Lakes TSA AAC Determination, June 10, 2019

Cumulative Effects,

Description:

- British Columbia's Cumulative Effects Framework (CEF) defines Cumulative Effects (CE) as the combined effects of past and present human activity and natural disturbances on environmental, social and economic values.[1]
- Currently, CEF has assessment protocols for aquatic ecosystems, grizzly bear, and old growth forests, approved by the Natural Resource Sector for implementation.
- Timber Supply Review (TSR) and CE are both landscape-level assessments that report on the state of values to support decision making.
- Under section 8 of the *Forest Act* the chief forester must consider, "any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber". CE is categorized as other information that should be considered.

Skeena Region's CE Initiatives

- Skeena Region currently has two Environmental Stewardship Initiative (ESI) demonstration projects. These projects are in partnership with multiple First Nations and are the primary mechanism to deliver the cumulative effects program in the Region.
- The Skeena Sustainability Assessment Forum (SSAF) ESI demonstration project, which covers most of the Lakes TSA, is developing CE assessment protocols, separate from CEF, for moose, aquatics, wetlands and medicinal plants values. Since these protocols are still under development they are not considered in this assessment.

Lakes TSR Cumulative Effects Assessment (CEA)

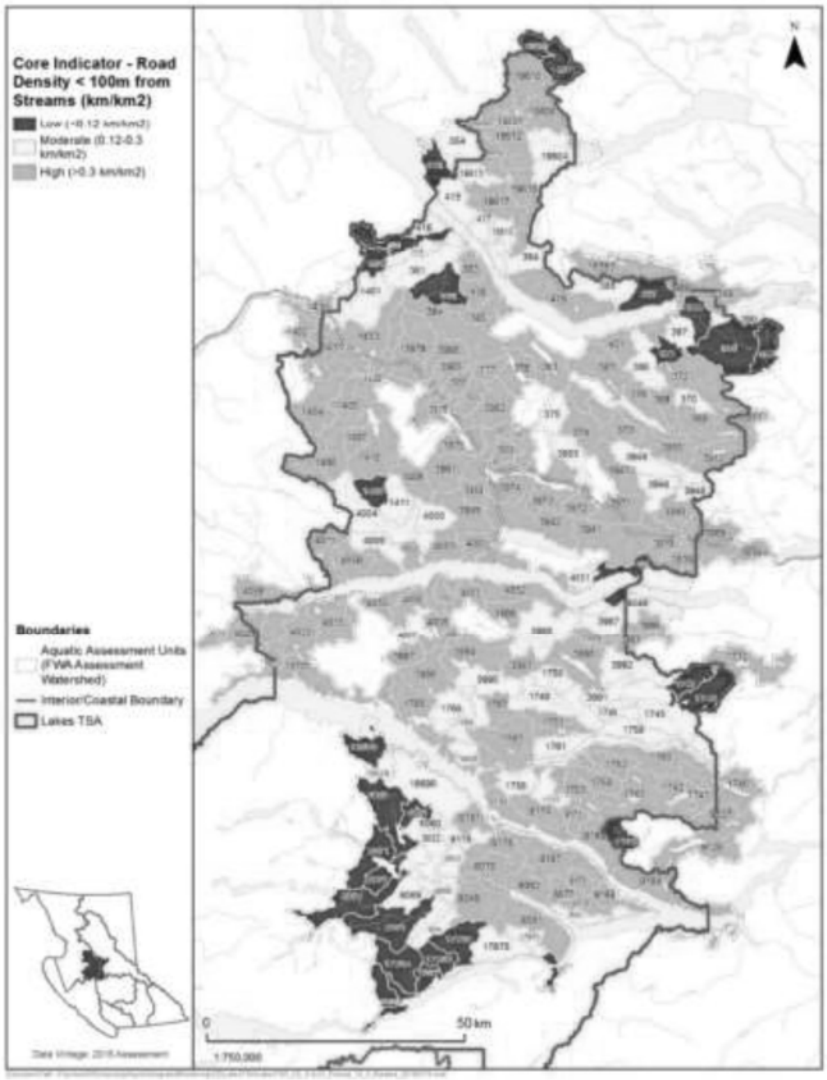
- For the Lakes TSR, Aquatic Ecosystems and Grizzly Bear CEF values are assessed. The other approved value, Old Growth, is not included as it has been assessed through existing Sustainable Resource Management Plan legal objectives and Old Growth Management Area designations.
- The assessment area includes all assessment units that overlap Crown managed forest land base (CMFLB) in the Lakes TSA. If an assessment unit overlaps CMFLB, the entire unit is assessed; therefore, many units include private land as well as CMFLB.
- Detailed assessment methods can be found in the CEF Interim Assessment Protocol for Aquatic Ecosystems and Grizzly Bears in BC.

