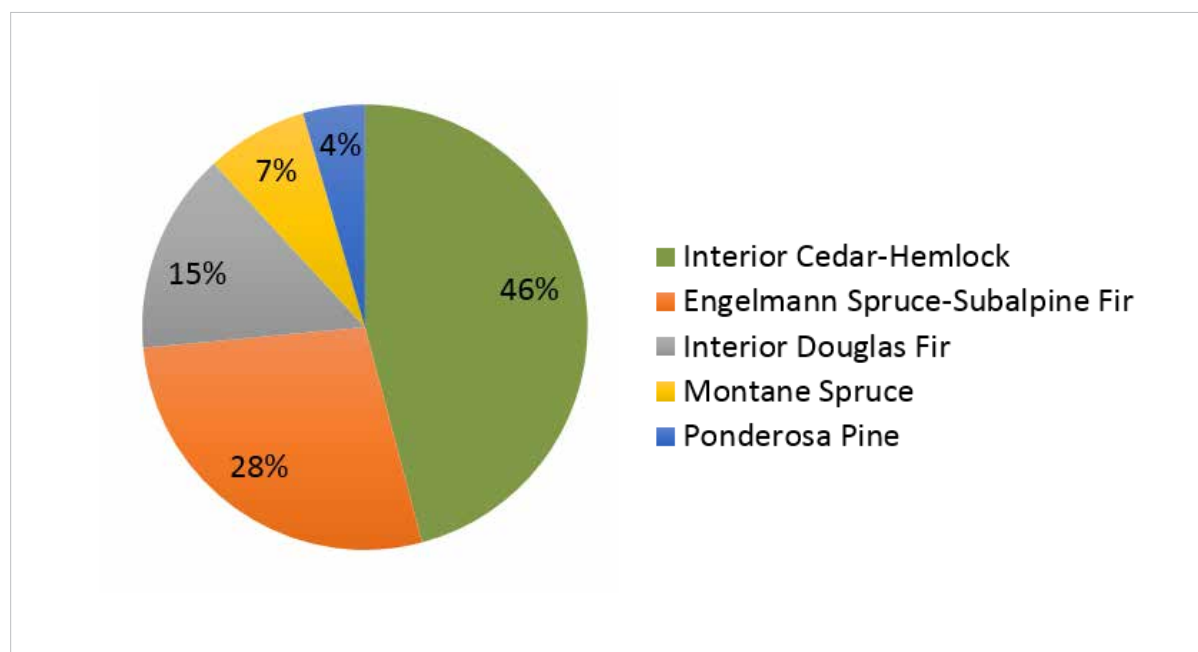


Figure 10: Percent of threatened ecosystems classified by biogeoclimatic zone³⁴

INVASIVE SPECIES

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator tracks the number of invasive plants found within each Biogeoclimatic subzone in our region. Data were acquired from the [Invasive Species Council of BC](#) and FLNRO's [Invasive Alien Plant Program](#).^{37,38} In the [Digital Basin](#), you can click on your area of interest, and it will tell you how many invasive species have been identified within that subzone, and a link to the list of species is providedⁱⁱⁱ.³⁹

Invasive species are a serious threat to the Columbia Basin-Boundary region environment and economy. They can displace native species, degrade habitats, change nutrient cycles, change wildfire cycles, and damage infrastructure.³⁷ Invasive plants negatively impact agriculture by reducing quality forage for livestock, reducing crop yields and increasing the need for expensive pesticide and herbicide applications. Some plants can also be damaging to human health, such as Giant Hogweed.⁴⁰ The best way to control invasive species is prevention and early action. Several Columbia Basin-Boundary region organizations (including sub-regional Invasive Species Councils) can be consulted for additional information on invasive species.

WHAT ARE THE CURRENT CONDITIONS?

As of 2016 in the Basin-Boundary region, 129 species of invasive plants are recorded in the Invasive Alien Plant Program database, up from the 114 invasive plant species reported in 2014.³⁹ This number continues to change over time as new species become established in our region, and as efforts to remove these species continue.

