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Draft S Ranks and Surrogate G Ranks for BEC Zones and Draft S Ranks for Ecoprovinces and Major Drainage Units of BC

Preliminary Rankings for Informing the Report on the Status of Biodiversity in BC

Written by L. Kremsater

For: The Biodiversity BC Technical Subcommittee for the Report on the Status of Biodiversity in BC

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Draft S ranks and surrogate G ranks for BEC zones and draft S ranks for Ecoprovinces and Major Drainage Areas of BC: Preliminary rankings for informing the Biodiversity Status Report and Action Plan

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Laurie Kremsater, Consultant (facilitator of workshop)

Workshop participants: Carmen Cadrin, Conservation Data Centre
Dave Clark, Ministry of Environment
Dennis Demarchi, Consultant
Andrew Harcombe, Nature Conservancy Canada
Ted Lea, Ministry of Forests
William MacKenzie, Ministry of Forests
Adrian Walton, Ministry of Forests

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1. Introduction

The Biodiversity Strategy requested that a group assign Global ranks (G ranks), Provincial ranks (S ranks), and Global Responsibility to Biogeoclimatic (BEC) zones, Ecoprovinces and Major Drainage Areas. The purpose of the ranking was to provide information that would subsequently allow priorities to be assessed for various conservation activities within and among those ecological units. Our work is the first attempt to rank these large ecosystems in B.C. and we attempted to follow Nature Serve methodology as far as possible. Because the NatureServe methodology was not created to rank large ecosystems, the rankings we developed cannot be considered equivalent to the NatureServe rankings for species. Our rankings are preliminary and the methodology to rank large ecosystems needs to be better developed, hence we refer to the rankings we developed as "modified" rankings.

I was asked to facilitate a workshop to develop modified S ranks for Biogeoclimatic Ecosystem Classification (BEC) zones, Ecoprovinces, and Major Drainage Areas and modified G ranks for BEC zones. The group (Carmen Cadrin, Dave Clark, Dennis Demarchi, Andrew Harcombe, Ted Lea, Will MacKenzie, and Adrian Walton) met for one day to outline the process we would use to assign the modified S and G ranks, and completed several threat tables for BEC zones within Ecoprovinces. That work provided the backbone for me to complete the remaining threat tables and sum the results to provide overall modified ranks. Subsequent to the main workshop, meetings with Art Tautz and Eric Parkinson (Fisheries UBC) helped set direction and complete rankings for the Major Drainage Areas.

2. Methods

At present there is no accepted process for developing S or G ranks for large ecological areas. We were directed to follow NatureServe methodology as closely as possible to assign modified S ranks for BEC zones, Ecoprovinces, and Major Drainage Areas and also applies that approach to assigning modified G ranks for BEC zones. Our estimation of global range for G ranks was mostly informed by the mapping completed for the Shining Mountains work (Demarchi et al. 2000), in the text we note where that mapping does not include the whole range of particular BEC zones so that we had to estimate those ranges based on expert opinion. The NatureServe methodology was found on the web, and in several draft notes provided by Carmin Cadrin that are in flux as methodologies continue to change and develop. The tables we used are included below.

First we focused on describing and completing a threat assessment that could be used in the NatureServe approach. We used the IUCN (June 2006) suggested list of threats (which has been adopted by NatureServe). Those threats include:

1. Residential (including housing and urban areas, commercial area, and tourism recreation areas)
2. Agriculture and aquaculture (non-timber crops, plantations, livestock)
3. Energy production and mining (oil and gas, mining and quarrying, renewable energy)

4. Transportation and service corridors (roads and railway, utility and service lines, seismic lines, shipping lanes, flight paths)
5. Biological resource use (hunting and collecting, logging, fishing and harvesting aquatic resources)
6. Human intrusion and disturbance (recreational activities, war and civil unrest, work)
7. Natural systems modification (fire and fire suppression, dams and water management)
8. Invasive and problem species (invasive and/or alien species, problematic native species, introduced genetic material)
9. Pollution (household, industrial, agricultural/forestry, garbage and solid waste, airborne pollution)
10. Geological events (volcanoes, earthquakes, avalanches)
11. Climate change and severe weather (habitat shifting and alteration, droughts, temperature extremes, storms and flooding)

We followed NatureServe's approach to ranking each of the above threats according to its Scope, Severity, and Magnitude. 'Scope' is the primary footprint affected by the threat. We used IUCN approaches and our internal discussions to assign a 'Severity' to each threat. We considered severity to be a measure of the degree of impact on habitat. We considered "Conversion" and "Degradation" to be direct effects applying to the footprint of the threat (conversion being the most severe), while "Indirect" severity applied to effects outside the primary footprint. We subjectively took the largest severity (severity of conversion, severity of degradation and severity of indirect effects) as the overall severity level and used NatureServe's categories for overall severity (see Table 1). Each threat was also given an "Immediacy" ranking as per NatureServe's approach (is the threat acting now or expected sometime in the future). The following table describes the NatureServe categories of scope, severity and immediacy:

Table 1. descriptions of levels for scope, severity and immediacy

Scope:
- H = High scope: >60% affected
- M = Moderate scope: 20–60% affected
- L = Low scope: 5–20% affected
- I = Insignificant scope: <5% affected

Severity:
- H = High severity: loss of species population (all individuals) or destruction of habitat; irreversible effects or requiring long-term recovery (>100 years)
- M = Moderate severity: major reduction in population or habitat requiring 50–100 years recovery
- L = Low severity: non-trivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 years
- I = Insignificant severity: essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 years) from minor temporary loss

Immediacy

- H = High immediacy: threat is operational
- M = Moderate immediacy: threat is likely to be operational within 2–5 years
- L = Low immediacy: threat is likely to be operational within 5–20 years
- I = Insignificant immediacy: threat not likely to be operational within 20 years

Scope, severity and immediacy were then combined into a "magnitude"- or 'overall threat' (Table 2). Following Natureserve's approach, the largest magnitude assigned to any of the 11 threats in the threat table was chosen as the overall threat rank for the ecological unit (BEC Zone, Ecoprovince, or Major Drainage Area). Both' magnitudes' and 'overall threat' were assigned the following NatureServe descriptors that subjectively combine scope, severity and immediacy (Table 2). The subjective combining of 'conversion' and 'degradation' and 'indirect threat' into 'severity' and then the combination of 'scope' and 'severity' and 'immediacy' into 'magnitude' or 'overall threat' make the calculations unlikely to be strictly repeatable by another group of experts.

Table 2. Magnitude or Overall Threat

A = Substantial, imminent threat
B = Moderate and imminent threat
C = Substantial, non-imminent threat
D = Moderate, non-imminent threat
E = Localized substantial threat
F = Widespread, low-severity threat
G = Slightly threatened
H = Unthreatened
U = Unknown

Many details were discussed as we filled out the threat tables. Some of the discussion points worth noting included how we characterized the threat from climate change, roads, and logging. For climate change we looked at present BEC zone footprint and the projected BEC zone footprint using the climate envelope results from Hamann and Wang (2006). Threat from climate change related to how much overlap there appeared to be between the projected and current BEC zone footprint. This was done visually/subjectively in this draft. Very little or no overlap between current and projected BEC zone, or extreme reduction in BEC zone extent, indicated high severity. Some overlap was considered moderate threat, and a high amount of overlap equated to low severity.

There was considerable discussion as to how to evaluate the scope and severity of roads. Was the scope the actual linear road feature? or the road and the edge effect around the road? Finally we used "Roaded_P." (the proportion of area roaded) from the data files supplied by Matt Austin to quantify the proportion of roaded area in the BEC zone or Ecoprovince.

Under the threat category "biological resource use" we considered logging, and used Logged_P (the proportion of the zone logged) from the data tables for guidance. Hunting and gathering were not considered because they are minor components at the BEC zone and Ecoprovince scale. We considered logging to be current area under harvesting, not areas that had been previously logged and now under agriculture or urban development.

After considering the threats tables, we then went through a similar process to the NatureServe approach, to combine the threats with other factors such as geographic extent, trend and vulnerability to develop G and S ranks. Although we were requested to follow NatureServe categories as closely as possible, we could not completely follow NatureServe (see categories of Table 3) because the process developed for ranking species and small discrete ecosystems does not apply well to the scales we are addressing at the BEC zone, Ecoprovince, or Major Drainage Area levels.

Table 3. Definitions of the factors used by NatureServe in assessing conservation status

1. Number of occurrences (number of distinct populations)
2. Viability of occurrences (species) or ecological integrity (communities)
3. Relative condition based on their size, condition, and landscape context
4. Population size (number of mature individuals; species only)
5. Area of occupancy (total area of occupied habitat across the range)
6. Range extent (extent of overall geographic range)
7. Trends: short-term (the past 10 years or three generations, whichever is longer) and long-term (past 100 to 200 years) increase or decrease in population size, area or extent of occupancy, or number or condition of occurrences
8. Threats (known or suspected current threats, or likely near-term future threats)
9. Protected occurrences (number of adequately protected and managed populations)
10. Intrinsic vulnerability (inherent susceptibility to threats due to intrinsic biological factors)
11. Environmental specificity (the vulnerability or resilience of the element due to habitat preferences or restrictions or other environmental specificity)

For example, several of the factors considered by NatureServe (Table 3) do not apply well:

- population size
- environmental specificity
- number of occurrences
- number of occurrences with good viability
- area of occupancy (we use geographic range instead)
- historic decline

For example, population size clearly applies to species. Number of occurrences and number of occurrences with good viability apply to distributions of populations or individuals within populations.

