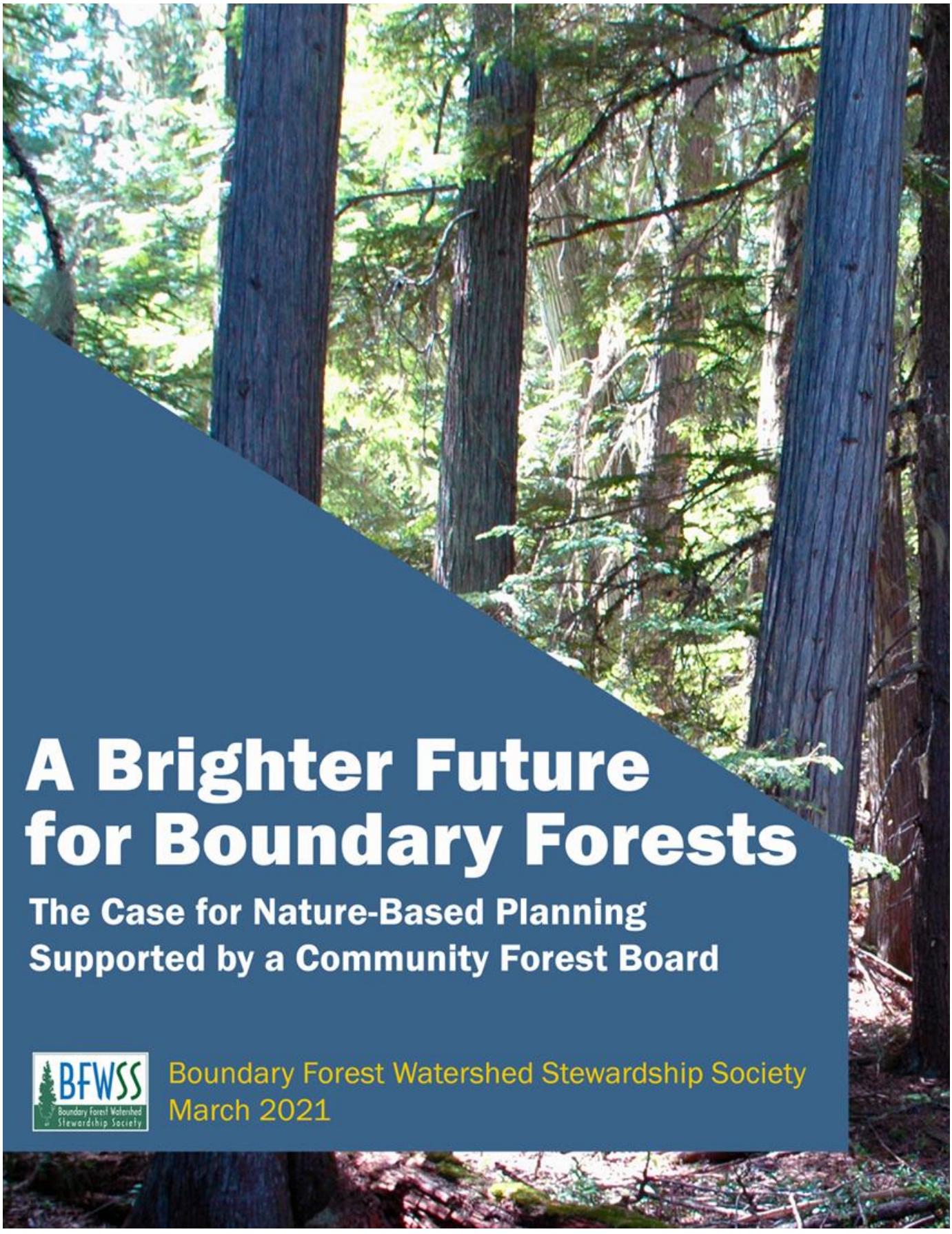

A Brighter Future for Boundary Forests

The Case for Nature-Based Planning Supported by a Community Forest Board

Boundary Forest Watershed Stewardship Society

March 2021

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FOREWORD

Sustainability is a journey, not a destination. This journey began for the Boundary Forest Watershed Stewardship Society during the summer of 2020 when members of their organization shared their knowledge about the condition of their forest. Their 2020 field reconnaissance of the forests in the Granby, West Kettle, and Kettle River watersheds will be published separately.

