Boundary Forest Watershed Stewardship Society (BFWSS)

Submission regarding Interfor TFL 8 Management Plan #11

June 7, 2020

We appreciate the opportunity to submit our comments. We are a grassroots citizens organization and hope to do our best to represent the outlook of local residents. Based in Grand Forks, British Columbia, Canada, we advocate for culturally, ecologically, and economically sustainable forestry practices in the forest and watershed of the Boundary

P. 8 – Intro

Response: Since climate is a major concern in our world today "Climate" should be added in the list of changes here.

It is good First Nations are being consulted and uncertainty of growth and yield are acknowledged.

Section 3.1: Mountain Pine Beetle

Response:

Ø Infested areas less than 40 years old were considered to be addressed. Addressed here means logged and not in terms of a solution to the Mountain Pine Beetle & global warming.

Ø Table 1 should revise the text to say Logged or Harvested instead of Area Addressed.

Ø It would be interesting to know how many hectares of 40 years old and less were impacted by Mountain Pine Beetle in the 5,385 hectares. If we work backwards that might be as much as 3,504 hectares or 4.5% of the total area of TFL 8.

Ø The asterisk for Table 1 can't include logged or planned blocks or where the age is less than 40 years because the lead in paragraph says that areas less than 40 years of age were too young to harvest.

Section 3.2: Dense Pine Stands

Response:

Ø Dense Pine Stands are providing Shade Habitat for moose on the landscape (Pers. Comm. Ray Demarchi) based on research by Mike Demarchi:
http://rcin.org.pl/Content/12347/BI002_2613_Cz-40-2_Acta-T40-nr2-23-36_o.pdf

Ø Ray Demarchi said that we want a wide range of Forest Age Classes across the landscapes. Especially don't forget woodpecker habitat and use either which is also evident in Dense Pine Stands.

Ø Liquidating Dense Pine Stands may have multiple negative cumulative effects.

Ø Dense Pine Stands are difficult to quantify especially Young Stands. The TFL 8 TSR uses the same approach that was used in the 2011 Boundary TSA Timber Supply Analysis which itself was based on a 1999 JS Thrower Report about Dense Pine Stands being difficult to locate and the 1999 report only had accurate data for tree heights but not diameters and densities which were extrapolated.

P. 12 – 3.3 Managed Stands

- **Stump Removal to combat Root Diseases**. Have there been any follow up studies of the efficacy of stump removal as a means of addressing root disease? It is a very invasive and disturbing strategy for the land.
- The work of many researchers and Suzanne Simard and Paul Stamets have shown us of the importance of all fungi in ecosystem functioning such as carbon storage (70% of the total ecosystem amount) below ground and nutrient and water exchange.
- Research by Suzanne Simard has also shown that these fungal networks connect large old mother trees with seedlings to provide for and supply water and nutrients.
- Fungi are also prime ecosystem movers in forests where live trees become dead trees which eventually fall down and become Coarse Woody Debris (CWD). Dead Standing Trees or Snags provide habitat for woodpeckers and all the way up to cougars and black bears.
- Coarse Woody Debris after many decades are fertilizer systems where massive amounts of Nitrogen are input into the soil after rainfall washes over the CWD.
- CWD also decay to form new soil
- Fighting fungi at every turn and attempting to remove them will disrupt many of the ecological processes that are essential for ecosystem functioning and in a direct way the Timber Supply.

Section 3.5: Adjacency and Green Up

- It is critical in the 21st Century that accurate and Spatial Data leads the way.
- Analysis and Modeling need to enter the 21st Century.
- Aspatial approximations over any time frame are not acceptable
- 25 years ago, Erik Piikkila (our consultant) used a software called: Landscape Management System: https://www.landscapemanagementsystem.org/ He was tasked with creating a plan for 200 – 300 year planning horizon. He was able to grow the trees

and see what each patch looked like through time. All of this work and analysis was Spatial and not Aspatial.

3.6 Landscape-Level Biodiversity

Response – OGMAS and their management and alternate replacement through sensitivity analyses of full seral by the end of the third rotation are contentious for us. With society's attention on the current liquidation of Old Growth and the review process underway, we request the more conservative method be maintained. We believe the attributes of original forests can not be duplicated my forest management. Something(s) will be lost from the biodiversity.

Removing Old Growth and by incorporating a sensitivity analysis, Interfor hopes to establish full seral objectives by the end of the third rotation? Albeit climate impacts do not impact regeneration and future growth rates. Spatial old growth reserves will not protect existing old growth and the non-timber values associated with existing old biodiverse seral stage forests.

Waiting until end of third rotation is punting the old growth issue way down the road.

Old growth is required now for carbon sequestration, climate change mitigation, natural fire breaks, habitat for woodpeckers (which prey on mountain pine beetles & others), habitat for old growth dependent species, and to slow down water and prevent flooding on the landscape especially in the upper 60% of every watershed.

Old growth & mature forests should be removed from the timber harvesting landbase.

We are very concerned as a result of information shared in the report entitled **BCs Old Growth: A Last Stand for Biodiversity** by Price, Holt, and Daust and want to see the recommendations within it acted upon in TFL 8: https://veridianecological.files.wordpress.com/2020/05/bcs-old-growth-forest-report-web.pdf

Section 3.7: Unsalvageable Losses

- This amount of waste should be left for ecological purposes.
- In fact, most if not all of this volume will be removed under the Small Scale Salvage Program
- How will this volume be tallied between TFL 8 and Small Scale Salvage Program? Included in TFL 8 AAC but not harvested. So another 3,646 m3 needs to be found for AAC or TFL 8 AAC is reduced by 3,646 m3 and Small Scale Salvage Program Gains 3,646 m3.

Section 4.1 Base Case

- Ø We like that all six bullet points have been included as new changes since TSR 3 in 2007
  - Ø Incorporating Williamson's Sapsucker Wildlife Habitat Areas
  - Ø Incorporating Williamson's Sapsucker Best Management Practices
  - Ø Incorporating OGMAs for old seral requirements
  - Ø Revised silviculture regimes for managed stands
  - Ø Increased allowance for non-recoverable losses
  - Ø Use of a fully spatial model for the entire planning horizon

Section 4.2 Sensitivity Analysis Table 4

- Ø Unclear about Timber Harvesting Landbase Area Increasing or Decreasing by 10%: Perhaps by using different harvesting systems? Please Clarify.
- Ø Growth & Yield
  - o No Calculations that include Dense Pine Stands
- Ø Integrated Resource Management
  - o Need Definition of Disturbance such as Harvesting, Fires & Insect Attacks and its inclusion in Non THLB
  - o Disturbance is also present in the THLB: Harvesting, Salvage Logging, Fires, & Insect Attacks
  - o Disturbances such as Fires & Insect Attacks Lead to Other Disturbances such as Harvesting & Salvage Logging
  - o Road building is also a disturbance as forest cover and soil are removed
- Ø More clarity is required for management of old seral targets in the THLB versus Old Growth Management Areas.