Some factors can be used, but *not* in the sense intended by NatureServe. For example, we used "number of protected occurrences" to refer to the percentage of the area

protected rather than numbers of individuals or occurrences protected, and simply used this as information to consider in the final assessment of the ranks rather than in the actual calculations. As well, we altered the 'geographic range' category noted in Table 4 below to discriminate better for larger ecosystems (The ranges of all the ecosystem units would have fallen into Natureserves D to H categories and all then given a value of "0" because NatureServe rated all large geographic ranges as "0". The value of "0" indicates that species covering large areas are less at risk than those occurring over small geographic ranges. However the range sizes are all small compared to the extent of BEC zones, Ecoprovinces or Major Drainage Areas.) Our alteration was:

Z = Zero (no occurrences believed extant)
A = <10000 km^2
B = 10000–50,000 km^2
C = 50,000–150,000 km^2
D = 150,000 -300,000 km^2
E = >300,000 km^2
U = Unknown

The notion of "vulnerability" does not apply well to large ecosystems, but we considered it to relate to how resilient and ecosystem would be to change. We considered only the driest ecosystems to be moderately vulnerable and the rest to be stable. Perhaps the alpine ecosystems should also have been considered moderately vulnerable (the rankings would not change substantially), that should be considered if this work is continued.

By omitting the factors that don't apply well, and adjusting some categories (as noted above and in Table 4), the end result of the calculations becomes quite different from NatureServe results. Because several factors are omitted, the process of assigning categories to the factors (Table 4), then assigning numbers to the categories (Table 5) and summing numbers to come up with G or S ranks (Table 6 and 7) comes up with very different end results than if all the factors could be used. Specifically, all totals are necessarily less. We therefore used the same categories as NatureServe for the factors included (Table 4), and same numbers for each category (Table 5), but based ranks on a different relative scale at the end. Instead of following Table 6, we adjusted the ranges. Since -3.0 was the worst score obtained and -0.75 the best, we split that range into five categories as follows:

S1 = <-3.0
S2 = -2.5 to >-3.0
S3 = -1.75 to > -2.5
S4 = >-1.0 to >-1.75
S5 = 0 to -1.0

(These adjustments are also noted in the tables below)

Where the rank of a BEC zone fell on a boundary, they were assigned to the upper or lower rank based on the group's opinion. Basically, the rationale and thinking used by the NatureServe system fits very well with ranking ecosystems, even large ones, but the numbers assigned to various factors, and how they are combined into ranks does not

work for large areas. For very large areas such as Ecoprovinces and Major Drainage Areas, the calculations do not reflect the rationale well, so ranks were based more on expert opinion rather than the calculated end numbers. In the body of the report we show where calculated numbers and expert opinion differed.

Considerable work needs to be done to improve the ranking systems for these large areas.

Table 4: Thresholds for each rank factor

NatureServe Number of occurrences
Our Translation – not used

- Z = 0 (zero)
- A=1-5
- B=6-20
- C=21-80
- D = 81–300
- E = >300
- U = Unknown

NatureServe Condition of occurrences
Our Translation – not used

- A = No occurrences with good condition
- B = Very few (1–3)
- C = Few (4–12)
- D = Some (13–40)
- E = Many (41–125)
- F = Very many (>125)
- U = Number of occurrences with good condition unknown

NatureServe Population size (number of mature individuals)
Our Translation – not used

- Z = Zero
- A = 1–50
- B = 50–250
- C = 250–1000
- D = 1000–2500
- E = 2500–10,000
- F = 10,000–100,000
- G = 100,000–1,000,000
- H = >1,000,000
- U = Unknown

NatureServe Area of occupancy Area Length
Our Translation: not used

- Z = Zero (no occurrences believed extant), LZ = Zero (no occurrences believed extant) (this applies to range of species)
- A = <0.4 km2 LA = <4 km
- B = 0.4–4 km2 LB = 4–40 km
- C = 4–20 km2 LC = 40–200 km

D = 20–100 km2 LD = 200–1000 km
E = 100–500 km2 LE = 1000–5000 km
F = 500–2000 km2 LF = 5000–20,000 km
G = 2000–20,000 km2 LG = 20,000–200,000 km
H = >20,000 km2 LH = >200,000 km
U = Unknown LU = Unknown

NatureServe Geographic range
Our Translation: used but categories altered

Z = Zero (no occurrences believed extant)
A = <100 km2
B = 100–250 km2
C = 250–1000 km2
D = 1000–5000 km2
E = 5000–20,000 km2
F = 20,000–200,000 km2
G = 200,000–2,500,000 km2
H = > 2,500,000 km2
U = Unknown

We altered the geographic range category to discriminate better for larger ecosystems (functionally, E,F,G,H were given the same rating of "0" in the Natureserve system):

Z = Zero (no occurrences believed extant)
A = <10000 km2
B = 10000–50,000 km2
C = 50,000–150,000 km2
D = >150,000
U = Unknown

Nature Serve trends
Our translation: used as is

Trends Long-term	Short-term
A = Very large decline (>90%)	A = Severely declining. >70%
B = Large decline (75–90%)	B = Very rapidly declining. 50–70%
C = Substantial decline (50–75%)	C = Rapidly declining. 30–50%
D = Moderate decline (25–50%)	D = Declining. 10–30%
E = Relatively stable (±25% change)	E = Stable. ±10% fluctuation
F = Increase (>25%)	F = Increasing >10%
U = Long-term trend unknown	U = Short-term trend unknown

Number of protected and managed occurrences
Our translation: not used

A = None
B = Few (1–3)
C = Several (4–12)
D = Many (13–40)
E = Very many (>40)
U = unknown

Intrinsic vulnerability

Our translation: used as is

A = Highly vulnerable
B = Moderately vulnerable
C= Not intrinsically vulnerable
U = Unknown

Environmental specificity
Our translation: not used

A = Very narrow. Specialist with key requirements scarce
B = Narrow. Specialist with key requirements common
C = Moderate. Generalist with some key requirements scarce
D = Broad. Generalist with all key requirements common
U = Unknown

Table 5: Point allocation for factor thresholds as developed in the explicit rule-based approach

Factor	Factor thresholds								
	A	B	C	D	E	F	G	H	U
Occurrences	1	2	3	4	5				3.5
Condition of occurrences	-0.5	-0.25	0	0	0	+0.25			0
'Population size'	-1	-0.75	-0.5	-0.25	0.25	0	+0.25	+0.5	0
Geographic Range	-1	-0.75	-0.5	-025	0				0
Range	-0.5	-0.5	-0.25	-0.25	0	0	0	0	0
Trends: short term	-1	-0.75	-0.5	-0.25	0	0.25			0
Trends: long term	-0.5	-0.25	0	0	0	0.25			0
Threats	-1	-0.75	-0.5	-0.25	0	0.5	0.75	1	0
Intrinsic vulnerability	-0.5	-0.25	0						0
Protected occurrences	-0.75	-0.5	-0.25	0	0.5				0
Environmental specificity	-0.5	0	0	0.5					0

Table 6: Final point translations into global NatureServe ranks

Original Natureserve categories	Our adjusted categories	Modified Global Rank	Modified Sub-national Rank
P<=1.5	*P* < -3.0	G1	S1
1.5<P<=2.5	-3.0 ≤ *P* < -2.5	G2	S2
2.5<P<=3.5	-2.5 ≤ *P* < -.1.75	G3	S3
3.5<P<=4.5	-1.75 ≤ *P* < -1.0	G4	S4
P>4.5	*P* >= -1	G5	S5

When assessing Global Responsibility we followed the approach of the Species at Risk Coordination Office (in prep) and assigned the following categories based on the proportion of the range of the zone in B.C. Note that when we calculated the G ranks, we had detailed mapping only for the range of the zone mapped by the Shining Mountains project. For some zones this range is smaller than in reality, thus we estimated the extent of the zone beyond the shining mountains map area. We note where ongoing work to map the zones across more jurisdictions is ongoing and global responsibilities should be recalculated once that work is complete. The only zone for

which we may have more of the range in BC than indicated by the Shining Mountains work is the CDF. We have used a conservative estimate of the extent of that zone based on ecologists' current understanding of the extent of the zone.

Table 7 Global Responsibility Rankings:

Proportion of range in BC	***Global Responsibility***
100%	1 = Endemic
75 to 99%	2 = Very High
51 to 74%	3 = High
30 to 50%	4 = Moderately High
11 to 29%	5 = Intermediate
<10% over >30% of BC	6 = Low and widespread
<10% and over <30% of BC	7 = low and localized

3. Summary

3. 1. Summary results

The following table summarizes the modified rankings for the BEC zones, Ecoprovinces, and Major Drainage Areas.

Table 8. Summary of Modified G and S ranks (alphabetical by ecosystem unit)

BEC Zone Ranks				Modified Ecoprovince Ranks		Major Drainage Area Ranks	
Zone	Modified S Rank	Modified G Rank	Global Responsibility	Ecoprovince	Draft S rank	MDA	Draft S rank
BAFA	S5	G5	4 to 5 moderately high to intermediate	BOP	S4	Coastal	S3/S4
BG	S2	G2	7 very low	CEI	S4/S5	Columbia	S2
BWBS	S4	G4	5 to 6 intermediate to widespread low	COM	S4	Fraser	S2/S3
CDF	S2	G2	2 very high	GED	S2/S3	MacKenzie	S3/S4
CMA	S4	G4	4 moderately high	NBM	S5	Nass	S5
CWH	S4	G4	4 moderately high	SAL	S5	Skeena	S4/S5
ESSF	S5	G5	4 moderately high	SBI	S5	Stikine	S4/S5
ICH	S4	G4	3 high	SIM	S4/S5	Taku	S4/S5
IDF	S3	G3	4 moderately high	SOI	S2	Yukon	S4/S5
IMA	S5	G5	4 moderately high	TAP	S5		
MH	S4	G4	3 high				
MS	S4	G4	2 to 3 very high to high				
PP	S2/S3	G2/G3	5 intermediate				
SBPS	S4	G4	1 endemic				
SBS	S4	G4	1 endemic				
SWB	S4	G4	4 moderately high				

Details of working calculations follow in sections 4, 5 and 6.