Aquatic Ecosystems CEA

- The provincial assessment protocol includes thirteen indicators that affect three main components of aquatic ecosystems; water quantity, water quality and aquatic habitat. Three indicators were chosen due to their relevance to TSR and subject matter expert recommendations, these include:
    1. Road Density within 100 meters from a stream
    2. Peak Flow Index (Equivalent Clearcut Area)
    3. Total Land Disturbance
- The indicators are assessed at the Freshwater Atlas Assessment Unit (AU) level and ranked by risk rating low, medium or high. Total land disturbance is not ranked as this indicator does not have a risk rating.
- This Aquatic Ecosystem assessment uses 2015 data. Datasets are updated periodically.

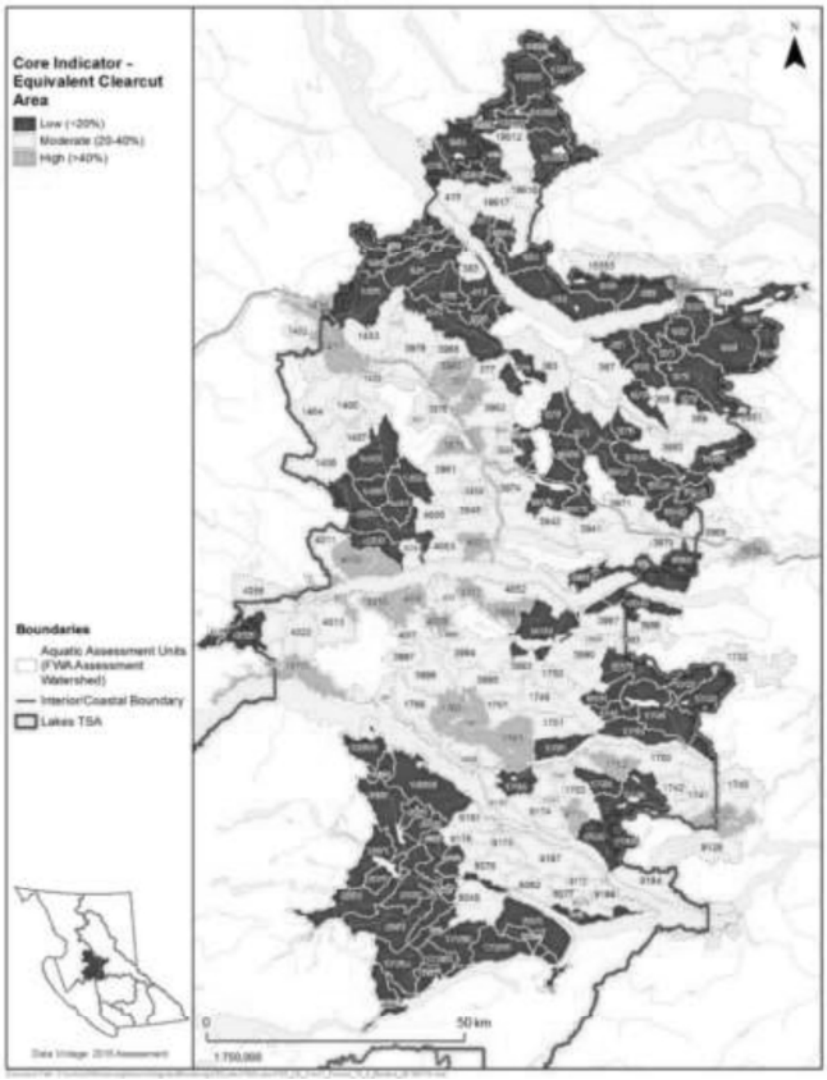
Road Density (within 100 meters from a stream) Indicator

- Road density relates to forest harvesting as well as other human activity on the land base.
- This indicator reports the road density within 100 meters of a stream, which more closely corresponds to the impacts roads have on aquatic systems when compared to other road density indicators.
- The results in the map below show that this indicator is at high risk across the majority of the AUs in the Lakes TSA.
- In many cases, AUs with low road density are overlapping provincial parks or no harvest management zones. For example, AUs in the southwest overlap Tweedsmuir Park, AUs at the east end of Babine Lake overlap Sutherland River Park and the AUs in the northern tip of the TSA overlap Mountain Goat Ungulate Winter Range no harvest zones.