- Limit ECA within watershed units: more clarity. If retention silviculture systems were used as opposed to clearcuts, ECA would decrease dramatically.
- Incorporating first nations interests is increasingly required with even more increases in the future

- Timber harvesting:

  o cutblock aggregation and cutblock size are independent variables

  o cutblock aggregation describes how connected, adjacent, contiguous, and grouped together the utblocks are

  o from a landscape fragmentation point of view, many smaller cutblocks will create more edges and edge effects than several larger cutblocks which will have less edge and less edge effects

  o also cutting 2% of a watershed every year will mean that in 10 years, 20% of the watershed will be cut, which means that in 40 years, 80% of the watershed will be cut

  o if a watershed started with 100% old growth at the beginning of commercial harvesting, then 20% old growth would remain after 40 years. but all of that is dependent on the amount of old growth a watershed began with at the beginning of commercial harvesting, and the rate at which it has been harvested.

  o harvesting 80% of a watershed in 40 years doesn't sound sustainable since forests and trees take decades and centuries to mature!

P. 14 – 4.3 Alternative harvest flows

Response: We are adamantly opposed to maintaining the current AAC as long as possible at the expense of the mid and long term harvest. This would be neither ethically nor morally right for the Boundary area.

Ø There are many more factors that control Timber Supply of the THLB and the TFL. Forest cover constraints and growth capacity are key but ecological considerations will also impact THLB and harvest flow.

The past harvest rates need to be examined with current and future rates!

To avoid large disruptions, it will be necessary to decrease harvest rates substantially in the short and medium term.

- Ø Decreases will likely be greater than 10% in a 10 year period to achieve the desired balance

- Ø Having a 300 Year Planning Window is admirable but really a 1,000 Year Planning Horizon should be used.

- Ø Ensure Growing Stock does not decline over entire planning horizon and not just last 50 years

- ø Ensuring a healthy forested ecosystem is working on all cylinders will ensure long term timber supply

- Ø There are several other factors that will also control Timber Supply:
    - o Forest Fires
    - o Insect Attacks
    - o Stress From Climate Change
    - o Droughts
    - o Reduced Soil Moisture (young forests have less soil moisture than older forests)
    - o Increased CO2
    - o Rotation Length
    - o Old Growth & Mature Retention
    - o protection of large old trees and their ecosystems which are the photosynthesis powerplants for forest & tree growth

5 Model

Response: This section mentions in a couple of places targets/goals and objectives and priorities. It would be helpful in reviewing the package if these were spelled out to better understand where the company is leading to with their information.

P. 15 6 Data Sources

Response: Mule Deer and Moose information sources are getting a bit outdated especially in the case of Mule Deer where population numbers have declined dramatically in recent years.

There is a large-scale research project involving multiple agencies and universities which is attempting to understand and reverse declines of mule deer in the Southern Interior.

"Mule deer declines have been a concern in portions of the southern interior since the 1960s, and decades of hunting regulation change have not reversed the declines," said Jesse Zeman, Director of Fish and Wildlife Restoration, BC Wildlife Federation (see source for this quote here).

In conversations with local hunters and old-time loggers from our region, BFWSS is hearing that the reason for mule deer decline is the loss of habitat and food due to clear cut logging.

Since information sources are outdated and the above referenced study project is yet to be completed, it would make sense to rely on the observations of citizen scientists. These hunters and loggers have spent decades in our forests and therefore have a baseline to compare their current observations to. These observations are relevant in decision making.

P. 16 – 7 Current Forest Cover Inventory

Response: This section points out several weaknesses in inventory data. Examples include the 540 ha. mapping location changes, "A regeneration delay of 2 years was assumed", 671 ha of NSR …."assumed to be fully stocked"…"currently forested". What are regen and free to grow surveys saying about these lands? We know from local knowledge there is still NSR area on the TFL. These are not satisfactory representations of these lands.

Sec. 7.2: NSR areas

Response: It states that recent imagery was used to confirm "that these stands are currently forested." However, no field checks were made to confirm that the stands are satisfactorily restocked as per provincial requirements. Just because stands are "currently forested" does not mean they are satisfactorily restocked. Field checks should be done to determine whether these areas are satisfactorily restocked.

P. 17 - 8 Description of the Land Base

Response: We appreciate the recognition of PFLB outside the THLB as important to ecosystems in the watershed and contributing biodiversity to critical wildlife habitat.

Pg. 18: Table 6: Productive Forest Land Base and deductions thereto

Response: The productive areas of Recreation Sites/Reserves have been fully deducted from the THLB. It is good that this has been done and we appreciate this deduction.

P. 20 – 8.1.1 Age class Distribution

Response: On face value having over half of the THLB less than 50 years intuitively seems high for sustaining the cut at an even flow in the med and long term.

Page 23 – Table 8 Non-Forest and Non-Productive Forest

Lake - why is removed area less than Gross? What's with the "no typing available" and difference in areas?

Pg. 23 Last sentence: A reasonable accounting of areas of trails and landings should be included (sine they are still being used) with appropriate deductions made to the THLB made. This should happen to represent what actually happens on the ground.

8.4.1 Roads, Trails and Landings

Response: It is good to confirm "permanent roads, trails and landings are not suitable for growing trees" and spatial data is retained to depict the assets.

There is a bit of confusion here or a misunderstanding regarding future roads.

Table 6 pg.18 THLB Current Less: Future Roads (aspatial) **587 ha. ** To be applied with a yield table reduction of 2.0% for future managed stands Then we go to page 24 8.4.2 Future Roads, Trails and landings 1st. para. …" and it can be assumed that all managed stands (i.e. Stands less than 45 years old) will need no further reduction made for future roads." Then we go to page 36 "…, future managed stands yield tables for existing naturals stands will be reduced by 2.0% in the model to account for future roads (see section 8.4.2)"

P. 26 8.11 Deciduous

Response: We see retention of some deciduous species on the TFL lands as positive and critically important for biodiversity, wildlife and ecosystems.

P. 27 8.1.3 Riparian Management Areas

Response: As in the case of OGMAs, we believe Riparian Management Areas should be excluded from harvesting except where some management protects the integrity of the area such as feathering edges to lessen windthrow or pest/disease management. These ecosystems have their own unique biodiversity value that should not be diminished by harvesting within them.

P. 29 Table 15:

Response: S-6 streams should be included in this table. Also, how will NCD's be protected and why is no consideration given to them?

P. 30 8.15 Recreation Sites and Reserves

Solitude Lake? Anyone know? Gross cut in half to remove?

P. 30 Rec Site removals:

Response: It is good that all Rec Site areas have been removed from the THLB.

Are the rec sites that are listed all of the rec sites located within the TFL?

8.17 Old Growth Management Areas

Response: In conjunction with government agencies and other timber managent licencees, classic examples of regional BEC areas must be set aside with no man made intervention. This is critical to preserving examples of natural forest types that will not be replicated through forest management. TFL 8 must share in this responsibility where their lands represent unique types. Managing for Old Growth does not replicate undisturbed old forests.

How much old forest exists in TFL#8? How accurate is the information? We would like to see a detailed report.

Once again, we ask that the recommendations in the BCs Old Growth Forest: A Last Stand for Biodiversity be applied in TFL 8. See below for some of the specifics

"Retention of mature forest is necessary in many ecosystems, particularly those with long harvest history, to recruit old forest for the future. Forest policy in BC relies upon the old forest strategy to maintain biodiversity into the future — yet that policy fails to maintain ecosystem diversity, thus posing high risk to biodiversity and carbon storage now, and higher risk into the future." (P.5, BCs Old Growth Forest Report, Holt, Daust, Price, 2020.)

Priority actions to stop further loss and increase retention of representative old forest must be taken immediately to reduce risk and maintain and restore values into the future. As stated in the above report:

- Stop the bleed. Immediately place a moratorium on logging in ecosystems and landscapes with very little old forest.
- Reduce risk. Immediately remove the 2/3 drawdown to match minimum targets in Biodiversity Guidebook. Then revise targets based on science to lower future risk.
- Implement intent properly. Design and revise spatial OGMAs to capture the best remaining old forest and ensure they maintain functional ecosystems.