Table 9. Summary of Modified G and S ranks in order of rank and global responsibility

BEC Zone Ranks				Modified Ecoprovince Ranks		Major Drainage Area Ranks	
Zone	Modified S Rank	Modified G Rank	Global Responsibility	Ecoprovince	Draft S rank	MDU	Draft S rank
CDF	S2	G2	2 very high	SOI	S2	Columbia	S2
BG	S2	G2	7 very low	GED	S2/S3	Fraser	S2/S3
PP	S2/S3	G2/G3	5 intermediate	BOP	S4	Coastal	S3/S4
IDF	S3	G3	4 moderately high	COM	S4	MacKenzie	S3/S4
SBPS	S4	G4	1 endemic	CEI	S4/S5	Skeena	S4/S5
SBS	S4	G4	1 endemic	SIM	S4/S5	Stikine	S4/S5
MS	S4	G4	2 to 3 very high to high	NBM	S5	Taku	S4/S5
ICH	S4	G4	3 high	SAL	S5	Yukon	S4/S5
MH	S4	G4	3 high	SBI	S5	Nass	S5
CMA	S4	G4	4 moderately high	TAP	S5		
CWH	S4	G4	4 moderately high				
SWB	S4	G4	4 moderately high				
BWBS	S4	G4	5 to 6 intermediate to widespread low				
ESSF	S5	G5	4 moderately high				
IMA	S5	G5	4 moderately high				
BAFA	S5	G5	4 to 5 moderately high to intermediate				

3. 2. Challenges and Limitations

This project faced several challenges and has limitations that should be kept in mind when reading the rest of the report.

- We were asked to follow Nature Serve methodology as closely as possible, but that methodology does not fit large ecosystems very well. To revise the

methodology would have taken much more time than the few days allowed for this work. The calculations noted in the methods sections and results for each ecosystem highlight some of the areas where the methodology needs revising to better suit large areas.

- Part of the rationale for following NatureServe was to follow an accepted, repeatable process. However, even in NatureServe some subjectivity remains. For example, the subjective combination of scope and severity and immediacy into magnitude does not allow for strict repeatability.

- Completing threat tables provides quite explicit picture of the ecosystem. For each threat table only the highest threat has an impact on the overall ranking. Thus a threat table with several "A"s (the highest threat) will have the same effect on an ecosystem's rank as one that has only one "A".

- Our information on areas roaded, logged, ecosystem loss, water diversions etc, came from "Hectares BC" and so is calculated at the broad scale they used in that project.

- The areas for each BEC zone were based on the mapping done by the Shining Mountains project. For those zones that extend beyond that mapped area we approximated their extent very roughly. See the text for each zone for more specifics.

- Our assumptions on extent of climate change are subjective visual estimates of how far a zone moves, or how much a zone shrinks based on maps in Hamman and Wong's paper. Although climate change is just one threat in the threats table and only affects the overall rank when it is the greatest threat, a more thorough look at climate change could be useful.

- We use 'global responsibility' to mean 'proportion of the range in BC' in the sense of Bunnell et al. (2006). This global responsibility could be used in conjunction with S and G ranks and other considerations to develop priorities for each zone much like SARCO (2007) has done for species at risk.

- Applying biodiversity ranks to Ecoprovinces and Major Drainage Areas is problematic as the geographic range can't be reduced or increased. NatureServe's G and S ranks are, in reality a 'vulnerability of extinction' rank, and so don't fit well with defined geographic areas. What we are really considering is current condition and threat.

4. Developing G and S Ranks for BEC Zones.

1. Boreal Altai Fescue Alpine(BAFA)

A. S rank:

Geographic range: 68,505 km^2 = C = -0.5

Protected range: 22.7% of BC range protected

Trend: long term: C or D (moderate to substantial decline because of climate change) = 0
short term E= 0

Vulnerability: C = 0

Threats: see table below. Largest is an C (climate change) -0.5

Threats table for BAFA: BAFA is found in the following Ecoprovinces: Northern Boreal Mountains (NBM); Sub-Boreal Interior (SBI); Central interior (CEI); Southern Alaskan Mountains (SAM); Coast and Mountains (COM). The threats table applies for all those areas.

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	Nil	n/a	n/a	n/a	n/a	n/a	n/a
Agriculture	I	I	H	I	H	I	L
Energy mines	I	H	H	H	H	I	I
Transportation	I	H	H	H	H	M	H
Biological Resource Use	I	I	H	I	I	I	I
Human Intrusion	I	I	H	I	I	I	I
Natural Systems Modifications	Nil	n/a	H	n/a	n/a	n/a	n/a
Invasives	Nil	n/a	H	n/a	n/a	n/a	n/a
Pollution	Nil	n/a	H	n/a	n/a	n/a	n/a
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	L	H	H	I

Notes to threats table:

- Cattle grazing is the greatest threat in the Central Interior
- Biological use in BAFA is hunting, trapping therefore low impacts
- Pollution insignificant except pulp mills in Quesnel and background world levels

- Climate change: BAFA in Northern Boreal Mountains impacted last (taller mountains); BAFA in Sub-Boreal Interior and Central Interior will be impacted sooner (lower mountains) so immediacy may change, but we didn't think it would change enough to alter S rank. All BAFA projected to decrease in range quite dramatically.

Totaling range, trend and threat: -1.0
Draft S rank is: S5

B. G rank:
BAFA extends beyond mapping of Shining Mountains into the Northwest Territories, southern Yukon, and central and eastern Alaska. However, if we consider just the area mapped by the Shining Mountains project:

Geographic range: 80% in B.C (1% in NWT, 19% in Yukon)
total range not less than = 86064 km^2 = C = -0.5

Protected range 25% total
Protected in BC 18% of total (rest in Yukon 7% of total)

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside an out side of BC, so no change in ranking

Surrogate G rank is: G5

C. Global responsibility: Because the BAFA extends beyond the Shining Mountains map area and significant portions are in the Yukon and Alaska, BC's global responsibility is likely a 5 to 4 (intermediate to moderately high, around 30 % in B.C)

2. Bunchgrass (BG)

A. S rank:

Geographic range: 2,588 km^2 = A = -1.0

Protected range: 11.5% protected in BC

Trend: long term: C moderate decline = 0
short term C (southern interior are) = -0.5 ; D (Cariboo area) = -0.25

Vulnerability: B =-0.25

Threats:

BG is found in the following Ecoprovinces: Southern Interior (SEi), Central Interior (CEI) and threats are different between the two

a) Threats table for BG in Southern Interior Ecoprovince: largest is an A = -1

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	M	H	E	H	H	H	H
Agriculture	H	M	B	H	M	M	L
Energy mines	I	H	E	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	I	n/a	H	n/a	n/a	n/a	n/a
Human Intrusion	L	M	F	H	L	M	L
Natural Systems Modifications	M	L	E	H	I	L	n/a
Invasives/problem spp	H	H	A	H	M	H	n/a
Pollution	L	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	H/L	H	H	I

Notes to threats table:

- Agriculture (vineyards, orchards, hay crops, grazing) and conversions to subdivisions convert land from natural conditions
- ATVs etc degrade rather than convert; they have low severity widespread impacts but can have localized high impacts
- Natural systems modification is mostly water management; changes to fire regimes are less of a threat. Water management is a localized threat that occurs throughout the zone
- Invasive plants impact some areas more severely than others
- Air pollution from pulp mills and cities leads to temperature inversions in winter in some of the major valleys
- Climate/weather: climate change predicted to increase the extent of the bunchgrass zone; summer drought will likely be a problem, and could (likely) favour invasives over natural vegetation, so even if the zone expands it potentially could be full of invasive plant species

Note: agriculture and residential development is the greatest factor in trend and in threat, but other threats are also important: agriculture, transportation, pollution, and altering of natural processes.

b) Threat table for BG in the Central Interior (less residential threat, less agricultural threat, fewer invasives) ; Largest threat is B = -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	L	H	E	H	H	H	H
Agriculture	M	M	B	H	M	M	L
Energy mines	I	H	E	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	I	n/a	H	n/a	n/a	n/a	n/a
Human Intrusion	L	M	F	H	L	M	L
Natural Systems Modifications	M	L	E	H	I	L	n/a
Invasives/problem spp	M	H	B	H	M	H	n/a
Pollution	L	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	H/L	H	H	I

For Southern Interior:
total = -2.75
draft S rank is: S2

For the Central Interior (less residential threat, less agricultural threat, less invasive plants)
total =-2.25
draft S rank S3

Take the most conservative S rank = S2

B. G rank: BG extends beyond mapping of Shining Mountains into the Snake River Canyon of Idaho and Oregon, east-central Oregon, and may extend sporadically east onto Snake River Plain of southern Idaho. If we look just as Shining Mountains map area:

Geographic range: 3% in B.C
1% in Idaho, 13%Montana, 5% Oregon, 77% in Washington,
Total range not less than = 68,923 km^2 = C = -0.5

Protected range: only 3% total

Threats, Trends, Vulnerability: same threats, trends, vulnerability etc apply throughout the global range as in BC, so the ranking does not change much

surrogate G rank is: G2

C. Global responsibility is : 7 (low and localized, <10% in <30% of province)

Note that the condition of BG in BC is likely better than BG in other parts of its range and thus increases BC's stewardship responsibility

3. Boreal White and Black Spruce (BWBS)

A. S rank:

Geographic range: 153,406 km^2 = D = -0.25

Protected range: 6% protected in BC.