This thorough "Brighter Future for Boundary Forests" citizen's report will be of interest to all British Columbians. In our vast public forests, we all live with the same top-down forest legislation, policies and practices, and their outcomes. Good decisions about forest policy choices require valid information about forest conditions as well as the economic, ecological, social, and cultural consequences of various management practices.

This information will inform two fundamental questions:

- What values do people of the Boundary want sustained from their forests?
- Once decided, what are the most effective forest practices to sustain these values?

The report answers three questions:

- What is happening now?
- What possibilities do we face?
- What are we going to do about it?

Especially in a time of climate change and COVID-19 the one thing known for sure is the future will be full of surprises and departures from the past.

Therefore, BC forestry must think, plan, and act differently to meet needs.

The top priority is to maintain and restore the forest to a condition where it can perpetuate a range of forest values.

Four principles will guide the reader of this report:

- To reduce risk, add value, and maintain options for society, the future forest must be built and created by decisions being made today;
- Much of the future forest has already been shaped because of the inevitable consequences of roads, clearcut logging, and planting that have already occurred;
- Change will be normal in the future;
- We must stop doing what is not working and incrementally improve what is.

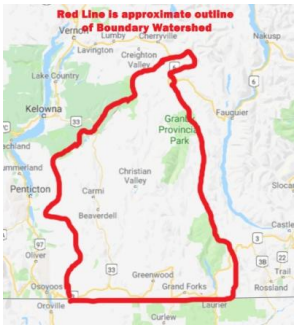
Ray Travers, RPF (Ret.)

EXECUTIVE SUMMARY

This report points out what is wrong in the Boundary forests, how the current forestry system is negatively impacting our watershed and the people living in it, and proposes a brighter future for both.[1]

The long-term solution we are proposing is a shift to the new paradigm of true sustainability: Nature-Based Forestry that is managed by Community Forest Boards.

We also present Recommended Actions that the BC government can implement immediately under the current system to make forestry practices more ecologically, economically, and socially responsible.



The watershed area covered in the report.

The Outdated Paradigm

The current paradigm (world view) of forestry management in the Boundary watershed[2] is out-dated, unsustainable, and highly flawed:

- the economic value of our forests is diminishing
- ecosystem integrity and resilience are diminishing
- plant and animal species are facing local extinction
- ancient forests are being lost
- local people are being negatively impacted by forestry practices
- we are losing our protection from climate change
- jobs are in decline

In order to have a healthy, functioning watershed, the forests must be intact. Tree plantations are not forests. They do not have the same structure, composition, and function as intact forests. The number one cause of the loss of intact forests in the Boundary is industrial clearcut forestry.

In this out-dated paradigm, the corporate narrative remains the primary influencer of policy. Because corporations are left to monitor themselves and make short-term profit their primary objective in the watershed, all other benefits (ecological, economic, social) continue to weaken and deteriorate.

[1] Our second report, the *Field Report*, shares examples of what is happening on the ground and makes site specific recommendations for improving forestry practices.

[2] Also known as the Kettle River Watershed – it includes the drainages of the Kettle and Granby Rivers.

The New Paradigm

The primary objective of forest management should be to maintain the ecological integrity of the forest ecosystem. Biodiversity and productivity are the source of what we value.