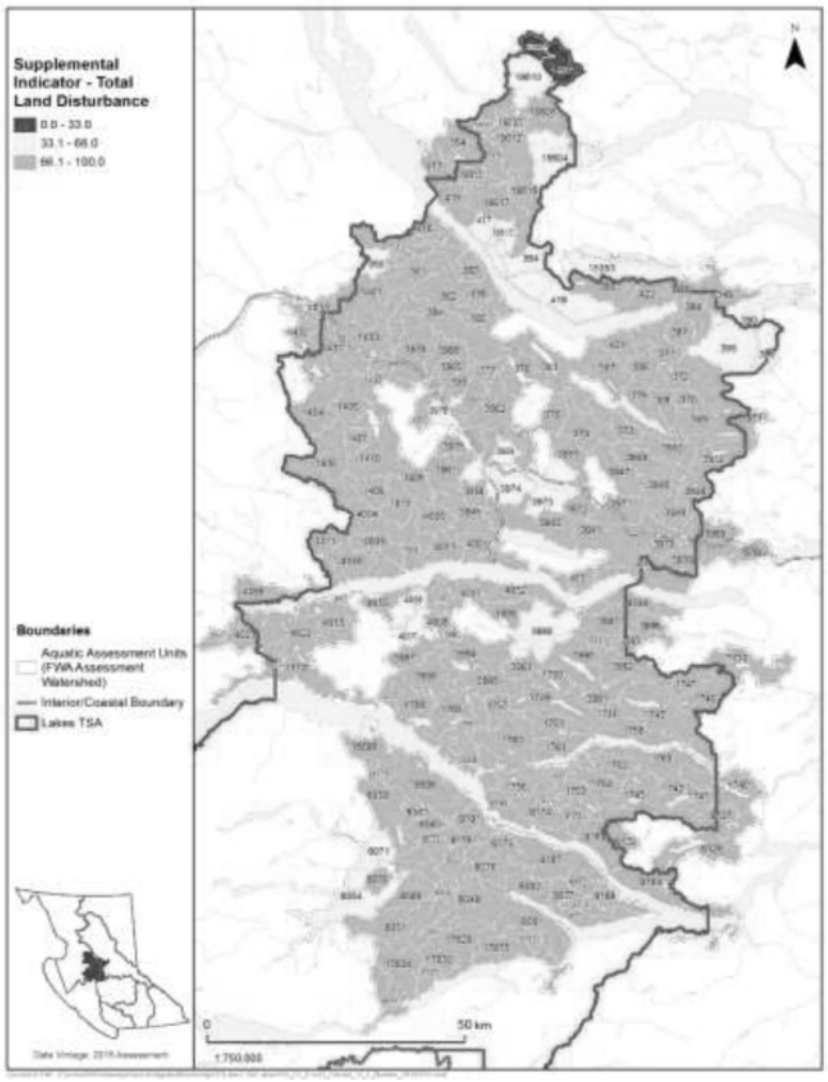
Peak Flow Index (Equivalent Clearcut Area) Indicator