Complex old growth forests play critical ecological functions in collecting, filtering, cooling and transporting water, and building soil. These are functions that the people of Grand Forks in particular are in great need of. We cannot afford to detract from the complexity of the structure and composition of old forests. The ecosystem is no longer functioning the way it did prior to clear cut harvesting. Grand Forks is paying the price for the loss of that function.

Old growth is capital. But the capital that took centuries to develop is no longer present. Which begs the question, how much longer will Interfor be logging in the Kettle watershed? Three years, five years, ten years? This is a question that is relevant to the residents of Grand Forks in terms of local forestry jobs and in terms of more potential floods.

We recommend that the Province allow Interfor to undertake the Recommended Priority Actions and Mid-Term Priorities in the BC Old Growth Forest: A Last Stand for Biodiversity report on pages 43 & 45 by Holt, Price, and Daust as applicable to TFL#8. We encourage Interfor to seriously consider implementing these priorities in order to protect the community. Interfor has a unique opportunity to do something differently than they have in the past that could have a significant beneficial impact on Grand Forks. We ask that you consider it.

P. 34-35 10 Growth and Yield Figure 6

Response: How is the difference accounted for in the noticable increase in the 2006 adjustment over the other two sources?

8.8 ENVIRONMENTALY SENSITIVE AREAS

Response: Why allow logging in ESA1, regardless if it was previously logged? Also, many previously harvested blocks intersect areas identified as ESA2 indicating that these areas are generally available for timber harvesting? Again, just because they were once logged, is that enough scientific criteria to continue further logging?

8.9 UNSTABLE TERRAIN

Response: (High likelihood of landslide initiation following timber harvesting) were fully removed from the THLB unless there was evidence of previous harvesting. Once again, it begs the question whether these areas should remain deleted.

With climate impacts and recent consecutive flooding events, even 'moderate likelihood of landslide' should be considered as additional potential compromise to the hydrologic cycle.

8.13 RIPARIAN MANAGEMENT AREAS

Response: 'Designed to MINIMIZE impacts of harvesting in areas immediately adjacent to water bodies, streams, lakes and wetlands.' The critical nature of riparian areas and their association to the hydrological cycle, wildlife and habitat, minimizing impacts is not an acceptable management strategy. Impacts must be eliminated. A 25% average retention level is simply inadequate. We are now entering an era where climate impacts will further stress existing riparian areas. Riparian areas are critical ecological components necessary for a functioning biological diverse ecosystem. There cannot be any impacts from harvesting.

8.14 WILDLIFE HABITAT AREAS

Response: #8-373 for Grizzly bear. It is expected that general wildlfie measures can be met operationally without requiring a reduction to the timber harvesting land base.

Though there have been what some assume to be an increase in grizzly bear sightings, effective intact (undisturbed habitat), connected corridors of habitat are at a premium throughout the grizzly bear study unit. In the long term, fragmented, high elevation habitat will serve to isolate the population, resulting in inbreeding, competition and the eventual extirpation of the Selkirk grizzly population. Operational plans and implementation, such as what has been documented in other logged areas, is far from ecologically acceptable, therefore an assessment of current WHA's and their conditions needs to be addressed.

Old forests are particularly important here. The watershed cannot afford to lose anymore of the habitat that old forests contribute.

10.2 UTILIZATION LEVELS

Utilization levels define the portion of the tree that is considered to be merchantable volume. Standards for utilization are specified in the cutting authority for the licence, and volume that meets these standards is charged against the allowable annual cut. The minimum merchantable timber specifications for TFL 8 are are shown in Table 23. These will be used for all species and analysis units (natural and managed) when developing the yield tables for this analysis.

Table 23 Utilization levels **Species**	**Minimum Diameter at Breast Height**	**Maximum Stump Height**	**Minimum Top Diameter Inside Bark**
Lodgepole pine	12.5 cm	30.0 cm	10.0 cm
Other conifer	17.5 cm	30.0 cm	10.0 cm

Response: The Utilization Levels as per Interfor's log Quality specs, especially for top sizes (see below)* should be used to determine the AAC yield tables; otherwise the level of forest harvest losses due to the adherence of these specifications will only be accounted for, at best, via Waste and Residue surveys. These surveys are not only unreliable but also often very inaccurate. They are also very costly to carry out, costs for which the public pays. The more waste the higher the costs.

* Minimum top diameters inside bark for all conifers, as per Interfor's log specs are 4.5" (11.4cm) except for cedar which is 5" (12.7cm.)

P. 37/38 10.6.1 Existing timber volume comparison

Response: What could account for the difference in Table 25 under existing managed stands (19-32 yrs) between Inventory and Yield tables volumes?

P. 43 10.7.2 Regeneration Delay

Response: Will the 2 year regen delay for planted stands be enough to accommodate projected climate change drought conditions? What have plantation survival rates been over the past 5 years?

P. 44 Sec 10.7 NSR areas

Response: There are several significant areas within the TFL that are NSR. These areas should be fully deducted from the THLB. They are not adequately "addressed in the analysis –etc." as stated in this section.

10.7.4 Genetic Improvement Table 32 Genetic Gain

What accounts for the dramatic gain for larch from Eras 1 and 2 to Eras 3 to future?

10.7.5 Not Satisfactorily Restocked

Response: Anecdotal local knowledge suggests there is older NSR on the TFL. This should be resolved.

P. 46 12.1 Non-Timber Forest Resource Management

Response: what are the non-timber resource objectives mentioned in this section for the TFL?

P. 47 12.2.1 Landscape-level biodiversity

Response: As pointed out in our comment in 8.17 OGMA concepts do not preserve the biological diversity of original Old Growth forests. Old-growth biodiversity values are important values to consider within timber management plans. Once again, we reiterate that we want to see the recommendations in the report BCs Old Growth Forest: A Last Stand For Biodiversity implemented as applicable in TFL 8.

We support the approach referred to below – that old growth must be optimised for its biodiversity value and should be ranked based on unique features rather than solely on age class that may miss important functional attributes.

> "The Ministry of Forests in British Columbia defines old-growth forests solely on Forest Cover age class. There is, however, increasing awareness that age class alone may miss functional attributes of old growth, and may be too coarse and inaccurate a scale for evaluating the biological value of older seral forests. In addition, Forest Cover age classes were found to be accurate in only 53% of stands sampled. In order to optimize the biodiversity retained in old growth management areas, it is important to identify and rank candidate sites based on their distinctive structural features."(p.2 Defining Old Growth Forests In the ICHwk1 BEC Variant in the Nelson Forest Region R.F Holt, D.J. MacKillop, 2002)

> "Policy on landscape unit planning in British Columbia recommends areal targets for the retention of old-growth forest by designating Old Growth Management Areas (OGMAs) within landscape units. The Ministry of Forests defines old-growth forest using forest cover age class. However, there is increasing awareness that age class alone may miss functional attributes of old-growth forests, and may also be too coarse and inaccurate a scale for evaluating the biological value of older seral forests. In order to optimise the biodiversity value (unique habitat features critical for old-growth associated species) retained in OGMAs, it is important to identify and rank candidate OGMAs based on their distinctive structural features." (An index of old-growthness for two BEC variants in the Nelson Forest Region, p1. Rachel F. Holt, T. F. Braumandl, and D. J. Mackillop, 1999.)