Trend: long term: E stable = 0
short term D declining = -0.5 (climate change already at boreal/tundra edge and oil and gas)

Vulnerability: C=0

Threats: largest is a B, so -0.75

Threat table for BWBS : BWBS is found in the following Ecoprovinces: Taiga Plains (TAP), Northern Boreal Mountains (NBM), Sub-Boreal Interior (SBI), Boreal Plains (BOP), Southern Interior Mountains (SIM), all can be considered similar enough in threats, vulnerability etc, that S rank won't change

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	M	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	A/B	H	I	H	n/a
Invasives/problem spp	I	M	H	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	L	H	H	I

Notes to threats table:

- Agriculture low except in Peace River area and localized in SBI and TAP
- Energy mines -- moderate to high oil and gas seismic activity in many places

- Logging also moderate for zone, mostly in BOP, SBI and TAP
- Natural systems modification includes significant fire suppression, but still only low for whole zone
- Climate change predicted to shift BWBS to higher latitudes so that range in BC shrinks considerably. Possible that bogs and wetlands, characteristics of the zone, will be lost.
- All the ecoprovinces with BWBS (TAP, NBM, SBI, BOP, SIM) can be considered similar enough in threats, vulnerability etc, that S rank won't change

Totaling range, trend, vulnerability and threat: -1.0
Draft S rank is: S4

B. G rank: BWBS extends beyond mapping of Shining Mountains across northern Alberta, and northern Saskatchewan, Mackenzie River of NWT, southern and central Yukon, and central Alaska. Thus the numbers for range are low, but increases in range will not affect the calculation of G ranks since they are already at categories that receive "0" weight for range.:

Geographic range: 23% in B.C
64% Alberta, 10% Northwest Territories, 4% Yukon,
Total range not less than = 681,203 km^2 = E = 0

Protected range: 1% in BC, 7% Alberta, 1% Northwest Territories
Protected range only 9% total
Protected in BC 1% of total

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is: G4

C. Global responsibility: BWBS extends well beyond the Shining Mountains area. Likely BB has about 10% or less (a 6 or 5; low and widespread to intermediate, about 10% in BC).

4. Coastal Douglas-fir (CDF)

A. S rank:

Geographic range: 2501 km^2 = A (from Table 4) = -1 (from Table 5)

Protected range 179.8 km^2, about 7% of BC's total

Trend: long term: large decline B (from Table 4) = -0.25 (from Table 5)
short term: declining D (from Table 4) =-0.25 (from Table 5)

Vulnerability: stable = C (from Table 4) = 0 (from Table 5)

Threats: See table below.

Largest magnitude is an A (from Table 4), so -1 (from Table 5)

Threats table for CDF:

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	H	H	A	H	H	H	H
Agriculture	L	H	E	H	H	I	L
Energy mines	I	H	E	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	L	H	B	H	L	H	L
Human Intrusion	I	I	H	I	I	I	I
Natural Systems Modifications	H	H	A	H	L	H	I
Invasives	H	H	E	H	I	H	H
Pollution	M	I	F	H	I	I	I
Geological	H	I	H	I	I	I	I
Climate change	H	L	D	L	H	H	I

Notes to threats table:

- We considered severity of "degradation" (see column in table) by harvesting of coastal forest to be high because of long natural rotations. Harvesting may be a more moderate severity in other, more frequently naturally disturbed areas.
- 'Natural systems modifications' was considered high because we have changed fire regimes and controlled flooding.
- The line between "degradation and conversion" is not clear.
- Pollution in this zone is localized.
- Geological threat is high due to risk of earthquake being high.
- CDF in Georgia Depression expected to increase slightly along mainland and Vancouver Island coast.
- In CDF, residential development the greatest factor in trend and in threat, but also agriculture, transportation, pollution, and altering of natural processes

.

Totaling range, trend, vulnerability and threat: -3.0
Draft G rank: S2

B. G rank:

To select a surrogate G rank, we followed the same thinking as for S ranks, but followed Cadrin's suggestions after her discussions with BC and Washington ecologists, that the zone extends only into the northern parts of Washington's drier coastal areas.

The ranges generated by the Shining Mountains map is thus too large, but the change does not reduce the range enough to affect the G rank. (Note that earlier discusion considered that the Shining Mountains could have underestimated the range (some areas of Puget Sound in Washington and the Willamette Valley in Oregon may also be CDF)).

Geographic range: According to the Shining Mountains map, 15% of the CDF is found in B.C (1% found in Oregon, 84% in Washington), but current thinking suggests the CDF does not extend very far south in Washington and not at all into Oregon (rather a dry subzone of CWH occurs in these areas)

total range = not greater than 1,646,860 ha (16,468 km^2) = B = -0.75

Protected range only 2% of total is protected, and protected in BC is 1% of total

Threats, Trends, Vulnerability: same threats, trends, vulnerability etc apply throughout the global range as in BC, so the ranking does not change much

Surrogate G rank is: G2

C. Global responsibility: The Shining Mountains mapped more of CDF than ecologists currently think belongs in that zone. BC's portion of the range is likely 70 to 80% which puts it as a 2 (very high).

5. Coastal Mountain Heather Alpine (CMA)

A. S ranks:

Geographic range: 23,680 km^2 = B = -0.5

Protected range: 21% protected in BC

Trend: long term: E stable 0

short term D = -0.25

Vulnerability: C=0

Threats: largest is a B, so -0.75

Threat table for CMA: In Ecoprovinces: COM, CEI, GED, NBM, SAM, SBI, SOI,

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	L	G	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	I	H	B	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	I	H	B	H	M	M/H	n/a
Invasives/problem spp	I	I	H	I	I	I	I
Pollution	I	I	H	I	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	L	M	C	H/L	M	M	I

Notes to threats table:

- Climate change will reduce extent of coastal mountain alpine and could be rapid

Totaling range, trend, vulnerability and threat: -1.50
Draft S rank is: S4

B. G ranks: CMA extends beyond the range of the Shining Mountains mapping onto coastal mountain tops from central and northern Oregon, across coastal Washington, to the Alaskan Panhandle as far west as the Chugach Mountains in Alaska, but if we look just at the Shining Mountains Region:

Geographic range:: 39% in B.C
44% Alaska, 16% Yukon, 2% Washington
Total range = 61,364 km^2 = C =-0.25

Protected range: 8% in BC, 15% Alaska, 2% Washington, 15% Yukon
Protected in BC 8% of total

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is: G5

C. Global responsibility: The portion of the range in BC is something less than the 39% mapped by the Shining Mountains. Likely BC has less than 30% of the range (Global responsibility of 4, moderately high)

6. Coastal Western Hemlock (CWH)

A. S rank:

Geographic range: 103,842 km^2 = D = -0.25

Protected range: 12.6% protected in BC

Trend: long term: D (moderate decline) in the southern parts; E (stable) in the northern parts = 0

short term D (declining) in the southern parts; E (stable) in the northern parts = 0

Vulnerability: C=0

Threats: largest is a B= -0.75

Threats table for CWH

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	L	G	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	L	H	B	H	M	M/H	n/a
Invasives/problem spp	I	n/a	H	n/a	n/a	n/a	n/a
Pollution	L	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	L	D	H/L	M	M	I

Notes to threats table:

- The impacts of Vancouver and other cities is low in the overall zone but would vary by subzone variant. The effects of air pollution are much wider so we ranked that as low. Logging is the biological resource use, but still only 1/3 of most drainages, so moderate impact overall.

- Climate change is predicted to expand CWH and still include most of existing CWH range, so low impact of climate change.

Totaling range, trend, vulnerability and threat: -1.00
Draft S rank is: S4

B. G rank: CWH extends beyond range of Shining Mountains (for example into coastal mountains and lowlands of lower and mid-slopes of central and northern Oregon ad west across southern Alaska from the Yukatat to Kenai Penninsula and eastern Kodiak Isaldnd, , but if we look just at the Shining Mountains Region:

Geographic range: 44% in B.C
(19% alaska58% BC, 2% Oregon, 22% Washington)
total area: 179,301 km^2 = D = -0.25

Protected range: 7% in BC,
(1% Alaska, 4% Washington).
that's 12% overall

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside southern BC as to the rest of the range, and northern BC much like Alaska, so no change in ranking

Surrogate G Rank: G4

C. Global responsibility: The CWH extends beyond the Shining Mountains area, so BC likely has about 30% of the entire zone (4, moderately high, 30% to 50% in BC)

7. Engelmann Spruce Subalpine Fir (ESSF)

A. S rank:

Geographic range: 167,426 km^2 = D = 0.-25

Protected range 15.9% protected in BC.

Trend: long term: E stable = 0
short term: E = 0

Vulnerability: C=0

Threats: largest is a B = -0.75

Threats table for ESSF in Southern Interior Mountains and Southern Interior:

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	L	G	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	L	H	B	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	M	M	B	H	M	M	n/a
Invasives/problem spp	I	I	H	M	I	I	I
Pollution	I	I	H	H	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	L/M	M	D	H/L	M	M	I

Notes to threats table:

- Mining at Tumbler Ridge and in the Elk Valley, but ends up being small component of zone, would be different at variant level
- Logging also differs by variant, but small proportion of area
- Effects of fire suppression in ESSF varies by moisture – drier variants affected more.
- Climate change predicted to shift ESSF north and into higher elevations.
- Although the predicted ESSF extent is still large extent, it is in different places than today. There is some overlap with present range
- Threats to ESSF won't be any worse in the other Ecoprovinces

Total = -1.0
Draft S rank is: S5

B. G rank: ESSF extends beyond mapping of Shining Mountains into mid-to upper slopes of the interior mountains of Oregon, Idaho, Montana (Shining Mountains map covers most of Montana except for the extreme southern areas adjoining Wyoming and Idaho), Wyoming, Colorado, and Utah; but if we look just at Shining Mountains area:

Geographic range: 69% in B.C
(10% Alberta, 4% Idaho,13% Montana,3% Washington)
total range = 242,135 km^2 = D = - 0.25

Protected range: Protected in BC 11% of total
(Protected: 11% in BC, 5% Alberta, 1% Idaho, 5% Montana, 1% Washington)

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is: G5

C. Global responsibility: Because the ESSF extends well into other jurisdictions, the 69% portion in BC calculated in the Shining Mountain map are is likely much lower 4 (moderately high, 30 to 50% in BC)

8. Interior Cedar Hemlock (ICH)

A. S rank:

Geographic range: 51,895 km^2 = C = -0.5

Protected: 9.3% protected in BC

Trend: long term: E stable = 0
short term D declining = -0.25

Vulnerability: C=0

Threats: largest is a B, so -0.75

Threats table for ICH in Southern Interior Mountains and Southern Interior. ICH in those Ecoprovinces will have the greatest threats. ICH is also found in the in Coast and Mountains Sub-Boreal Interior, and Central Interior:

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	L	G	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	H	H	B	H	M	M/H	n/a
Invasives/problem spp	I	n/a	H	n/a	n/a	n/a	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	L	D	H/L	M	M	I

Notes to threats table:

- Natural systems modifications includes fire and water dams etc, logging
- Climate change predicted to increase range of ICH into ESSF and SBS.