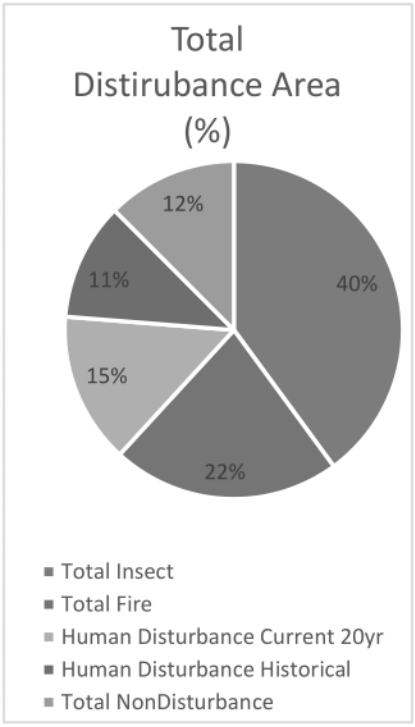
- "Equivalent clearcut area (ECA) is a modeled metric that attempts to relate the influence of forest cover disturbance to changes in stream flow".[2] This indicator relates to water quantity because changes to canopy cover affect snow accumulation, melt and evapotranspiration in a watershed.
- Only human disturbance to forest cover is considered in this metric so natural disturbance is not accounted for. This may explain the large number of low-risk AUs. FLNRORD researchers recommend that ECA be modified to account for partial or complete loss of green trees in stands thinned, burned, or killed by insects due to loss of forest cover.[3]
- The map below shows ECA as largely moderate and low risk. High risk areas are found along highway 16 and 35 down to Nechako Reservoir. This exemplifies the higher level of resource development in these areas.



Total Land Disturbance

- Total Land Disturbance shows the percentage of area in an AU that is disturbed. To do so, this indicator considers current human disturbance (e.g., rail, transmission, mining, harvest, oil and gas), historic harvesting (pre-1995), and natural disturbance (e.g., fire and insect).
- When interpreting the results of this metric, there are two important points to note;
    1. total disturbance takes into account historic harvesting (pre-1995) as well as historic fire disturbance; however, it does not consider forest regeneration, and
    2. disturbance from recent fire seasons are not included since this assessment uses base data from 2015.
- The map below shows that the majority of AUs have a high level of disturbance (greater than 66% of the area within the AU is disturbed). The high level of land disturbance can be partially attributed to the large spatial extent of fire and insect disturbance in the Lakes TSA. 26% of the total area is disturbed by human-caused impacts whereas 62% is disturbed by insect and fire, see pie chart below.





Summary Interpretation

- Natural disturbance from mountain pine beetle outbreaks and forest fires contribute to the significant amount of disturbance in the Lakes TSA. 62% of the assessed area is disturbed by natural disturbance types.
- These large-scale natural disturbance events can largely be attributed to two main factors; changes to weather patterns as a result of a changing climate and accumulation of mature lodgepole pine due to fire suppression.[4] The majority of the timber volume killed by mountain pine beetle epidemics took place between 2000 and 2005 whereas losses due to forest fires have been increasing over the past decade.[5] It is assumed that fire losses will continue given anticipated dryer conditions resulting from the impacts of climate change.[6]
- High road density in close proximity to streams across much of the Lakes TSA translates to a high risk to aquatic ecosystems. Road density has a strong relation to forest harvest, other industry, and human habitation as road networks expand to increase access.
- The impact of roads to water quality is reported in Forest and Range Evaluation Program (FREP) results. Sediment delivery from roads to streams has generally caused FREP water quality sampling sites to rank as high and medium impact levels in the Lakes.[7] High levels of sediment affects water quality, aquatic habitat quality and aquatic species.[8]
- ECA shows a lower level of risk because it only assesses human caused disturbance to forest cover. Since this indicator does not consider natural disturbance it can be assumed that ECA is higher across the landscape than the results of this assessment show.
- Moderate risk levels across many of the AUs in the ECA indicator can be attributed to lower tree heights which generally correspond to a younger age class. The Lakes TSA has large areas of young forest due to intensive beetle salvage harvest activities and larger fires over the past two decades.[9]
- Forest regeneration will improve ECA and decrease the risk to water quantity overtime. Although, present flow needs may be a point of concern in the Lakes given the current age distribution. Research suggests that extensive areas of second growth stands within a watershed result in higher variability of streamflow, with spring flow increases and summer deficits due to changes in snow accumulation and melt, and evapotranspiration.[10]

Conclusion:

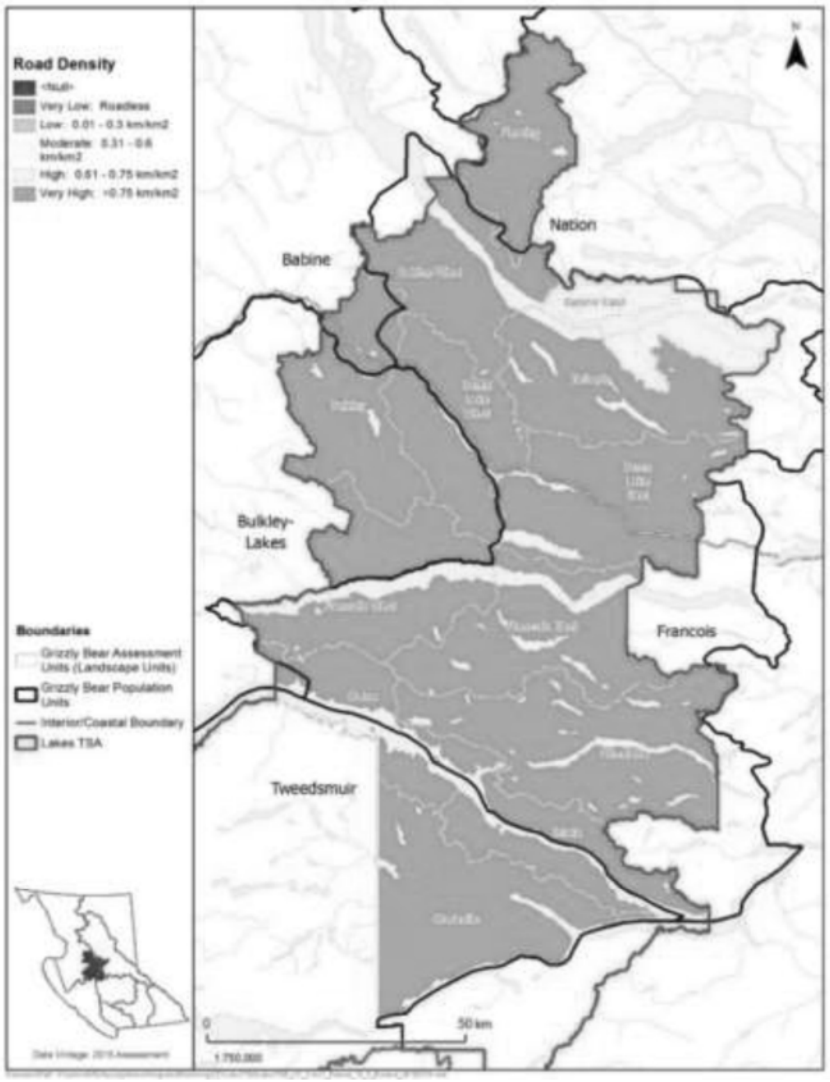
- Overall, when considering total disturbance, equivalent clearcut area and road density, the Lakes TSA Aquatic CEA reports high risks to aquatic ecosystems.
- With continued forest harvest pressure, it is assumed that disturbance levels, road density and ECA will increase and create additional risk to aquatic ecosystems in the Lakes.
- Considering the large areas of young forest within the Lakes, future forest regeneration will contribute to a lower level of ECA if high levels of forest cover disturbance does not continue.
- Lastly, natural disturbance levels are high although large fire seasons since 2015 are not reflected in this assessment. Recent fire seasons contribute to a higher current level of disturbance on the land base and it is assumed that fire losses will continue to occur because of climate change.

Grizzly Bear CEA

- The provincial assessment protocol includes thirteen indicators that affect two main components; grizzly bear habitat and population. Three indicators were chosen due to their relevance to TSR and subject matter expert recommendations, these include:
    1. Road Density
    2. Forage Supply
    3. Bear Density
- These indicators are assessed at the Landscape Unit (LU) level and grouped by Grizzly Bear Population Unit (GBPU) for interpretation. LUs generally coincide with one to several female grizzly bear home ranges whereas GBPUs correspond to a larger area, are used for management purposes, and can reflect bear population ecology.[11]
- This grizzly bear CE assessment uses 2015 data. Datasets are updated periodically.