P. 49 12.2.4 Mule Deer Winter Range

Response: Local observations and knowledge suggests Mule deer populations have dropped off dramatically in recent years. Until up to date science is applied to this situation full measures known to preserve or enhance Mule deer habitat should be observed. Government must address this gap in current knowledge and until that gap is filled, the precautionary principle must be applied. As we commented above, local hunters have told us that Mule Deer numbers are down due to loss of habitat and food from clear cut logging.

P. 51 12.2.4.2 MDWR Maximum Disturbance

Response: For most of the moderate snow pack areas the planning cells appear maxed out. How will this impact the analyis for these planning units?

12.2.6 BADGER

Response: It clearly states that the GWM for Badger ONLY allow for ecological harvesting to create future stands. Why is a one time harvest within the WHA necessary or allowed?

P. 52 12.2.8. Cutblock Adjacency

Response: Althought numerically the KBHLPO may be satisfied, what about wildlife cover and movement corridors?

12.2.10 WATERSHED HEALTH

Response: Surrogate watershed units by definition means replacing one for another. If Interfor plans to use the watershed units outside of TFL 8 as a surrogate watershed group, can we expect further declines in populations of wildlife, insects and biodiversity? Any further declines are unacceptable.

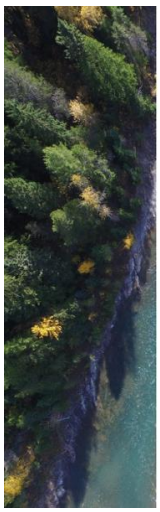
P. 53 12.2.9.1 First Nations Interests Identified During Field Reviews

Response: In the last paragraph "relatively thin buffers" can be adversely impacted by periodic freak winds that happen in the Boundary. Every effort should be made to protect these buffers by making them wide enough to employ feathering on either side to reduce blowdown and destruction of the buffer.

P. 56 12.2.10 Watershed Health

Response: " The level of disturbance in a watershed can impact stream flow, sediment delivery, channel stability, riparian function and aquatic habitat." We appreciate the acknowledgement of this statement but would further add that recent and ongoing research implies you could substitute "the can" for "does". Field observations confirm this for us.

Also, there is an increasing body of research indicating that forest disturbance has impacts on average peak flows and large destructive floods. Most recently, this was a finding from a hydrological model that was designed for the Kettle River watershed. See quote from the study below as well as quotes from other relevant studies regarding flooding and forest disturbance:



MacHydro

Pex Geoscience Consultants Ltd.

The hydrological effect of forest disturbance on the Kettle River Watershed, BC

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Summary

A hydrological model was designed for the Kettle River watershed that incorporated historical land cover and climate data to simulate streamflow for a variety of locations throughout the region. Model parameters were constrained using multiple lines of evidence and the model showed strong performance in reproducing observed streamflow and hydroclimatic processes. These factors indicate that the model is not only accurate, but also has proper process-representation (i.e. is right for the right reasons) and is therefore a reliable tool for investigating the effect of land cover change on streamflow regimes.

The model was used to simulate the hydrologic effect of forest disturbance on streamflow, particularly peak flows, by simulating five land cover change scenarios examining varying levels of forest disturbance at high and low elevations within the Kettle River watershed. Four scenarios increased forest disturbance by 25% and 50% at either high or low elevations. A fifth "No Disturbance" scenario reverted all currently disturbed areas to mature forest. The No Disturbance scenario led to a reduction in both median and extreme peak flows across the watershed relative to current conditions. Conversely, increased forest disturbance scenarios led to an increase in the magnitude of both median and extreme peak flows. Forest disturbance at upper elevations approximately doubled the flood response relative to disturbance at lower elevations. Increasing levels of disturbance displayed non-linear increases in extreme peak flows: where the magnitude of a 100-year peak flow approximately tripled due to a doubling of forest disturbance. These findings emphasize how increasingly large forest disturbances can have substantial impacts on both average peak flows and large, destructive floods. In addition, the location and elevation of the disturbance is an important consideration in determining the amount of hydrologic change experienced, where the hydrologic effects are greater in areas with higher precipitation, particularly at higher elevations.

Although this study has advanced hydrologic modelling in the region, there is substantial opportunity to further develop and apply this tool. The tool can be used to assess site- to watershed-scale hydrologic effects of human and natural disturbance as well as changes in weather and climate. Cumulatively, these factors can be evaluated to help guide landscape-level planning.

1 Introduction

Vegetation can exert strong hydrological control over runoff processes, most notably by intercepting a fraction of incoming precipitation and by providing shade which slows spring snowmelt. These factors have potential to modify the timing and quantity of water delivery from forested systems. While they can affect streamflow throughout the year, vegetation changes can have particularly consequential effects on peak streamflow (Moore and Wondzell, 2005). Changes to the quantity and timing of peak streamflow can alter stream channel morphology and sediment transport characteristics in watersheds, ultimately affecting downstream water users as well as aquatic ecosystem function and structure. In addition, forest disturbance has been shown to increase the likelihood of very large peak flow events (i.e 100-year return periods) which can cause flooding with potential impacts on infrastructure and human life (Schnorbus and Alila 2004).

Forest hydrology research in Alberta and British Columbia has demonstrated that removal of forest vegetation generally increases snow accumulation and melt rates, and consequently increases the magnitude of average and peak streamflow as well as increasing the frequency of floods of a given magnitude originating from forested watersheds (Winkler et al., 2010; Pomeroy

Schnorbus, M., & Alila, Y. (2004). Forest harvesting impacts on the peak flow regime in the Columbia Mountains of southeastern British Columbia: An investigation using long term numerical modeling. Water Resources Research, 40(5).

FEATURE ▷ By John Rex, PhD, P.Ag.

This article is the first in a series of articles on forest hydrology, written by research hydrologists from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development. In future editions of *BC Forest Professional*, the series will cover topics including climate change, hydrologic response to disturbance levels and disturbance location, emerging issues, and technologies such as LiDAR. The information in these articles is presented for forest professionals to incorporate into their work.

Forest Hydrology Issues Associated with Climate Change

Examples from the Interior

Climate change will alter temperature and precipitation regimes, including extreme events, which will in turn influence forest disturbance patterns from wind, fire, water, insects, and pathogens[1]. Government-based applied research aims to support resource management by providing research findings and decision support tools to enhance resiliency of managed watersheds and forests for tomorrow. This article highlights three climate and forest hydrology related issues and the research initiatives to address them. Although the initiatives identified here are northern in focus, the issues are not. Climate change is occurring on a global scale, so I'm asking you to substitute your priority resource values for those presented here in order to think of future watershed conditions where you work.

Spruce Beetle

On the heels of the recent mountain pine beetle (MPB) epidemic, the Omineca Region now faces a spruce beetle outbreak that has refocused the direction and intensity of harvesting activities within regional watersheds. If the outbreak continues, there is opportunity to learn from recent MPB-focused research, which identified that the influence of beetle infestation on hydrologic conditions can be watershed-specific[2] and overshadowed by climatic conditions[3].

Although beetle infestations can alter hydrologic processes, the management response can exaggerate impacts beyond that of the beetle. Consequently, guidelines for watershed planning drafted as part of the Chief Forester's retention guidance[4], emphasize the need to consider non-timber values such as water and aquatic ecosystems when planning harvesting. Example recommendations from the document include:

- Completing watershed assessments at the watershed level rather than areas of operational focus,
- Developing watershed management strategies to maintain non-timber values,
- Harvesting in stages by using a variety of cutting intensities and retention strategies, distributed over the landscape, to desynchronize runoff, and
- Minimizing harvesting in riparian areas.