Totaling range, trend, vulnerability and threat: -1.50
Draft S rank is: S4

B. G rank: Shining Mountains mapping includes entire global range of ICH

Geographic range: 58% in B.C
(25% Idaho, 7% Montana, 8% Washington)
total range = 89129 km^2 = C = -0.5

Protected: 5% in BC, 2% Idaho, 1% Montana, none in Washington
Protected range only 8% total; Protected in BC 5% of total

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking. ICH in National Forests protected from alienation. Many water impoundments along riparian areas.

Surrogate G rank is G4

C. Global responsibility: 3 (high, 51% to 74% in BC)

9. Interior Douglas-fir (IDF)

A. S rank:

Geographic range: 43,008 km^2 = B = -0.75

Protected range: 4.6% of total

Trend: long term: D moderate decline = 0
short term: D =-.25

Vulnerability: C = 0

Threats: largest is a B = -.75

Threats table for IDF: The IDF is found in the following Ecoprovinces: Southern Interior, Central Interior, and Southern Interior Mountains; some IDF also occurs in the Coast and Mounatins (Bella Coola Valley, KlinnaKlinns, Mosely, upper Lillooet, lower Fraser Canyon and Skagit Valley.

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	L	H	E	H	H	H	H
Agriculture	H	M	B	H	L	M	I
Energy mines	I	H	E	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	I/L	M	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	H	M/H	B	H	L	M/H	n/a
Invasives/problem spp	M	M	C	H	I	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	H/L	H	H	I

Notes to threats table:

- The main threats are fire suppression, logging, urbanization/agricultural, invasives, and climate change
- The wetter subzones do not have as much degradation from grazing
- In drier subzones, degradation from invasives higher
- IDF predicted to expand considerably due to climate change. Also moves north.

Totaling range, trend, vulnerability and threat: -1.75

Draft S rank is: S3. If S ranks were applied to finer delineations of BEC zones, the S3 would apply to the drier IDF (southern Interior) (Would perhaps drop to S4 for wetter areas of IDF where less impact of invasives (SI Mountains and Central Interior)

B. G rank: The IDF extends beyond the mapping of the Shining Mountains. It occurs sporadically on lower slopes in wide valleys of the southeast Rockies, south into the northern Blue Mountains and Snake River Canyon of Oregon and adjacent Idaho. If we look just at the Shining Mountains region:

Geographic range: 44% in B.C
(3% in Alberta, 6% Idaho, 30% Montana; 1% Oregon, 17% Washington)
total range = 97418 km^2 = C = -0.5

Protected range: only 5% total
Protected in BC 2% of total (2% protected in Montana and 1% in Washington)

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside an out side of BC, so no change in ranking

Surrogate G rank is: G3

C. Global responsibility: BC has something less than 44% of the range: 4 (moderately high, 30 to 50% in BC)

10. Interior Mountain Heather Alpine (IMA)

A. S ranks:

Geographic range: 10,212 km^2 = B = -0.75

Protected range: 3% protected in BC

Trend: long term: E stable = 0
short term D = -0.25

Vulnerability: C=0

Threats: largest is an E so 0.

Threat table for IMA. IMA found in Ecoprovinces: CEI, COM, SIM, (GED)

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	L	G	H	I	L	I
Energy mines	I	H	H	H	H	I	I
Transportation	I	H	H	H	H	M	H
Biological Resource Use	I	H	H	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	I	H	H	H	M	M/H	n/a
Invasives/problem spp	I	n/a	H	n/a	n/a	n/a	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	H/L	M	M	I

Notes to threats table:

- Climate change seems shrink range considerably.

Totaling range, trend, vulnerability and threat: -1.0
Draft S rank is: S5

B. G ranks: IMA extends beyond the range of the Shining Mountains mapping to include upper slopes of the interior of Oregon and California, as well as in Idaho, southern Montana, Wyoming, Colorado, Utah, New Mexico and Arizona; but if we look just at the Shining Mountains area:

Geographic range:: 36% in B.C
50% Alberta, 1% Idaho, 10% Montana, 4% Washington
Total range = 28354 km^2 = B = -0.75

Protected range: 12% in BC, 41% Alberta, 8% Montana, 3% Washington, none in Idaho
Protected in BC 5% of total

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is: G5

C. Global responsibility: BC has something less than 36% mapped by the Shining Mountains, Our portion of the range is likely a 3 (intermediate) or 4 (moderately high)

11. Mountain Hemlock (MH)

A. S ranks:

Geographic range:: 33,317 km^2 = B = -0.75

Protected range: 14.7% protected in BC

Trend: long term: E stable 0
short term E=-.0

Vulnerability: C=0

Threats: largest is an C so -0.5.

Threats table for MH: MH is found in the following Ecoprovinces: CEI, COM, SOI, (NBM), (SAL)

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	H	H	H	H	H
Agriculture	I	L	H	H	I	L	I
Energy mines	I	H	H	H	H	I	I
Transportation	I	H	H	H	H	M	H
Biological Resource Use	I	H	G	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	I	H	H	H	M	M/H	n/a
Invasives/problem spp	I	n/a	H	n/a	n/a	n/a	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	L	M	C	H/L	M	M	I

Notes to threats table:

- Climate change will reduce extent of Mountain Hemlock

Totaling range, trend and threat: -1.25
draft S rank is: S4

B. G ranks: MH extends beyond the range of Shining Mountains mapping into upper coastal forests of northern Oregon, and southern Alaska from the Yukatat to eastern Kenai Penninsula and Kodiak Island; but if we consider just the Shining Mountain area:

Geographic range: Total range = 57,188 km^2
58% in B.C (27% Alaska, 15% Washington)

Protected range: 9% in BC, 1% Alaska, 9% Washington

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is: G4

C. Global responsibility: BC has something less than 58% of the range of MH: 3 high (51 to 74% in BC)

12. Montane Spruce (MS)

A. S rank:

Geographic range: 28,113 km^2 = B = -0.75

Protected range: 8.1% protected in BC

Trend: long term: D to E (stable to moderately declining) = -0.25
short term C to D (declining to rapidly declining) = 0 (character of zone changing due to beetle)

Vulnerability: C=0

Threats: largest is a B = -.75

Threats Table for MS: MS is Found in the following Ecoprovinces: CEI, SOI, SIM, (COM)

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	M	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I	B	I	I	I	I
Natural Systems Modifications	H	H	B	H	I	H	n/a
Invasives/problem spp	H	M	B	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	L	H	H	I

Notes to threats table:

- Much like SBS
- Major threats are grazing, logging, fire suppression, beetle

Totaling range, trend, vulnerability and threat: -1.75
Draft S rank is: S4

B. G rank: The MS may extend beyond the area mapped by the Shining Mountains south into Yellowstone NP, but if we look just at the range mapped by the Shining Mountains project:

Geographic range:: 76% in B.C
(6% Alberta, 13% Montana, 5% Washington)
Total range = 3691462 ha F in the table 0

Protected range: 6% in BC, 3% Alberta, 3% Montana, 1% Washington,
Protected range 10% very many C -.25
Protected in BC 6% of total C -.25

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is G4

C. Global responsibility: The shining Mountains maps most of the range, so BC has 70 to 75% of the zone: 3 (high) to 2 (very high, 75 to 99% in BC)

13. PP (Ponderosa Pine)

A. S rank:

Geographic range: 3,426 km^2 = A = -1.0

Protected range: 4.4% protected in BC

Trend: long term: substantial decline = C = 0
short term: rapidly declining C = -0.50

Vulnerability: B = -.25

Threats: largest is an A = -1.00

Threats table for PP: Found in SIM, SOI, CEI

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	M	H	E	H	H	H	H
Agriculture	H	M	B	H	M	M	L
Energy mines	I	H	E	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	M	n/a	H	n/a	n/a	n/a	n/a
Human Intrusion	L	M	F	H	L	M	L
Natural Systems Modifications	H	L	E	H	I	L	n/a
Invasives/problem spp	M	H	A	H	M	H	n/a
Pollution	L	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	H/L	H	H	I

Notes to threats table:

- Invasives throughout zone but some areas more severely impacted than others
- Pollution = temperature inversions in winter
- Climate change predicted to shift zone north. As with bunchgrass zone and IDF, summer drought may be a problem. Invasives may be favoured over natural vegetation.
- Other significant threats include fire suppression, logging, urbanization/agricultural, invasives

Totaling range, trend, vulnerability and threat: -2.75
draft S rank is: S2/S3

B. G rank: PP extends beyond the range mapped by in the Shining Mountains project into the lower slopes of Oregon, central and southern Idaho, and extends out onto the Great Plains of Montana, North Dakota, South Dakota, and the mountains of Wyoming, Colorado, Utah and Nevada. If we just consider the Shining Mountains area:

Geographic range:: 22% in B.C
(4% Idaho, 17% Montana, 8% Oregon, 49% Washington)
Total range = 15,392 km^2 = B = -0.75

Protected range: 6% in BC, 3% Alberta, 3% Montana, 1% Washington,
Protected range 8%: 1% Idaho, 2% Oregon, 3% Washington
Protected in BC 1% of B -5

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is G2/G3

C. Global responsibility: BC has less than the 22% mapped by the Shining Mountains project: 5 (intermediate, 11 to 19% in BC)