Some species are listed as 'noxious weeds' under the BC Weed Control Act, meaning that all land occupiers must control these designated noxious plants due to their highly destructive nature.⁴¹ These noxious species are listed provincially, as well as regionally, by regional district (see **Table 3**).⁴²

Regional District	Regionally Noxious Weed
Central Kootenay	Blueweed (<i>Echium vulgare</i>) Common Tansy (<i>Tanacetum vulgare</i>) Hawkweed, Orange (<i>Hieracium aurantiacum</i>) Thistle, Plumeless (<i>Carduus acanthoides</i>)
East Kootenay	Blueweed (<i>Echium vulgare</i>) Common Tansy (<i>Tanacetum vulgare</i>) Hawkweed, Orange (<i>Hieracium aurantiacum</i>) Perennial Pepperweed (<i>Lepidium latifolium</i>)
Kootenay Boundary	Common Bugloss (<i>Anchusa officinalis</i>) Field Scabious (<i>Knautia arvensis</i>) Hoary Alyssum (<i>Berteroa incana</i>)
Columbia-Shuswap	Blueweed (<i>Echium vulgare</i>) Burdock (<i>Arctium spp.</i>) Common Tansy (<i>Tanacetum vulgare</i>) Hawkweed, Orange (<i>Hieracium aurantiacum</i>) Hoary Cress (<i>Cardaria spp.</i>) Knapweed, Meadow (<i>Centaurea pratensis</i>) Sulphur Cinquefoil (<i>Potentilla recta</i>)
Fraser-Fort George	Burdock (<i>Arctium spp.</i>) Marsh Plume Thistle (<i>Cirsium palustre</i>)

Table 3: Protection of BEC Zones and concentration of red listed species in the Columbia Basin-Boundary region³⁴

ⁱⁱⁱIf you identify an invasive weed that is not on the list generated for that area, you may have found a recent invader to that ecosystem. In this case, the Invasive Species Council of BC will be particularly interested in hearing about it. You can report it through the Report-A-Weed tool, which allows members of the public to report invasive plant sightings.

A variety of control methods are employed to reduce the impact of invasive weeds and to control their spread. This includes manual removal, herbicide applications, reducing soil disturbance and biocontrols. Biocontrols are typically natural enemies (e.g., insects, parasites, pathogens) of the targeted invasive weeds that infect or feed on various parts of the plants to reduce their vigour or seed production. In the Columbia Basin-Boundary region, 18 different biocontrol agents have been used on 13 invasive weed species. More than one biocontrol agent has been released for some invasive weeds, and the same agent may work on several species. For example, six different agents work on several different species of knapweed, which have shown to be effective in reducing knapweed densities.⁴³

In addition to invasive weeds, there are also invasive species present in the aquatic environments of the Columbia Basin-Boundary region, such as Zebra and Quagga mussels. In their 2016 summer field season, the Shuswap Invasive Species Society, in partnership with the Ministry of Environment, did not detect any mussels in their samples.⁴⁴ This is an exciting discovery as invasive mussels cost the province millions of dollars each year, and there have been ongoing awareness efforts to reduce their introduction.⁴⁴

BEARS DESTROYED

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator monitors the number of bears destroyed by Conservation Officers on an annual basis in the Columbia Basin-Boundary region. It also tracks reported attractants that lead to bears coming into conflict with humans. Data for this indicator were provided by the Conservation Officer Service.

There are both grizzly and black bears living throughout our region, and humans generally co-exist peacefully with bears. A number of factors can cause unwanted encounters between humans and wildlife. These can include factors beyond an individual's control, such as expanding development into wildlands, or unusual weather that causes wildlife to seek refuge outside of its natural habitat. However, the majority of human-wildlife conflict in our region is linked to bears that are drawn into our communities as a result of improper management of attractants (e.g., garbage or fruit trees). Unfortunately, hundreds of bears are destroyed in BC each year when they become conditioned to human food sources and therefore to humans themselves. 'Human-habituated' bears represent a risk to public safety because they are less wary of humans and, in some cases, become aggressive.

Fortunately, there are many groups and individuals working to reduce human-wildlife conflict in our region. For example, [WildSafeBC](#) (formerly Bear Aware) works closely with communities and Conservation Officers to enhance public awareness of strategies to reduce bear encounters, while also implementing innovative conflict-reduction programs.