Climate Change, Stream Temperature, and Bull Trout

Climate change is and will continue to alter temperature and precipitation patterns. In the northern region, air temperatures have increased over the last 100 years, with summer maximums increasing upwards of 1.7 degrees Celsius in some areas[5]. Climate projections to 2055 predict that our mean annual temperature will increase approximately three degrees Celsius. Although much of this warming is projected in winter minimum temperatures, summer maximum temperatures will also increase.

In anticipation of temperature and precipitation change — as well as effects on streams and fish — climate, fisheries, and hydrology researchers in the Omineca Region are working to identify how future climate may influence regional hydrology and fish habitat conditions. Specifically, they are testing the application of a model developed in the Pacific Northwest Region of the United States to predict future stream temperatures as well as using environmental DNA sampling to identify current bull trout habitat areas. Together, this information will be used to identify watersheds capable of providing thermal refugia for bull trout in the future[6]. Bull trout were selected because they are a temperature sensitive species with some life stages requiring temperatures below 10 degrees Celsius.[7] Once the modeling approach has been regionally validated and watersheds capable of providing thermal refuge have been identified, collaborative management solutions can be formulated.

Stand-level Drought Risk Assessment

As a result of changing temperature and precipitation regimes, predicted climatic conditions. Field validation studies at locations within the Prince George District confirmed that sites predicted to have higher risk exhibited higher levels of tree stress. The tool is available online and it provides climate induced mortality projections for the Cranbrook and Prince George TSAs through the 2020, 2050, and 2080 periods.

Forest harvesting has been shown to influence peak flow in snowmelt-dominated watersheds depending upon the climate and physiographic condition of the watershed, as well as the amount and intensity of forest harvesting[8]. Although attention has generally focused on peak flow because of public safety, recent investigations have shown that low flow conditions can also be influenced by development. Work in the headwaters of the Penticton Creek watershed shows that once harvesting extended across 47 per cent of the study basin, there was a significant reduction in water yield during the July and August low flow period[9]. Similarly, stream flow levels in headwater watersheds with immature Douglas fir stands (150-year-old) were found to be less than half that of those with mature stands (>150-years-old)[10] due to higher transpiration of the young forest

tended and forest resilience. Future climate change effects can appear daunting, but it is our responsibility to use the tools and information at our disposal today to manage and plan as best we can for the watersheds and forests of tomorrow. ❖

A climate monitoring station at Alarza Lake. The station is part of the Alarza Lake Project, which is looking at snow accumulation and melt under immature stands as well as harvested and spruce beetle affected inventory.

From: BC Forest Professional, Oct 2018, Author: John Rex, "Forest Hydrology Issues Associated with Climate Change: Examples from the Interior"

UBC Forestry > 2012 > October > **Deforestation in snowy regions causes more floods**

DEFORESTATION IN SNOWY REGIONS CAUSES MORE FLOODS

2 October 2012

AGU Release No. 12-43

For Immediate Release

WASHINGTON—New research suggests that cutting down swaths of forest in snowy regions at least doubles – and potentially quadruples – the number of large floods that occur along the rivers and streams passing through those forests.

For decades, the common perception in hydrology has been that deforestation in such areas made seasonal floods bigger on average, but had little effect on the number of large floods over time, said geoscientist Kim Green of the University of British Columbia. But a new study by Green and her co-author

TITLE: A paradigm shift in understanding and quantifying the effects of forest harvesting on floods in snow environments"

Authors:
Kim Green and Younes Alila:
Department of Forest Resources Management, University of British Columbia, Vancouver, BC, Canada.

Brookside Creek	934	56	0	64
Lower Residual Area	853	76	0	34
BX Creek above BX Ranch	**7,050**	**43**	**20**	**37**

Equivalent Clearcut Area (ECA) Calculation

The Equivalent Clearcut Area (ECA) is calculated as an indicator of possible changes in the watershed's peak flow characteristics in relation to forest harvesting. Scientific literature suggests that the rates of peak streamflow in snow-dominated environments may increase after timber harvesting, as a result of changes to canopy interception and snow accumulation, and increases in the rate of snow melt during the spring (e.g., Jones and Grant[2]). For the BX Creek watershed assessment, ECA is estimated using tree height and block size information contained in the digital forest cover data for the Crown land portion of the watershed, using a number of adjustments:

- Tree heights in the Ministry of Forests' forest cover data were projected to January 1997. For this assessment, tree heights were projected to December 1998 using the MoF's Site Tools program[3]. Tree growth on each harvested block was projected based on dominant tree species inventoried and the block's site index.

From: Watershed Assessment of the BX Creek Community Watershed, MOF, 1999

The Boundary has suffered 3 high level flood seasons since 2017. In Grand Forks in 2018, homes, businesses and infrastructure suffered a degree flood damage not seen in previous decades. Given the increasing number of major floods that have happened at the bottom of the Boundary drainage basin and the economic impact on the local economy, it is imperative that the government and industry proceed with extreme caution; not only to protect property but also to protect lives. As of yet, there is no evidence that the clear cut forestry practices in the Boundary have *not* contributed to the amount of flooding in the past 3 years. Until that evidence is gathered, it is imperative that forestry professionals and the BC government choose to apply the Precautionary Principle to logging practices.

The British Columbia Economic Development Association (BCEDA) was engaged by Community Futures Boundary (CF), with funding provided by the Province of BC's Ministry of Forests, Lands, Natural Resource Operations and Rural Development to produce a report on the economic impact of the 2018 Grand Forks flood on businesses. The report can be found here: https://bfre.ca/wp-content/uploads/BCEDA-Business-Assesments.pdf

The report was published a few months after the flood and at that point the Grand Forks business losses were estimated at $26 million. Forestry is not the only employer in the Boundary.

FLNRORD provided funding for the Economic Disaster Recovery Program to help restore the Grand Forks area economy in the short and longer term after the 2018 flood. As mentioned in the report, there are additional economic losses not accounted for in the report, including from the agricultural sector (P. 3). It is suggested that "the numbers within this report be interpreted as the minimum economic impact on businesses with the actual numbers being much higher." "Of the 125 businesses assessed 92.0 percent will experience an economic loss due to the floods." (P.5).

"Many businesses will continue to experience economic loss. Over two-thirds (67 percent) of businesses surveyed state they will have further economic loss in subsequent years as a result of the flood. For those businesses that could provide the value of future economic loss, approximately $12.5 million in additional economic loss was reported."" When combined with losses already reported total economic loss due to the flooding is $38,689,665 for those businesses who were able to provide the data."(p.5)

Other financial impacts of the flooding include the monies paid out by Disaster Financial Assistance (millions?), the Red Cross, and the $53 million flood infrastructure project being undertaken by the City of Grand Forks. Not to mention the financial and emotional suffering of the 89 homeowners whose homes are being removed to make way for this infrastructure.

The truth is that the full economic impact of the 2018 flood is unknown. The $53 million flood infrastructure project will not be completed for years. Meanwhile, in 2020 Grand Forks experienced another flood that damaged numerous homes. How much economic devastation is being and will be caused by clear cut logging in the Boundary watershed (including TFL 8)?

Unless someone can accurately answer that question, the application of the Precautionary Principle is essential in all future logging in the Boundary.