14. Sub Boreal Pine Spruce (SBPS)

A. S rank:

Geographic range: 100% in B.C
Total 22,851 km^2 = B = -0.75

Protected range: 9% in BC

Trend: long term: stable = E = 0
short term: rapidly declining = C = -0.25

Vulnerability: C = 0

Threats: largest is B =-.75

Threats Table for SBPS found only in CEI and SIM Ecoprovinces

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	M	H	G	H	I	H	n/a
Invasives/problem spp	M	M	G	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	L	H	H	I

Notes to threats table:

- Climate change will reduce extent of SBPS to almost nothing

Totaling range, trend, vulnerability and threat: -1.75
draft S rank is: S4

B. G ranks

G rank same as S rank (G4) because entire zone in BC

C. Global responsibility: 1 (endemic)

15. Sub boreal Spruce (SBS)

A. S ranks

Geographic range: 97,859 km^2 = C = -0.5

Protected range: 5.8%

Trend: long term: E stable = 0
short term: D declining = -0.25

Vulnerability: C = 0

Threats:

SBS is found in the following Ecoprovinces: Sub-Boreal Interior, Central Interior, and just small areas in Southern Interior Mountains, Southern Interior and Northern Boreal Mountains. Threats in Northern Boreal Mountains are different than those in other Ecoprovinces, so threats table are separated and S ranks separated.

a) Threats table for SBS in SBI, CWI, SOI and SIM Ecoprovinces: Largest is an A, so -1 (mountain pine beetle the largest threat)

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	M	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	H	H	A/B	H	I	H	n/a
Invasives/problem spp	H	M	A/B	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	L	H	H	I

Notes to threats table:

- There are some subzones where agriculture conversion is high (hay fields) and others where its lower (grazing), and scope varies subzone to subzone. Since over all subzones the ratio of grazing to area converted for agriculture is very high, we dropped severity to moderate.
- Fire suppression pervasive, has led to mountain pine beetle
- Invasives/problem species = mountain pine beetle. widespread change, but not changing ecosystem hugely.
- SBSdk air pollution in winter in valley bottom with pulp mills, saw mills, and cities (leads to inversions)
- Climate change projected to shrink range of SBS. Climate change may also affect extent of beetle outbreaks. SBS in the Southern Interior Mountains shrinks more than in the Central Interior or Sub Boreal Interior.

b) Threats table for SBS in NBM Ecoprovince Largest is an B, so -0.75 mountain pine beetle the largest threat)

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	H	H	H	L	L
Energy mines	L	H	H	H	H	I	I
Transportation	I	H	H	H	H	M	H
Biological Resource Use	L	M	B	H	L	M	I
Human Intrusion	I	I	H	I	I	I	I
Natural Systems Modifications	I	H	H	H	I	H	n/a
Invasives/problem spp	I	M	H	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C/B	L	H	H	I

Notes to threats table:

- Difference is that effect of beetle is less in NBM
- Effects of climate change for SBS in Northern Boreal Mountains predicted to be quite large

For SBI, CEI, SOI, SIM; total is -1.75 and S rank is: S4
For NBM total is -1.50 and S rank is S5

Most conservative for zone = S4

B. G rank: (all in BC)

Surrogate G rank is: G4

C. Global responsibility: 1 endemic

16. Spruce Willow Birch (SWB)

A. S rank:

Geographic range: 78,920 km^2 = B = -0.75

Protected range: 20.6% protected in BC

Trend: long term: E stable = 0
short term E = 0

Vulnerability: C = 0

Threats: largest is B = -.75

Threats table for SWB:

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	M	H	G	H	I	H	n/a
Invasives/problem spp	I	I	G	H	L	L	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	C	L	H	H	I

Notes to threats table:

- Climate change will reduce extent of SWB to almost nothing left in BC (and not sure if more northerly or not)

Totaling range, trend, vulnerability and threat: -1.5
Draft S rank is: S4

B. G rank: SWB is found outside the area mapped for the Shining Mountains project and extends across the northern slopes and upper plateaus of the mountains of NWT,

southern Yukon, and east-central Alaska. If we consider just the Shining Mountains area then:

Geographic range: 64% in B.C
32% Yukon, 3% NWT
Total 122,731 km^2 = C = -0.5.

Protected range: 13% in BC, 2% Yukon

Threats, Trends, Vulnerability: Approximately same threats and trends apply inside BC as to the rest of the range, so no change in ranking.

Surrogate G rank is G4

C. Global responsibility: BC has something less than the 64% mapped by the Shining Mountains project**:** 4 (moderately high, 30 to 50% in BC)

5. Developing Draft S Ranks for Ecoprovinces.

There are 10 terrestrial Ecoprovinces in B.C.:

- Boreal Plains (BOP)
- Central Interior (CEI)
- Coast and Mountains (COM)
- Georgia Depression (GED)
- Northern Boreal Mountains (NBM)
- Southern Alaskan Mountains (SAL)
- Southern Interior (SOI)
- Southern Interior Mountains (SIM)
- Sub-Boreal Interior (SBI)
- Taiga Plains (TAP)

We summarize the ranking process and draft S ranks for each.

1. Boreal Pains (BOP)

Note only a small portion occurs in B.C.; the majority occurs in Alberta, Saskatchewan and Manitoba, and a smaller portion occurs in the Northwest Territories

Geographic range: 37,940.1 km^2 = B = -0.75

Protected range: 32,891.35 km^2 (0.8%)

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C = 0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	M	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I	H	I	I	I	I
Natural Systems Modifications	L	H	A/B	H	I	H	n/a
Invasives/problem spp	I	M	H	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	L	H	H	I

Notes to threats table:

- *low in alien species*
- *low to moderate ecosystem loss (agriculture)*
- *moderate proportion grazed, moderate to low proportion logged*
- *high oil and gas development*
- *high roadedness, relatively low unroadedness (but that's 77% unroaded)*
- *moderate species irreplacability and richness*
- *note, climate in BOP projected to change dramatically from BWBS,ESSF, Alpine to IDF,PP like.*

Totaling range, vulnerability, trend and threat: -1.5

draft S ranks: S4

2 Central Interior (CEI)

This Ecoprovince is entirely within B.C.
Geographic range: 111,356.6 km^2 = D = -0.25

Protected range: 1,634,602.27 km^2 (14.7%)

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C= 0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	L	H	E	H	H	H	H
Agriculture	H	M	B	H	L	M	I
Energy mines	I	H	E	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	I/L	M	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	H	M/H	B	H	L	M/H	n/a
Invasives/problem spp	M	M	C	H	I	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	H/L	H	H	I

Notes to threats table:

- *moderate alien species*
- *low in ecosystem loss(conversion to urban or high intensity agriculture)*
- *moderate proportion logged*
- *high in proportion grazed*
- *11% roaded, 88% unroaded = moderate*
- *high in water diversions and moderate in water pollution*
- *moderate in species richness and irreplacability*
- *note, climate in SOI projected to be more BG, PP, ICH and less IDF; much less MS and ESSF.*

Totaling range, vulnerability, trend and threat: -1.0

draft S ranks: S4/S5

3. Coast and Mountains (COM)

Note that except for a small area around the Ross reservoir and as far south as Snoqualmie Pass in Washington, and the Alaskan Panhandle in Alaska, a large portion of this Ecoprovince is in BC.

Geographic range: 182,676.7 km^2 = D = -0.25

Protected range: 23,020.2 km^2 (12.6%)

Trend: long term: relatively stable E = 0
short term: E = 0

Vulnerability: stable = C = 0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	L	G	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	L	H	B	H	M	M/H	n/a
Invasives/problem spp	I	n/a	H	n/a	n/a	n/a	n/a
Pollution	L	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	M	D	H/L	M	M	I

Notes to threats table:

- *third of all Ecoprovinces in alien species*
- *low in ecosystem loss*
- *moderate proportion logged*
- *low to nil livestock grazing*
- *low roadedness*
- *high area unroaded*
- *moderate to low in water diversions and high in water pollution*
- *moderate in species richness and irreplacability*
- *note, climate in COM will be more CWH, less MH, and less alpine, so some loss of diversity*

Totaling range, vulnerability, trend and threat: -1.0

draft S rank: S4 (calculates to S5. but several threats above a "B" lean to S4, the NatureServe thinking is fine, but the calculation just does not work for these large areas)

4. Georgia Depression (GED)

Geographic range: 17,535 km^2 = B = -0.75

Protected range 1,755 km^2 (10%)

Trend: long term: substantial decline C = 0
short term: C = -0.5

Vulnerability: moderately vulnerable = B = -0.25

Threats: see table below, largest magnitude is an A, so -1

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	M	H	A	H	H	H	H
Agriculture	L	H	E	H	H	I	L
Energy mines	L	H	H	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	L	H	L
Human Intrusion	L	I	H	I	I	I	I
Natural Systems Modifications	H	H	E	H	L	H	I
Invasives	H	H	E	H	I	H	H
Pollution	M	L	F	H	I	I	I
Geological	H	L	H	I	I	I	I
Climate change	H	?	D	L	?	?	I

Notes to threats table:

- *first (worst) of all Ecoprovinces in alien species*
- *highest in contaminated sites*
- *highest in ecosystem loss*
- *highest in proportion logged*
- *highest in NOx and SOx pollution*
- *highest in roads*
- *low in unroaded area*
- *high in water diversions and water pollution*
- *high in species richness and irreplacability*
- *note, climate in Georgia depression will be more CDF like rather than more CWH.*
- *residential development the greatest factor in trend and in threat, but also agriculture, transportation, pollution, altering of natural processes.*

Totaling range, vulnerability, trend and threat: -2.50

Draft S rank: S2/S3 (Adding the numbers come to S3, but low protected area and several large threats shift to S2)

5. Northern Boreal Mountains (NBM)

Note that there is work underway to divide this Ecoprovince into a northern and southern once, with the southern Ecoprovince lying totally within B.C.