Figure 11: Total number of bears destroyed by Conservation Officers in the Columbia Basin-Boundary region, 2009-2015⁴⁶

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

In 2015, over 175 bears were destroyed in our region by Conservation Officers (see **Figure 11**). This is the highest number of recorded bears destroyed since 2009. In comparison to 2015, this represents an approximate 95% increase. The number of bears destroyed on an annual basis varies due to a number of factors. One of the most influential factors in our region is the size of the berry

crop. Strong berry (e.g., huckleberry) crops can keep bears satisfied with a natural food source, but when the crop is poor, bears tend to look elsewhere for food. A recent study identified the Elk Valley as an ‘Ecological Trap’ for grizzly bears, because of the discrepancy between apparent suitable habitats from rich berry crops and higher grizzly bear mortality rates. This discrepancy is attributed to the overlap of a bountiful food source with human settlement.⁴⁵

Garbage is consistently the attractant associated with the largest percentage of incidents with noted attractants, accounting for 38% of incidents in 2015 and 64% of incidents in 2014. Unpicked fruit trees (21% of 2015 incidents) and livestock/livestock feed (16% of 2015 incidents) are other commonly cited attractants (see **Figure 12**). The number of incidents where fruit trees or berry bushes was the attractant increased fourfold from previous years (5% in 2014).

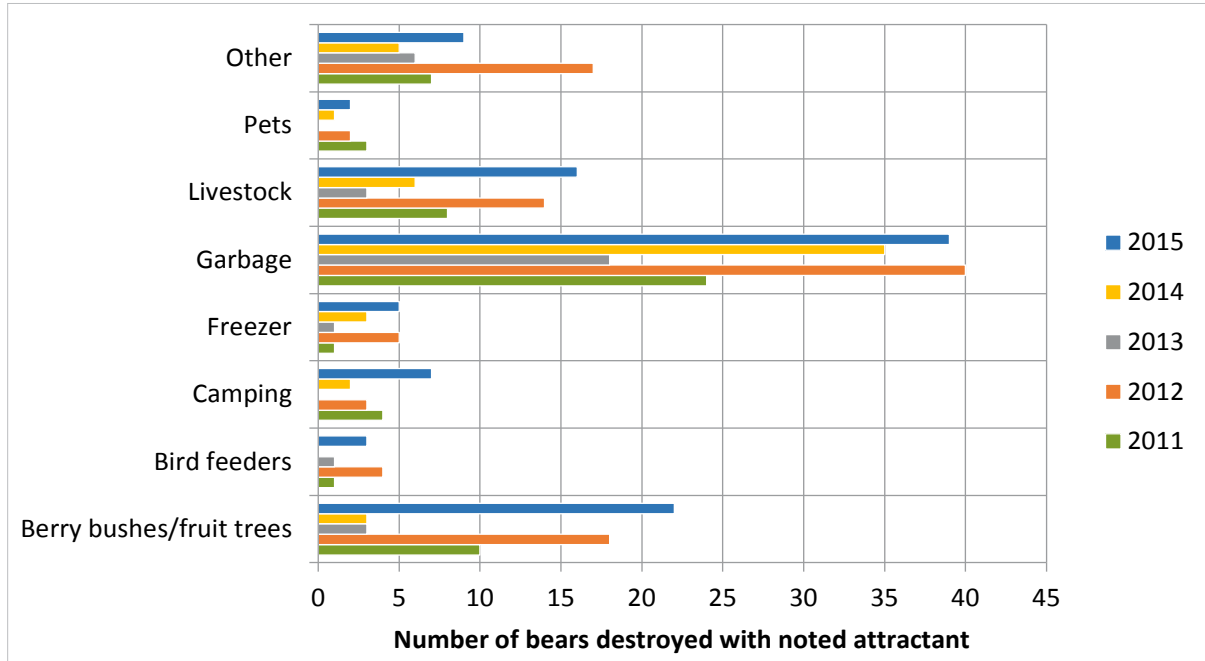


Figure 12: Attractants linked to incidents resulting in bear(s) being destroyed by Conservation Officers⁴⁶