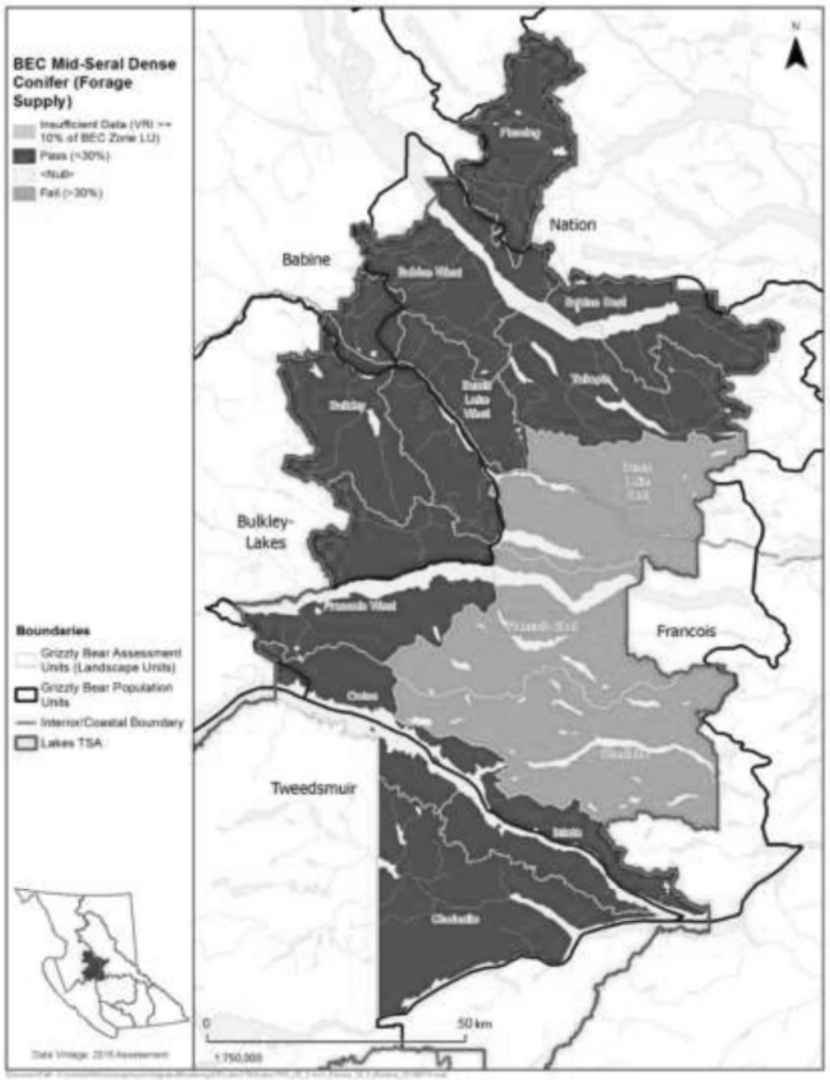
Road Density Indicator

- As discussed in the aquatics section, road density relates directly to forest harvesting and other human activity on the land base. With higher road density, grizzly bear mortality and habitat avoidance increases, and populations can decline. [12]
- All LUs, but one, are flagged as very high with a road density greater than the 0.75 km/km^2 threshold, see figure below.
- In the Francois GBPU, population linkage between north and south is a potential concern because highway 16 and a long-established agricultural and human settlement zone bisect the unit. [13]