Geographic range: 188,996.6 km^2 = D = -0.25

Protected range: 3,830,556.64 km^2 (20.3%)

T***rend***: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	L	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	G	H	I	H	n/a
Invasives/problem spp	I	M	G	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	H	L	H	H	I

Notes to threats table:

- *low in alien species*
- *low in ecosystem loss*
- *moderate to low proportion grazed, low proportion logged*
- *low roadedness, high unroadedness*
- *low species irreplacability and richness*
- *note, climate in NBM projected to change dramatically from SWB,BWBS, Alpine to ESSF*

Totaling range, protected range, vulnerability, trend and threat: -1.0

draft S ranks: S5

6. South Alaskan Mountains (SAM)

Note that this Ecoprovince is almost entirely in Alaska, except for a small area in extreme northwestern B.C. and the southwestern Yukon Territory.

Geographic range: 3,541.53 km^2 = A = -1.0

Protected range: 353,255.02 km^2 (99%)

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	M	H	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I	H	I	I	I	I
Natural Systems Modifications	L	H	B	H (10 am)	I	H	n/a
Invasives/problem spp	I	M	H	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	L	M	M	I

Notes to threats table:

- *low to nil in alien species*
- *low to nil ecosystem loss*
- *zero or no info on grazing, logging, oil and gas for the BC portion*
- *low roadedness, high unroadedness*
- *low species irreplacability and richness*
- *note, climate in SAL projected to increase CWH and decrease IMA and MH BEC zones*

Totaling range, vulnerability, trend and threat: -1.75

draft S ranks: S5 (calculates as S4)

7. Southern Interior (SOI)

Note that except for the Okanagan Highlands and the Okanagan Ranges in the northern interior of Washington, the majority of this Ecoprovince is in BC.

Geographic range: 56,465.7 km^2 = C = -0.5

Protected range: 496,030.64 km^2 (8.8%)

Trend: long term: moderate decline = D = 0
short term: substantial decline = C = -0.50

Vulnerability: moderately vulnerable = B= -0.25

Threats: see table below, largest magnitude is a A, so -1.00

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	M	H	E	H	H	H	H
Agriculture	H	M	B	H	M	M	L
Energy mines	I	H	E	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	L	M	H	H	M	M	n/a
Human Intrusion	L	M	F	H	L	M	L
Natural Systems Modifications	M	L	E	H	I	L	n/a
Invasives/problem spp	H	H	A	H	M	H	n/a
Pollution	L	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	H/L	H	H	I

Notes to threats table:

- *second of all Ecoprovinces in alien species*
- *third in ecosystem loss*
- *moderate proportion logged*
- *highest proportion grazed*
- *fourth in roadedness*
- *moderate area unroaded*
- *moderate in water diversions and high in water pollution*
- *second in species richness and irreplacability*

- *note, climate in SOI projected to be more BG, PP, ICH and less IDF; much less MS and ESSF.*

Totaling range, vulnerability, trend and threat: -2.25

draft S rank: S2 (calculation would be a S3)

8. Southern Interior Mountains(SIM)

Note this Ecoprovince is about half in B.C. with the rest shared among Alberta, Montana and Idaho and a small portion in Washington.

Geographic range: 138,743.9 km^2 = D = -0.25

Protected range: 2,386,050.7 km^2 (17%)

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	L	H	E	H	H	H	H
Agriculture	L	L	B	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	I/L	H	I
Human Intrusion	L	L	H	H	L	L	L
Natural Systems Modifications	H	M/H	B	H	M	M/H	n/a
Invasives/problem spp	M	M	C	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	M	D	H/L	M	M	I

Notes to threats table:

- *moderate in alien species*
- *high in upriver dams*
- *moderate ecosystem loss*
- *moderate proportion logged*

- *moderate in roadedness (but 90% unroaded which is middle of the list of Ecoprovinces)*
- *high species irreplacability*
- *moderate in water diversions and moderate in water pollution*
- *note, climate in SIM projected to be more ICH and much less of now dominant ESSF and alpine..*

Totaling range, vulnerability, trend and threat: -1.0

draft S ranks: S4/S5

9. Sub Boreal Interior (SBI)

This Ecoprovince occurs entirely within B.C.
Geographic range: 138,786.6 km^2 = C = -05

Protected range: 903,389.77 km^2 (6.5%)

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	M	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I	H	I	I	I	I
Natural Systems Modifications	L	H	A/B	H	I	H	n/a
Invasives/problem spp	I	M	H	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	D	L	H	H	I

Notes to threats table:
- *moderateto low in alien species*
- *moderate ecosystem loss*

- *moderate proportion grazed, moderate to low proportion logged*
- *moderate oil and gas development*
- *low roadedness, moderate unroadedness*
- *low/moderate species irreplacability and richness*
- *note, climate in SBI projected to change from mostly SBS to IDF, ICH.*

Totaling range, vulnerability, trend and threat: -1.25

draft S ranks: S5 (calculates as S4)

10. Taiga Plains (TAP)

Note only a small portion of this Ecoprovince occurs in B.C.; most occurs in the Northwest Territories and a small portion occurs in northern Alberta.

Geographic range: 69,523.2 km^2 = C = -0.5

Protected range: 144,885.44 km^2 (2.1%)

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	M	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	G	H	I	H	n/a
Invasives/problem spp	I	M	G	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	H	L	H	H	I

Notes to threats table:

- *low in alien species*
- *low in ecosystem loss*

- *moderate proportion grazed, moderate proportion logged*
- *moderate to high oil and gas development*
- *moderate to low roadedness, high unroadedness*
- *low species irreplacability and richness*
- *note, climate in TAP projected to change dramatically from BWBS to more IDF, PP like*

Totaling range, vulnerability, trend and threat: -1.25

draft S ranks: S5 (calculates as S4)

6. Developing Draft S Ranks for Major Drainage Areas In BC

The 9 Major Drainages Areas delineated for the Province are:

- Coastal
- Columbia
- Fraser
- MacKenzie
- Nass
- Skeena
- Stikine
- Taku
- Yukon

We summarize the ranking process and draft S ranks for each. For Major Drainage Areas we placed more emphasis on aquatic threats and conditions than terrestrial threats and condition.

1. Coastal

Watersheds include Vancouver Island, Queen Charlotte Islands, Squamish, Homathko, Klinnaklinni, Bella Coola, Dean, Whiting, Alsek/Tatshenshini
Geographic range: 164,772.6 km^2 = D = -0.25

Protected range: 3,248,309.43 ha Provincial Parks + 168,363.76 ha National Parks = 3416673.20 ha; 21%

Trend: long term: relatively stable E = 0
short term: E = 0

Vulnerability: stable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	L	G	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	I/L	H	I
Human Intrusion	I	L	H	H	L	L	L
Natural Systems Modifications	L	H	B	H (10 am)	M	M/H	n/a
Invasives/problem spp	I/H	n/a	E	n/a	n/a	n/a	n/a
Pollution	L	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	M	D	H/L	M	M	I

Notes to threats table:

- *highest major drainage area in alien species, but those are on south eastern Vancouver Island and southern Mainland, hence the split rank of "I/H" for scope of invasives*
- *moderate in ecosystem loss*
- *Natural aquatic systems and processes have been greatly altered (mainly by logging). Many of these drainages salmon dominated and impacts of logging and roads especially seen on coho and cutthroat trout.*
- *moderate proportion logged*
- *low grazing*
- *moderate to low roadedness*
- *moderate to high area unroaded (94%, note range in major drainage area is from 87.8 to99.9 % unroaded)*
- *high in water diversions and high in water pollution*
- *moderate in species richness and irreplacability*
- *least climate change – loss of some MH and alpine, expansion of CWH*

Totaling range, vulnerability, trend and threat: -1.0

draft S ranks: S3/S4 *(We ranked it as S3/S4 despite the total only coming to -1.0 which should equate to S5. The threats are larger than the NatureServe approach allows us to recognize. The large range outweighs threats and condition; this ranking system requires work to use at these scale of very large areas)*

(consider delineating Vancouver Island from Mainland Coast as separate Major drainage Areas)

2. Columbia

Watersheds include Okanagan/Smilkameen, Columbia, Canoe, Kootenay, and Duncan

Geographic range: 102,847.6 km^2 = C = -0.5

Protected range 879,422.67 ha Prov. Parks + 428,135.16 ha Nat'l parks = 1307557.8 ha

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: moderately vulnerable = B = -0.25

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	L	H	E	H	H	H	H
Agriculture	M	M	B	H	I	L	I
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	I/L	H	I
Human Intrusion	L	L	H	H	L	L	L
Natural Systems Modifications	H	H	B	H	M	M/H	n/a
Invasives/problem spp	M	H	C	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	M	D	H/L	M	M	I

Notes to threats table:

- *third (moderate) in alien species. Some alien species enter from the US. The USA also stocks non natives that then enter Canadian system. Invasives are more of a problem in the Columbia than in the Fraser River system.*
- *high in up river dams. This systems has natural processes that are very changed due to impoundments (reservoirs), water extraction, logging and agriculture.*
- *highest in ecosystem loss*
- *third in proportion grazed*
- *second highest proportion logged (16%)*

- *second highest proportion roaded*
- *low unroaded*
- *highest species irreplacability and richness*
- *second highest in water diversions and moderate in water pollution*
- *note, climate projected to be more ICH and much less of now dominant ESSF and alpine. Columbia system projected to move from a cold water system to a cool water system. (Some areas of Columbia, such as Okanagan, are warm water systems naturally). As climate change progresses, Bull Trout will likely decrease, but salmonids will likely persist.*

Totaling range, vulnerability, trend and threat: -1.5

draft S ranks: S2 *(We ranked it as S3 despite the total only coming to 1.5 which should equate to S4. The threats are larger than the NatureServe approach allows us to recognize. The large protected area outweighs threats and condition; this ranking requires work to use at these scales of very large areas)*

3. Fraser

Watersheds include the Lilloet, Thompson, Nicola, Stuart, Chilcotin, and upper Fraser.