MOUNTAIN CARIBOU POPULATION

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator monitors caribou counts throughout various mountain ranges in the Columbia Basin-Boundary region. Data for this indicator were retrieved from census results of the Mountain Caribou Census administered by FLNRO. Caribou rely on large areas of old growth forest and do not tolerate human disturbance. The decline in caribou numbers is due to a variety of factors, including increased predation and habitat destruction from human activities^{47,48}, and they are now confined to high elevation areas in small, scattered populations. The same changes in habitat (i.e., forest harvesting, fires) that have led to the decline in caribou numbers may also have resulted in shifts to other ungulate population numbers. For example, elk numbers have increased significantly over the past century.⁴⁹

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

Between 1996 and 2016, the total population of mountain caribou declined from 654 to 206 (see **Table 4**). During this time, significant efforts to reverse this trend have taken place including snowmobile closures in caribou habitat, transplanting animals, and predator control. Some projects have shown promising results, while others have had limited success.

The rate of decline between the mid-1990s and 2002 was over 6% per year, which then decreased to 3.5% per year between 2002 and 2013. However, recently the rate of decline in caribou has increased substantially to 22% per year from 2013-2016. While some herds (the South Purcells and North Columbia) had seen increased counts in 2013, their numbers are once again on the decline. In the South Purcells' herd, calf recruitment rates in 2016 were 6.3%, which is well below the recommended rate of 12-16% needed for a stable population. However, some herd's calf recruitment rates were higher than this suggested range. For example, the South Selkirks' herd showed a calf recruitment rate of 16.7% for 2016.

Efforts to recover caribou are continuing with projects aimed at relocating pregnant cows to specially constructed secure enclosure in their native habitat, and others geared towards collaring and relocating predatory wolves whose range overlaps with those of caribou herds. Moreover, a proposal for a Selkirk Mountain Caribou park has been submitted which calls for the additional protection of over 150,000 hectares of caribou habitat.

Herd	Mid 1990s	2002	2006	2013	2016
South Selkirks	52	34	37	27	12
South Purcells	63	14	16	20	16
Central Selkirk	148	96	83	53*	35
Monashee	10	4	7	4***	1
Frisby Boulder	36	20	16	11	11**
South Columbia	105	29	26	6	4
North Columbia	206	145	125	152	124
Central Purcell	15	5	0	0	0
South Kinbasket	19	5	0	3****	3****
Total	654	352	310	276	206

Table 4: Mountain caribou population estimates for Columbia Basin-Boundary region herds⁵⁰⁻⁵³

* 2014 estimates, ** 2013 estimates, *** 2012 estimates, **** 2008 estimates

WATER STEWARDSHIP GROUPS

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator measures the number of watershed stewardship groups registered with the Columbia Basin Watershed Network. Data was retrieved from the Columbia Basin Watershed Network. For more information see the Columbia Basin Watershed Network's [website](#).¹⁶ Stewardship groups are usually comprised of concerned citizens acting as advocates, advisors, or educators for the protection, conservation, and sustainable use of watersheds. Within the Basin-Boundary, watershed stewardship groups undertake several roles and responsibilities, including water monitoring programs, fish re-introduction projects, and promoting safe development in watersheds.

WHAT ARE THE CURRENT CONDITIONS?

Currently there are 49 watershed stewardship groups registered with the Columbia Basin Watershed Network and operating within the Columbia Basin-Boundary region. Each of these groups operates at different scopes and in different areas. At the broad level there are groups, such as the Land Conservancy of BC, that operate globally, across Canada or all across BC (these groups are categorized as 'other' in **Figure 13**). At a narrower level, groups such as the Joseph Creek Streamkeepers operate within specific regional districts or specific watersheds. A vast majority of the watershed groups operate within the Central Kootenays. With