The impacts of forestry practices must be viewed with the entire picture of the region in mind, including impacts on the economy as a whole and the people who have homes and own businesses there. Again, forestry is not the only employer in Grand Forks and the Boundary.

Increasing severity and occurrence of floods are to be expected as stated in Preliminary Strategic Climate Risk Assessment for BC:
https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/prelim-strat-climate-risk-assessment.pdf

Pg 56: Sec 12.2.11 Road Access

Response: The statements made in this section are very vague. How are the GAR orders for mule deer and grizzly bear relative to roads dealt with operationally by Interfor? An explanation is required.

Relative to roads in general: As is stated in this paper, TFL 8 has a *"…permanent road network that is very well developed, with most of the TFL in close proximity to an existing road."*

Why then are more permanent roads involving an area of 587 hectares even needed? It would seem beneficial to both Interfor and all other resource values to keep the amount of permanent roads in the TFL to a minimum. This would retain a sizable area of the THLB in production and hence alleviate reductions to the AAC. It would also make significant environmental and economic sense for all concerned. It would also reduce Interfor's costs and liability concerns involved in retaining and maintaining an unnecessarily large area of permanent roads.

Concerning main access roads, the entire Boundary area already has a crap tonne of roads (over 16,000 kilometers) and more are not necessary as they have a very high environmental impact.

We suggest that Interfor adopt a zero net new roads policy throughout their operating area. Adoption and implementation of such a policy would be a very wise decision that would greatly benefit not only Interfor but all other resource values. All forest tenure holders in the Boundary, especially Interfor and BCTS as they are the largest tenure holders should adopt such a policy.

P.59 12.3.3 Siliviculture systems

Response: It is disappointing to read that "clear cut harvesting with reserves is the only silviculture system that will be modelled." As science has been sugggesting, forests have a major role in the future habitation of the planet. One would think that a major international timber company like Interfor would be at the forefront of this global dilemma by using some alternative systems to clearcutting. We urge you to reconsider this decision and incorporate some partial cut systems.

Interfor has implemented significant areas of partial cut systems on the TFL over the past few years. Also, there are many areas that lend themselves to partial cutting and for ecological as well as long term economic reasons, Interfor should use partial cutting systems on a wider basis. Assuming and modeling the AAC on one silvicultural system i.e. clearcutting, while quite simple, does not reflect what actually occurs on the ground.

Another key question we have is: How many more years will Interfor be clear cutting in TFL #8? 3, 5, 10? The answer to this question is relevant to all of the planning for this TFL and to the methods being used in cutting. If Interfor plans on taking as much as possible now only to leave in 3 years, it would make sense for their bottome line to use only clear cutting methods. However, if Interfor is going to be part of this community for the long term, selective logging methods make more sense economically.

Also, excessive clearcut areas throughout the Boundary area greatly increase the risk of excessively high peak flows during the spring freshet such as occurred during the spring of 2018. The peak flows that spring caused disastrous floods which, as noted above, resulted in millions of dollars of damage with many associated negative consequences experienced by hundreds of local residents. These consequences were life-changing and long-lasting with many restorative measures yet required to mitigate the damage and protect the downstream resources from future damage.

Significant areas located on south aspects that have been clearcut have become permanent NSR areas; this is due to increased drying, lack of shade and generally the development of areas inhospitable to and for young seedlings. Yet similar areas that have been selectively logged have regenerated very well via natural regeneration. The proliferation of these NSR areas is easily avoided by use of the selective/partial-cut systems and Intefor and the ecosystem services provided by the retained trees would profit by harvesting these areas via the application of a partial cutting system.

P. 60 & 61 Sec 12.4 and 12.5 Natural Disturbance Assumptions and Climate Change:

Under Sec. 12.4 only fire and insect infestations are mentioned. However, abnormal wind, drought and disease events are significantly current and ongoing events that are on the increase due to the overall effects of climate change. A sizeable reduction in the AAC should

be made to allow for these losses----most of which have been and are likely to remain as unsalvageable losses. This is mainly due to the scattered nature of these losses.

The rationale for determining the annually disturbed area is outdated as it uses data and information that is far too old. The use of outdated information is unacceptable and irresponsible. Also the statement that indicates Interfor's approach to account for future expected losses i.e. that "Any future changes in these losses will be captured as part of the next timber supply review which will be completed ten years from now" is unacceptable.

Future climate events will be much more severe and occur more frequently than they ever have. To discount this fact by stating that relatively distant adjustments to the AAC (i.e. 10+ years from now) will be an adequate measure or modus operandi to deal with these events is neither responsible, appropriate, or acceptable to the people of BC or the Boundary.

The precautionary principle, via a reasonable, immediate` reduction in the AAC. E.G. at least 5% to 10% should be used to account for these expected events and associated losses. We cannot prevent or mitigate such losses by waiting for them to happen and then deal with them afterwards.

P. 61 12.5 Climate change

Response: The examples of adaption strategies for resilient forests seem rudimentary. Planting mixed species has been around a long time. Tighter control over micro sites and planting weather windows might add to better survival rates. Surely some research and trials are happening in this field and the results can be applied.

It is incumbent upon forestry professionals to stay abreast of studies that are being conducted both locally and internationally in regards to climate change, hydrology, and silviculture. The same methods that have been applied for decades can no longer be used unless there is a high degree of certainty that they are appropriate to climate change conditions and also not doing damage to the ecosystem structure, function, and composition.

The Cumulative Effects Study for the Boundary also has yet to be published. Its results must also be taken into consideration when making decisions regarding TFL #8.

<u>Statement:</u> 13.2 GROWTH AND YIELD ASSUMPTIONS and Yield Tables for existing Natural Stands and for Managed Stands.

Response: The assumptions and volumes shown in these tables appear to be too high especially for the Managed Stands being based on future predictions and hence unknown information.

The Precautionary Principle should be included throughout the plan.

Table 47 Minimum harvest ages for existing natural and existing managed stands

Response: All minimum except for those within the ESSF areas, should be at least 80 years of age. Harvesting younger stands adds to the risk of overcutting. .

P. 63 Sec. 13.3.4 Equivalent Clearcut Area

Response: Consideration and appropriate use of the information included in the recent Kettle River Technical and Hydrological reports should be made relative to the amounts of ECA in the KR watershed and their potential effects on the timing and peak flows in the Kettle River system.

Appendix 1 Yield Tables: Much of the information cited is out of date and how it is used in the development of the tables is not stated. A detailed explanation of how the data was used is necessary.

A review of the tables indicate volume levels that are too high. Please explain in more detail how these volumes were derived. For example, what ground samples were used and when were these samples taken and what was the sampling intensity and coefficients of variation, etc.

Appendix 2 p. 192: Unsalvaged Losses:

4th bullet: We know that drought has been and will continue to be a present and increasing problem. See the Preliminary Strategic Climate Risk Assessment for BC: https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/prelim-strat-climate-risk-assessment.pdf

Interfor cannot ignore the expected losses due to drought with statements like "drought experienced in 2018 was not felt to be representative of ongoing losses". There is no rationale or basis on which to discount the need for any adjustments in the AAC due to losses caused by drought because they are "not felt to be representative of ongoing losses."

The losses will most likely be much higher. Weather will not repeat itself in the same patterns as in the past. The above-noted study indicates that BC will experience more drought, more often, and it will be more sever.

As noted above, a 5-10% reduction should be made in the AAC to at least partially account for the expected losses before they occur. There is no way they can be appropriately dealt with afterwards.