Geographic range: Includes many BEC zones from coastal, central and montane areas of Province: 231,514.6 km^2 = D = -0.25

Protected range : 3,093,049.46 ha of Provincial Parks,
13% protected

Trend: long term: moderate decline D = 0
short term: D =-.25

Vulnerability: moderately vulnerable = B = -0.25

Threats: see table below, largest magnitude is an B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	L	H	E	H	H	H	H
Agriculture	M	H	E/B	H	H	I	L
Energy mines	L	H	H	H	H	I	I
Transportation	M	H	E/B	H	H	M	H
Biological Resource Use	M	H	B	H	L	H	L
Human Intrusion	L	I	H	I	I	I	I
Natural Systems Modifications	M/H	M/H	E/B	H	L	H	I
Invasives	M	H	E	H	I	H	H
Pollution	M	L	F	H	I	I	I
Geological	I	L	H	I	I	I	I
Climate change	H	H	B	L	?	?	I

Notes to threats table:

- *second of all major drainage areas in alien species*
- *second in ecosystem loss*
- *highest in proportion logged (17%)*
- *second highest in proportion grazed (40%)*
- *highest in roads (12%); relatively low in unroaded (but 88%)*
- *moderate to high in water diversions and water pollution (pollution high in lower mainstem, but tributaries not badly polluted)t*
- *A large, relatively unmodified river system, but some diversions, catchments, logging , fire suppression all alter natural processes*
- *high in species richness and irreplacability*
- *climate change to more IDF, less ESSF, less SBPS, The Fraser is predicted to change from a cold water system to a warmer water system, particularly in the Interior. Likely to lose salmon (chinoock, coho, sockeye) from the upper Fraser. Bull Trout are also likely to be lost. Some of these changes are already happening*

Totaling range, vulnerability, trend and threat: -1.5

draft S rank: S2/S3 *(We ranked it as S2/S3 despite the total only coming to -1.5 which should equate to S4. The threats are larger than the NatureServe approach allows us to recognize. A better ranking systems needs to be developed to use at these scale of very large areas.*

4. MacKenzie

Watersheds include the Liard (Dease, Liard, Kechika, Toad, Fort Nelson), Peace (Hay, Peace, Finlay, Parsnip)

Geographic range: 27,870,808.11 ha = E = 0

Protected range: 2,478,830.45 ha; 8.9%

Trend: long term: relatively stable E = 0
hort term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	H	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	B	H	I	H	n/a
Invasives/problem spp	I	M	H	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	M	L	M	M	I

Notes to threats table:

- *main threat is oil and gas; logging increasing too*
- *moderate to low in alien species(brook trout a localized non-native)*
- *moderate ecosystem loss*
- *highest proportion grazed*
- *lowest proportion logged*
- *highest proportion oil and gas development*
- *high roadedness, low unroadedness*
- *low species irreplacability and richness*
- *note, climate change could be a dramatic shift from BWBS to IDF and even drier types*

Totaling range, vulnerability, trend and threat: -0.75

draft S ranks: S3/S4
(Again, the calculations don't work for large areas. The calculation gives an S5, but the area is not that secure. Consider splitting MacKenzie into two or even 4 Major Drainage areas. Minimally split the Liard from the Peace. The Upper and Lower Peace are different as are the Upper and Lower Liard. The Peace has eastern fauna such as Arctic Greyling, Walleye and Pike; the Liard is dominated by Bull Trout (particularly Upper Liard))

5. Nass

Watersheds include the Nass
Geographic range: 21,567.5 km^2 = B = -0.75

Protected range: 25,463.73 ha = 1.2%

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	L	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E/B	H	H	M	H
Biological Resource Use	M	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	H	H	I	H	n/a
Invasives/problem spp	I	M	H	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	H	H	L	H	H	I

Notes to threats table:
- *low in alien species*
- *low in ecosystem loss*
- *lowest in grazing*

- *low proportion logged*
- *no oil and gas development*
- *moderate to low roadedness, moderate unroadedness (but that's 97% unroaded)*
- *moderate species irreplacability and richness*
- *low water pollution and diversions*
- *note, climate in Nass projected to change SBPS to CWH, EFFS to IDF and CWH, alpine areas shrink.*

Totaling range, vulnerability, trend and threat: -1.5

draft S ranks: S5 (calculates as S4)

6. Skeena

Watersheds include Skeena, Babine, Bulkley
Geographic range: 54,432.4 km^2 = C = -0.5

Protected range: 303,813.17 ha = 5.5%

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C = 0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	L
Agriculture	L	M	G	H	L	M	I
Energy mines	I	H	E	H	H	I	I
Transportation	L	H	E	H	H	M	H
Biological Resource Use	M	M	B	H	I/L	M	I
Human Intrusion	I	L	H/F	H	L	L	L
Natural Systems Modifications	M	L	B/F	H	L	M/H	n/a
Invasives/problem spp	I	I	H	H	I	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	H	M	D	H/L	H	H	I

Notes to threats table:

- *moderate alien species*

- *moderate in ecosystem loss*
- *moderate proportion logged*
- *moderate proportion grazed*
- *heavy harvesting of trout and salmon*
- *some oil and gas development, but low*
- *low roadedness; high unroadedness*
- *moderate in water diversions and low in water pollution*
- *moderate in species richness and irreplacability*
- *note, climate to change in coastal portions not large, but interior portions shift to more ICH, more IDF, with almost no SBS or ESSF remaining.*

Totaling range, vulnerability, trend and threat: -1.25

draft S ranks: S4/S5

7. Stikine

Watersheds include the Stikine, Iskut, Tanzilla, Tuya, Klappen, Spatsizi
Geographic range: 4,965,584.45 ha = E = 0

Protected range: 1,359,883.63 ha = 27%

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	L	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	G	H	I	H	n/a
Invasives/problem spp	I	M	G	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	M	H	L	H	H	I

Notes to threats table:

- *only real threat is climate change and harvesting of fish*
- *very low in alien species*
- *very low ecosystem loss*
- *no dams*
- *low proportion grazed, low proportion logged*
- *low oil and gas development*
- *low roadedness, moderate to high unroadedness*
- *low species irreplacability and richness*
- *low water diversions and pollution*
- *note, climate in Stikine could have large change from generally SWB and BWBS to ESSF.*

Totaling range, vulnerability, trend and threat: -0.75

draft S ranks: S4/S5
(consider combining Yukon, Taku, and Stikine into one large Major Drainage Area)

8. Taku

Watersheds include Taku
Geographic range: 16,603.8 km^2 = B = -0.75

Protected range: 37,875.65 ha = 2.2%

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	L	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	G	H	I	H	n/a
Invasives/problem spp	I	M	G	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	M	H	L	H	H	I

Notes to threats table:

- *only real threat is climate change and harvesting of fish*
- *no alien species*
- *no/very low ecosystem loss*
- *no dams*
- *very low proportion grazed, no logging*
- *no oil and gas development*
- *very low roadedness, highest unroadedness*
- *low species irreplacability and richness*
- *no water diversions and pollution*
- *note, climate in Taku could have large change from generally SWB and BWBS to ESSF.*

Totaling range, vulnerability, trend and threat: -1.5

draft S ranks: S4/S5

(consider combining Yukon, Taku, and Stikine into one large Major Drainage Area. However Yukon doesn't flow to the Pacific. Could also break down by south, central and north coast with Vancouver Island and Queen Charlottes separate)

9. Yukon

Watersheds include Yukon and Teslin

Geographic range: 24,981.8 km^2 = B = -0.75

Protected range: 206,166.41 ha = 8.3% total

Trend: long term: relatively stable E = 0
short term: stable = 0

Vulnerability: not intrinsically vulnerable = C=0

Threats: see table below, largest magnitude is a B, so -0.75

Threat	Scope	Severity	Magnitude	Immediacy	Conversion	Degradation	Indirect
Residential Commercial	I	H	E	H	H	H	H
Agriculture	I	M	G	H	H	L	L
Energy mines	I	H	E	H	H	I	I
Transportation	I	H	E/B	H	H	M	H
Biological Resource Use	L	M	B	H	L	M	I
Human Intrusion	I	I		I	I	I	I
Natural Systems Modifications	L	H	G	H	I	H	n/a
Invasives/problem spp	I	M	G	H	L	M	n/a
Pollution	I	I	H	n/a	I	I	I
Geological	Nil	n/a	H	n/a	n/a	n/a	n/a
Climate change	M	M	H	L	H	H	I

Notes to threats table:

- *only real threat is climate change and harvesting of fish*
- *low in alien species*
- *no dams*
- *low in ecosystem loss*
- *low proportion grazed, very low proportion logged*
- *no oil and gas*
- *low roadedness, high unroadedness*
- *moderate species irreplacability and low richness*
- *moderate water diversions, low pollution*
- *note, climate projected to change dramatically from SWB,BWBS, Alpine to ESSF and even IDF. River will still be a cold water system.*

Totaling range, vulnerability, trend and threat: -1.5

draft S ranks: S4/S5
(calculates as S4; consider combining Yukon, Taku, and Stikine into one large Major Drainage Area)

Appendix 1: Definition of global NatureServe G and S ranks

Rank	Definition
GX/SX	Presumed extinct: not located despite intensive searches and virtually no likelihood of rediscovery
GH/SH	Possibly extinct: missing; known from only historical occurrences but still some hope of rediscovery
G1/S1	Critically imperilled: at very high risk of extinction due to extreme rarity (often five or fewer populations), very steep declines, or other factors
G2/S2	Imperilled: at high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors
G3/S3	Vulnerable: at moderate risk of extinction due to restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors
G4/S4	Apparently secure: uncommon but not rare; some cause for long-term concern due to declines or other factors; or stable over many decades and not threatened but of restricted distribution or population size
G5/S5	Secure (common, widespread and abundant)
G?/S? or GNR, SNR	Unranked
GU/SU	Unrankable (lack of information or conflicting information about status or trends)

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