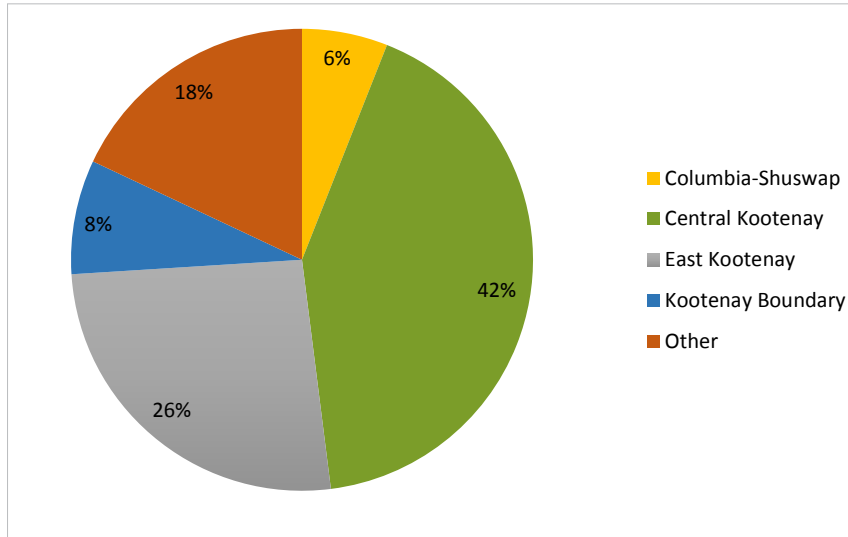


Figure 13: Percent of watershed stewardship groups operating within each regional district within the Basin-Boundary region¹⁶

increasing watershed stewardship groups in the region, there are more opportunities to ensure the protection, conservation, and sustainable use of watersheds, and more ongoing projects to accomplish this goal. For example, in November of 2016 Mainstreams Environmental Society launched their website for the Columbia Basin Water Quality Project, where you can explore monitoring data for watersheds in the region.⁵⁴

CUTBLOCKS

WHAT DOES THIS MEASURE & WHY IS IT IMPORTANT?

This indicator tracks the area logged on crown land each year in the Columbia Basin-Boundary region since 1960. The logging industry is a very important economic driver in our region, and also has a major impact on many environmental issues such as biodiversity, water quality and quantity, soil productivity, erosion and landslides, wildlife habitat, and fisheries. Data was accessed through DataBC and is based on reporting by tenure holders on crown land^{55,56}. The area logged is calculated based on the total cutblock size, minus all the reserves (e.g., wildlife tree patches, riparian reserves). The year a block was logged is based on the year logging was initiated.

WHAT ARE THE TRENDS & CURRENT CONDITIONS?

While there is some variation from year to year due to variable lumber prices or shutdowns due to high fire hazard, the area logged has remained relatively consistent since the early 1970's (see **Figure 14**). This consistency is mostly due to the government legislated Annual Allowable Cut which determines the volume of trees that tenure holders must harvest. It should be noted that the data for 2016 has shown a dramatic decrease in the hectares cut by the logging industry. This is because the results of this report are being published before the year's end and so more cutting operations will be reported at a later date.

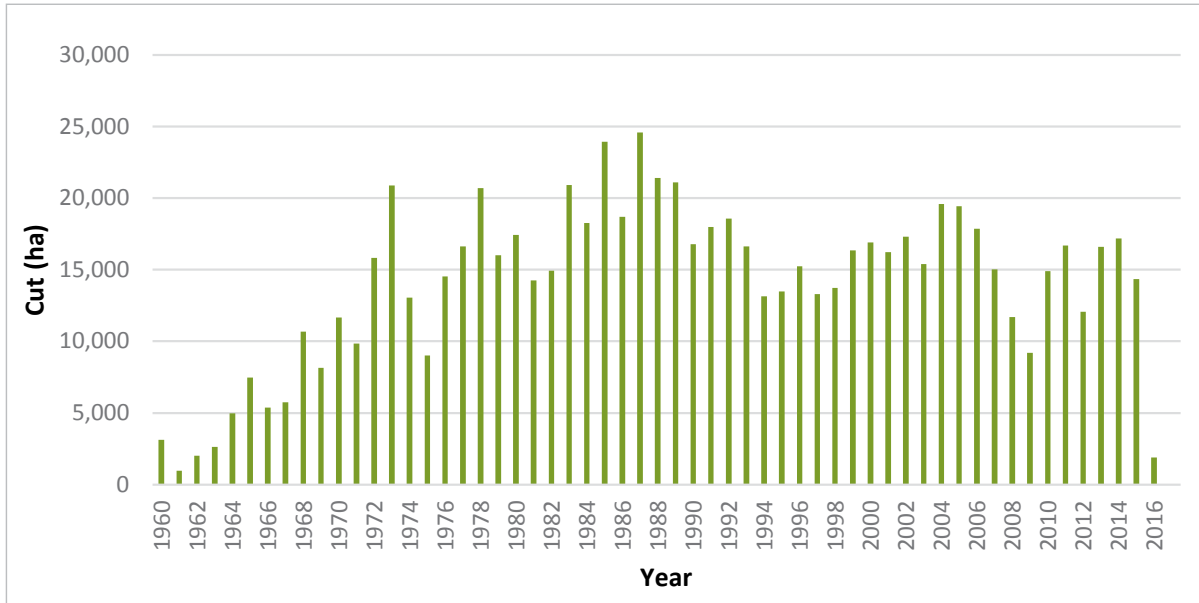


Figure 14: Total area cut on crown land by the logging industry between 1960-2016^{55,56}