Also, any decisions regarding this TFL should wait until the Cumulative Effects Study for the Boundary is released. Conditions in the watershed have changed substantially in the past few years, as evidenced by the increased degree of flooding since 2017.

Disturbance through industrial management can lead to cumulative effects that push ecosystems beyond their natural capacity — so they no longer provide the range or amount of values and services they did previously. Is there proof that the amount of logging in TFL#8 has not pushed the ecosystem there beyond its natural capacity to manage water? If not, then the rate and the amount of logging must be decreased immediately. Since the level of risk of losing ecological function increase with more logging disturbance, it makes sense to decrease the logging disturbance. How much more disturbance can the ecosystem withstand before it becomes less resilient? Is this known? How much functional value do the forests in TFL #8 current provide? It is necessary to present a more detailed examination of the data for old forests in TFL#8.

COMMENTS REGARDING ECA, LiDAR, VRI, Methodology, etc

Relying on old calculations, equations, and methodologies for figuring out where to harvest, how much to harvest, and when to harvest is no longer supportable in the era of climate change and with the unprecedented amount of flooding impacting Grand Forks. Licencees must manage the resources in a more responsible and beneficial way for the people instead of to make more profits. That includes changing the methods that are used for choosing where to harvest, when to harvest, and how much to harvest.

Here are some of our specific concerns about methodology:

Why is Interfor using inferior VRI stand height data to calculate the ECA and adjacency rules for new blocks when they should be using the LiDAR instead?

Interfor in their information package for TFL-8 only models the adjacency requirements aspatially; likely because using actual spatial data would reduce their options of harvesting next to too many stands hence automatically reducing the AAC. This concerns us.

Interfor states in their TSR that they will do an ECA using “third order watersheds” that intersect the TFL and their adjacent harvest/height information to inform their ECA analysis. They should be using 1:20,000 “Assessment Units” from the Freshwater Atlas of BC.

The concern about this is that a) the third-order watersheds are out-of-date and 2) why is Interfor not using the LiDAR information that they paid for? Is it because LiDAR is showing that the stand heights are significantly lower than reported in VRI (which most often uses a growth model, rather than photo interpretation)? This question must be answered in detail or it looks suspicious.

If the entire Boundary (if not the Kettle) has LiDAR data, what is the reason that Interfor isn’t doing an analysis with it instead of VRI?

What formula did Interfor use for their TFL to come up with their ECA numbers?

If it is possible that in LiDAR data the trend is for lower heights in harvested areas than in VRI data this must be examined. We would like to see the differences in the data.

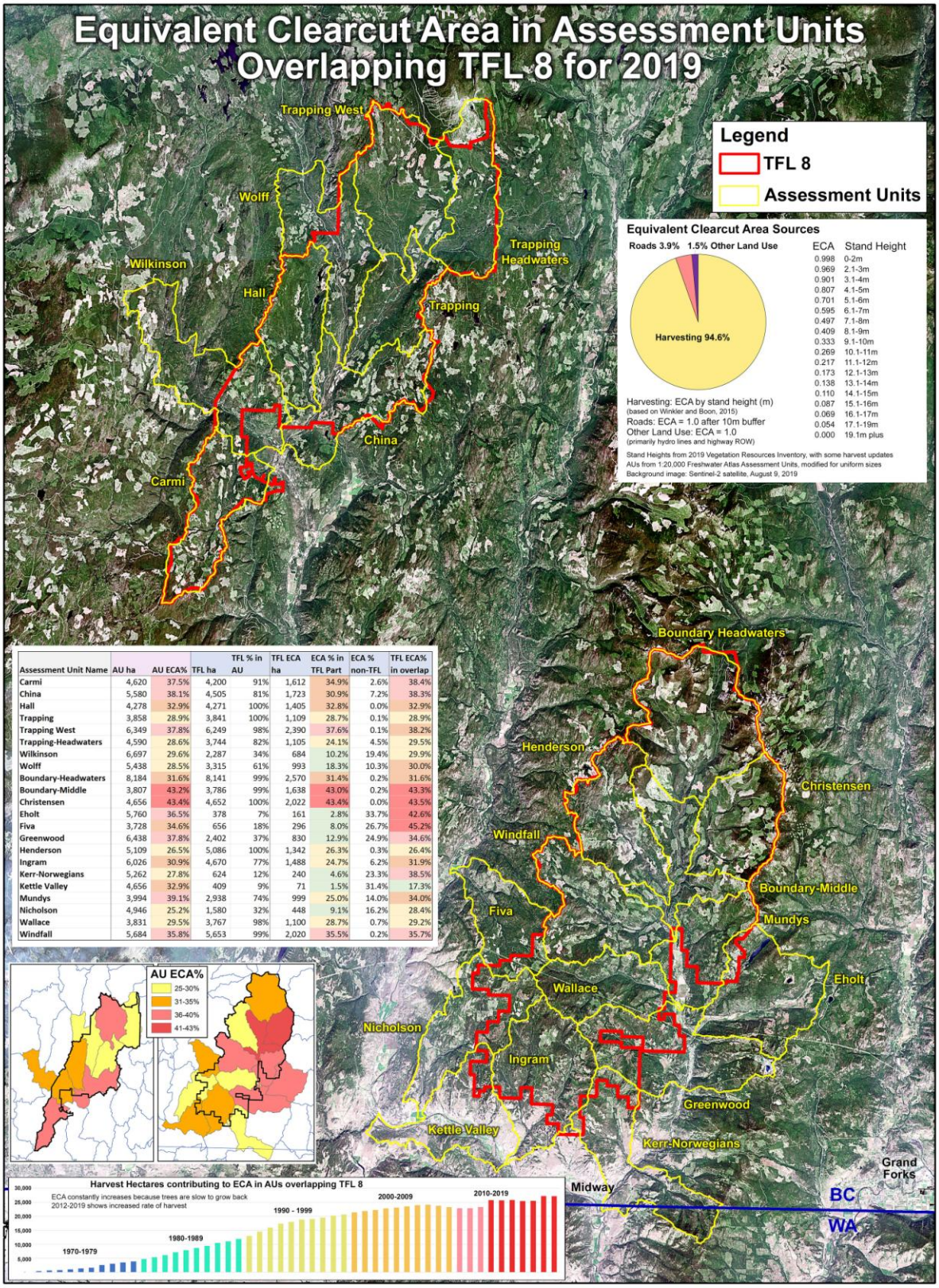
Isn't Interfor professionally and ethically bound to use the best information available to them? They should use the best inventory information available to them (i.e. LIDAR) as appropriate in determining a new AAC for their TFL.

The map below displays our concerns (it is also attached as a higher version PDF. This map is part of a BFWSS project. Publishing date TBD):

All of the AUs related to the TFL are > 25% ECA. This is a problem. Almost 2/3 of the AUs have an ECA > 30% which is a serious concern The average ECA of the 9 AUs that lie completely (98%-100%) within TFL8 is 34% (not shown).

For those AUs that partially overlap the TFL, the ECA portion percentage contributed by the TFL is the second coloured column and the ECA percentage of just the overlapping portion is in the third coloured column. So, for example, Greenwood AU has a very high ECA of 37.8%, only overlaps the TFL by 37%. Therefore, only 12.9% of the ECA hectares in the AU came from the TFL portion. In the area where they overlap however, the ECA% is 34.6%.

ECA's are calculated for watersheds, or watershed units in this case, and not for chunks of land like a TFL. However, if one were to treat the TFL as an Assessment Unit and ignore the area outside, then it's own ECA would be 34%.