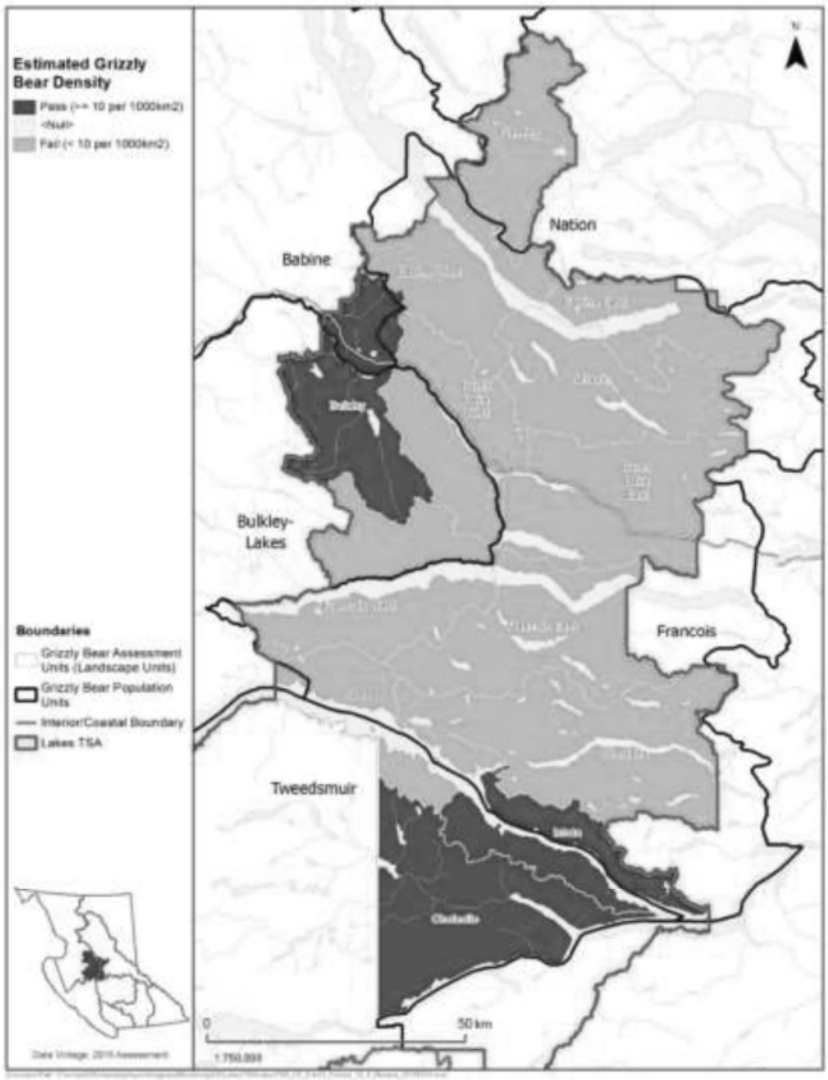
Forage Supply (Mid-Seral Conifer) Indicator

- Berry patches are an important food source for grizzly bears and the dense closed canopy characteristics of mid-seral conifer forests can cause sub-optimal berry production. [14]
- LUs with greater than 30% mid-seral dense coniferous forest receive a “fail” as it is assumed there is a shortage of forage supply.
- All LUs with sub-optimal forage supply are within the Francois GBPU, see figure below.



Bear Density

- Bear density reports the estimated number of bears in a 1000km^2 area. Less than 10 bears in 1000km^2 is flagged as a "fail".
- Based on population size models, most LU's have a low density of bears in the Lakes TSA, see figure below. The Francois GBPU is of particular concern given the low population density across the majority of the area.



Summary Interpretation

- Due to high road density, the Lakes TSA has a high risk of grizzly bear mortality. With increased road density there is an increased chance of human-bear conflicts, human caused mortality, habitat fragmentation and a lack of core security habitat. All of these metrics can contribute to grizzly bear population decline.
- Road density is a key factor for grizzly bear core security habitat. Core security habitat is defined as areas large enough to cover the average daily movement of an adult female grizzly bear and support

her daily foraging requirements, with minimal amount of human use.[15] High road densities lead to a lack of core security habitat, this can negatively affect female grizzly bear survival rates and contribute to population decline.[16]

- The Lakes TSA is dominated by Sub-Boreal Spruce (SBS) and Engelmann Spruce Subalpine Fir (ESSF) biogeoclimatic zones. Management objectives for seral stage distribution are legally established by Sustainable Resource Management Plans in the Lakes. As per the TSR Data Package, the Lakes is generally meeting targets for early and mature seral distribution but a deficit of old seral ESSF forest exists within all LUs. [17]
- Although seral stage diversity targets are generally being met, when considering grizzly bear forage supply, LUs within the Francois GBPU have a greater abundance of mid-seral dense conifer which limits forage production in this area. Two of the three LUs that fail in regards to bear forage supply are also legally classified as low biodiversity emphasis options.
- Immediately after forest harvest, open forest patches may benefit bears since early seral, open canopy promotes forage production. However, berry production declines rapidly as the canopy closes and therefore benefits of harvest are generally short lived.[18] When allowed to mature beyond 100-120 years, forests in the Lakes will no longer be considered mid-seral.[19] The increased canopy openness that comes with seral stage maturity should positively affect grizzly bear forage supply.