WETLANDS

WHY IS IT IMPORTANT?

Wetlands can be defined as areas saturated with water for long periods of time so as to result in low oxygen levels, and include areas such as bogs, swamps, marshes and ferns.⁵⁷ This indicator, as seen on the [Digital Basin](#), displays the location and sizes of the various wetlands that occur in the Columbia Basin-Boundary region.⁵⁸ Wetlands are some of the most important landscapes to protect as they provide habitat for a disproportionately large number of species. These species include species at risk, migratory birds, fish, amphibians, and numerous plant species, and provide areas for wildlife breeding, including fish nurseries. In addition to ecological significance, wetlands also provide several ecosystem services to humans. For example, wetlands purify water and buffer water flows during times of flooding and drought, store vast amounts of carbon and provide recreational areas for human to view wildlife and enjoy nature.

WHAT ARE THE CURRENT CONDITIONS?

While changes in size and health of wetlands hasn't been extensively studied, there has still been a lot of attention paid to wetlands in the Columbia Basin-Boundary region in recent years. Boating regulations have been put in place to prevent noise and disturbance to species, such as the Great Blue Heron, who reside in the wetlands of the main channel of the upper Columbia River.⁵⁹ This recently approved regulation prevents boats over 20 hp on this main channel, and supplements previous regulations that prohibit motor vessels from the wetland portion of the Columbia Wetland Wildlife Management area, eliminating some water sports like waterskiing and wake-boarding. In addition to these regulations, in September 2014 an action plan for the Columbia Basin's Riparian and Wetland areas was drafted.⁶⁰ This action plan outlines various actions to maintain productive and diverse ecosystems, maintain or improve the status of habitat, opportunities for sustainable use and community engagement.

Studies and surveys pertaining to the health of wetlands has begun in certain regions within the Columbia Basin-Boundary. For example, the Slocan Wetlands Assessment and Monitoring Project unveiled the third phase of their project this year. This phase of the project ranked wetlands on six ecological factors (each with several metrics) including landscape, size, buffer, vegetation, hydrology and soil for four wetland complexes in the Slocan Valley. On average the scores ranked 3.84 out of a possible five.⁵⁷

SUMMARY

Based on a review of the indicators in this report, many elements of the natural environment in the Columbia Basin-Boundary region are in decline. We have seen a rapidly declining mountain caribou population, an increasing number of bears destroyed, and an increased number of species at risk. Some indicators such as air quality and the leading causes for bears destroyed have remained relatively unchanged. It is important to note, however, that small change may make an indicator seem stable, but accrued over long periods of time small changes can have serious implications on the environment and are not to be ignored. As such, continued monitoring of the indicators in this report is of critical importance given the uncertainties and complexities of the natural environment.

The health of the natural environment should be a priority in all decision-making, especially regarding decisions surrounding development, tourism, and conservation programs and policies. These indicators and the information provided in this report are highly relevant to decision-makers and they should be used to inform understanding of potential impacts of decisions on the natural environment, as well as any impacts the state of the natural environment may have on the people and communities of the Columbia Basin-Boundary region. For example, decreasing snow packs will likely have adverse effects on skiing tourism in the region; the presence of species at risk may prevent future development; and poor air quality conditions pose serious human health threats. Furthermore, this type of environmental data can help prioritize issues that need our attention, contribute to our understanding of the effectiveness of environmental initiatives, and allow us to identify achievements that should be celebrated.

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The Columbia Basin Rural Development Institute, at Selkirk College, is a regional research centre with a mandate to support informed decision-making by Columbia Basin-Boundary communities through the provision of information, applied research and related outreach and extension support. Visit www.cbrdi.ca for more information.