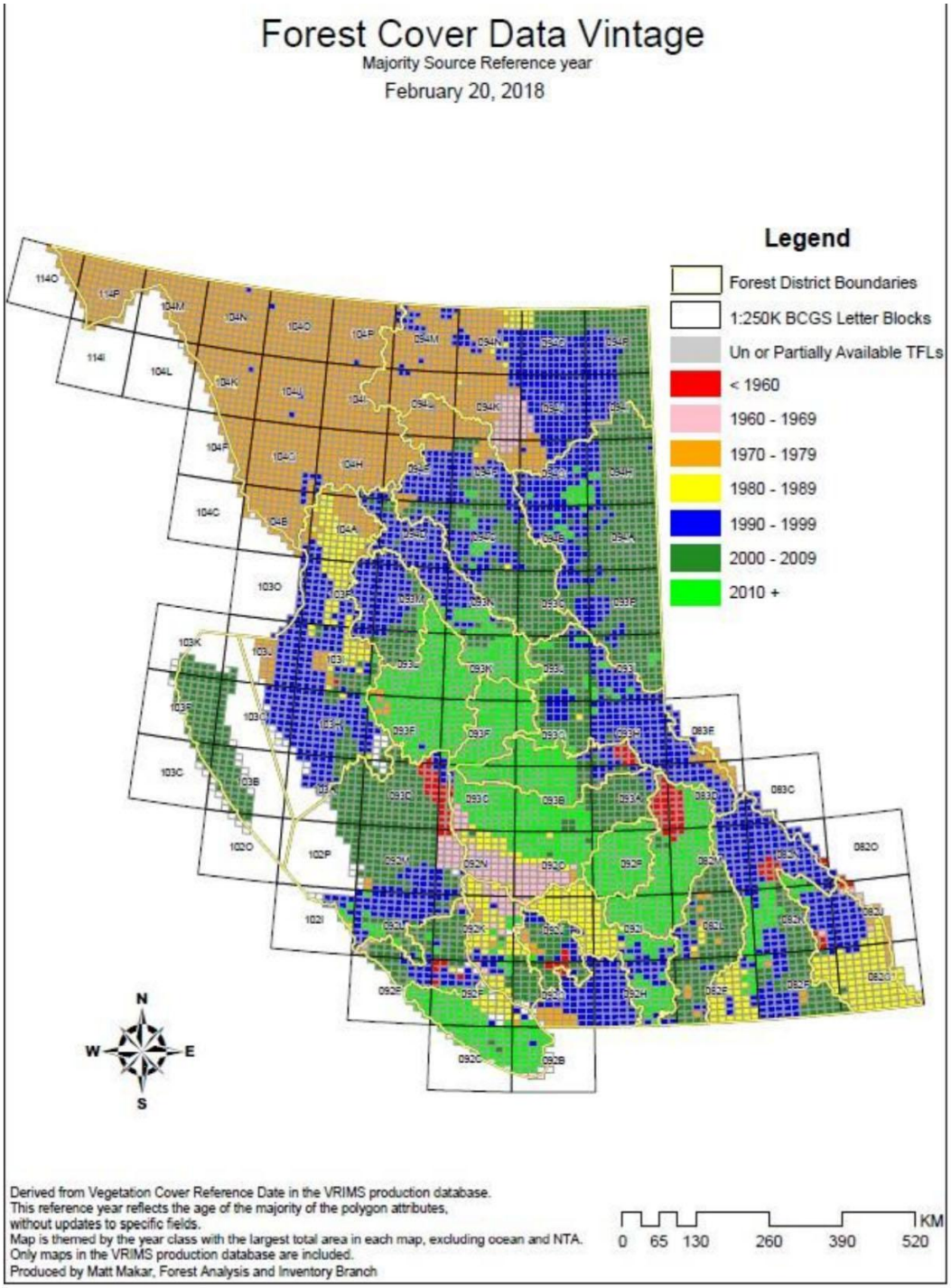
Assessment Unit Name	AU ha	AU ECA%	TFL ha	TFL % in AU	TFL ECA ha	ECA % in TFL Part	ECA % non-TFL	TFL ECA% in overlap
Carmi	4,620	37.5%	4,200	91%	1,612	34.9%	2.6%	38.4%
China	5,580	38.1%	4,505	81%	1,723	30.9%	7.2%	38.3%
Hall	4,278	32.9%	4,271	100%	1,405	32.8%	0.0%	32.9%
Trapping	3,858	28.9%	3,841	100%	1,109	28.7%	0.1%	28.9%
Trapping West	6,349	37.8%	6,249	98%	2,390	37.6%	0.1%	38.2%
Trapping-Headwaters	4,590	28.6%	3,744	82%	1,105	24.1%	4.5%	29.5%
Wilkinson	6,697	29.6%	2,287	34%	684	10.2%	19.4%	29.9%
Wolff	5,438	28.5%	3,315	61%	993	18.3%	10.3%	30.0%
Boundary-Headwaters	8,184	31.6%	8,141	99%	2,570	31.4%	0.2%	31.6%
Boundary-Middle	3,807	43.2%	3,786	99%	1,638	43.0%	0.2%	43.3%
Christensen	4,656	43.4%	4,652	100%	2,022	43.4%	0.0%	43.5%
Eholt	5,760	36.5%	378	7%	161	2.8%	33.7%	42.6%
Fiva	3,728	34.6%	656	18%	296	8.0%	26.7%	45.2%
Greenwood	6,438	37.8%	2,402	37%	830	12.9%	24.9%	34.6%
Henderson	5,109	26.5%	5,086	100%	1,342	26.3%	0.3%	26.4%
Ingram	6,026	30.9%	4,670	77%	1,488	24.7%	6.2%	31.9%
Kerr-Norwegians	5,262	27.8%	624	12%	240	4.6%	23.3%	38.5%
Kettle Valley	4,656	32.9%	409	9%	71	1.5%	31.4%	17.3%
Mundys	3,994	39.1%	2,938	74%	999	25.0%	14.0%	34.0%
Nicholson	4,946	25.2%	1,580	32%	448	9.1%	16.2%	28.4%
Wallace	3,831	29.5%	3,767	98%	1,100	28.7%	0.7%	29.2%
Windfall	5,684	35.8%	5,653	99%	2,020	35.5%	0.2%	35.7%

The use of LiDAR in the Peachland ECA analysis as an example of best practices. Here is a link to the report and appendices.

https://www.dropbox.com/s/29wxw7rx8hqxzjn/Peach.zip?dl=0

“Determined current rates of hydrologic recovery based on tree height data that was generated from LiDAR data for the entire watershed” page 9/116 of pdf (23 on paper). Citation = “Watershed Assessment of Proposed Forest Development within the Peachland Creek Community Watershed, Scherer, R., 2018”

The VRI for the Boundary area is one of the oldest vintages in the province. This has resulted in a large number of harvested stands that have ages older than the date of harvest, meaning that the stand heights are incorrect. We are attaching a report analyzing the VRI data for the province. As the jpeg shows, the Boundary is in yellow, meaning it is vintage 1980-1989. Not good.



ure 4.2 BC Forest Inventory dates of last inventory (i.e., Reference Date).

low lines indicate Timber Supply Areas (Source: Presentation by FAIB Staff to the Blue bon Panel, April, 2018; yellow lines delineate Timber Supply Areas). NOTE: VRI

We submit these questions and comments respectfully and look forward to the response.

Yours truly,

Jennifer Houghton, President

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