Conclusion:

- Large areas of young, early seral stage forests in the Lakes[20] will age to mid-seral in the next 10-40 years and pose a further risk to bear forage supply. LUs currently not flagged as a risk to forage supply may become at risk in the future given the current stand age distribution in the Lakes.
- Future forest harvesting will likely further increase road density in order to access more area. This will create additional risk to LUs already considered high risk for grizzly bears.
- When considering road density, forage supply and bear density, the Francois GBPU is of the highest conservation concern within the Lakes TSA. Field studies of the Francois GBPU have not been conducted extensively enough to formally establish it as a declining population.[21] However, the indicators described above suggest Francois has a high risk of population decline or reduced density.

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[1] *CEF Interim Assessment Protocol for Aquatic Ecosystems in British Columbia* (Ministry of Forests, Lands, Natural Resource Operations, and Rural Development: British Columbia, 2017), 2, https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/interim_aquatic_ecosystems_protocol_dec2017_v11_final.pdf

[2] *CEF Interim Assessment Protocol for Aquatic Ecosystems in British Columbia*, 14

[3] R. Winkler, and S. Boon. *Extension Note 118: Equivalent Clearcut Area as an Indicator of Hydrologic Change in Snow-dominated Watersheds of Southern British Columbia* (Ministry of Forest, Lands, Natural Resource Operations, and Rural Development: British Columbia, 2017), 5, https://www.for.gov.bc.ca/hfd/pubs/docs/en/EN118.pdf

[4] *Lakes Timber Supply Area Timber Supply Analysis Discussion Paper* (Ministry of Forest, Lands, Natural Resource Operations, and Rural Development, British Columbia, 2019), 10, https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/14ts_tsr_dp_2019.pdf

[5] *Lakes Timber Supply Area Timber Supply Analysis Discussion Paper*, 9

[6] *Lakes Timber Supply Area Timber Supply Analysis Discussion Paper*, 11

[7] *Multiple Resource Value Assessment Lakes Timber Supply Area 2013* (Nadina Natural Resource District, British Columbia, 2013), 8, https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/mrva-lakes-tsa.pdf

[8] *CEF Interim Assessment Protocol for Aquatic Ecosystems in British Columbia*, 14

[9] *Lakes Timber Supply Area Timber Supply Analysis Discussion Paper*,79
[10] Julia A. Jones, and David A. Post, "Seasonal and successional streamflow response to forest cutting and regrowth in the northwest and eastern United States." *Water Resources Research* 40 (2004): 17, https://doi.org/10.1029/2003WR002952.
[11] *Skeena Watershed Current Conditions: Grizzly Bear Assessment Summary* (Ministry of Environment: British Columbia, 2018), 3.
[12] G. Mowat, C.T. Lamb, L. Smit and A. Reid. *Extension Note 120: The Relationships among Road Density, Habitat Quality, and Grizzly Bear Population Density in the Kettle-Granby Area of British Columbia* (Ministry of Forest, Lands, Natural Resource Operations, and Rural Development: British Columbia, 2017), 6, https://www.for.gov.bc.ca/hfd/pubs/Docs/En/En120.pdf
[13] *Skeena Watershed Current Conditions*, 10.
[14] *CEF Interim Assessment Protocol for Grizzly Bear in British Columbia* (Ministry of Forests, Lands, Natural Resource Operations, and Rural Development: British Columbia, 2017), 20, https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/cef_assessment_protocol_grizzly_interim_v11_2018feb6.pdf
[15] *Skeena Watershed Current Conditions*, 5.
[16] Gibeau, M.L., S. Herrero, B.N. McLellan, and J.G. Woods. *Managing for Grizzly Bear Security Areas in Banff National Park and the Central Canadian Rocky Mountains*, 127, https://www.bearbiology.org/wp-content/uploads/2017/10/Gibeau_Herrero_Vol_12.pdf
[17] *Lakes TSA Timber Supply Review Data Package* (Ministry of Forests, Lands, Natural Resource Operations, and Rural Development: British Columbia, 2019), 59, https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/14tsdp_update_apr2019.pdf
[18] G. Mowat, C.T. Lamb, L. Smit and A. Reid., 9.
[19] *Lakes TSA Timber Supply Review Data Package,* 57
[20] *Lakes Timber Supply Area Timber Supply Analysis Discussion Paper,* 7-8.
[21] *Skeena Watershed Current Conditions*, 9.