The achievement of truly sustainable forestry encompasses four essential elements:

1. Keeping and linking all the parts (ecological and social)
2. Understanding nature's patterns and processes
3. Using a long-term planning horizon
4. Public involvement to maintain community standards

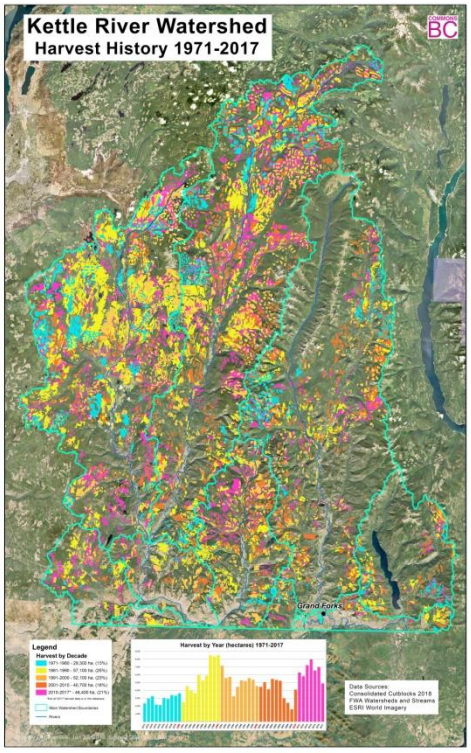
Rather than eliminating jobs, a shift to the new paradigm of true sustainability (Nature-Based Forestry that is managed by Community Forest Boards) merely changes the outcomes of forestry jobs. It also makes them more meaningful.

Under the new paradigm, employment benefits are driven by a number of factors, including allowing more small- to medium-sized operators access to public timber (eliminating regional monopolies), an increase in the number of public and private sector jobs in planning, monitoring, and research, decentralizing forest management, enabling a competitive, open marketplace, and maintaining a supply of good quality wood that can be accessed by small-businesses to manufacture value-added wood products.

Comparison of forest management paradigms		
Feature	Out-dated Paradigm	New Paradigm
Paradigm	Industrial	Nature/ecosystem, community
Dominant value	Timber supply	Ecological values (nature's needs)
Policy influencer	Private interests	Public interest/citizens
Business model	Large corporations	Small and Medium Sized Businesses
Market	Monopolistic	Competitive, open market
Objective	Uninterrupted timber supply	Ecological integrity and resilience
Objective	Corporate profits	Stable community economies
Outcome	High volume of production	High value of products
Products	Raw logs, dimension lumber	Value-added products
Decision-making	Centralized	Decentralized – community-based
Planning method	Timber-volume based	Base planning on nature's needs and community needs
Silviculture focus	Tree farms	Biodiverse species, conserve old and mature forests
Logging method	Clearcut/ remove all the pieces	Selection logging (constrained by nature's limits)

Summary of the Costs of Industrial Clearcut Forestry in the Boundary

1. There is evidence that the information used to determine the AAC for the Boundary TSA could have been miscalculated. This means that the logging over the past 6 years may have been higher than even what the BC government has determined as 'sustainable'.



Clearcut blocks in the Boundary watershed. Map courtesy David Leversee.

2. A huge percentage of the watershed has been clearcut. Numerous cutblocks in the Boundary watershed are hundreds of hectares in size. Clearcutting adds stress to nature in many ways, including increasing peak spring flows, negatively impacting wildlife, reducing biodiversity.

3. In May of 2018 Grand Forks was hit by the most catastrophic flood BC has ever experienced and the Boundary has suffered three higher than average level flood seasons since 2017. Damages and costs were well over $150,000,000. The connections between flooding and clearcut forestry are well established - large forest disturbance increases average peak flows and the probability of large, destructive floods. Government studies are finding that streams in the Boundary are not 'functioning properly'.

4. Climate change predictions in the Boundary include increased magnitude and frequency of flooding, an increase in fire frequency, increased drought, increased extinction threat, increased tree mortality, and the possibility of current 50-year floods becoming 5-year events. Massive losses of intact forests are exacerbating these consequences.

5. The 16,000 km of forest roads in the Boundary are wreaking havoc on ecosystems including the devastating consequences of high forest road density on grizzly bear populations and the ways that roads are negatively impacting streams and aquatic organisms (increased sediment and turbidity).

6. Species at risk in the Kootenay-Boundary include 158 red and blue-listed animal species and 84 red and blue listed plant species. Clearcut logging poses threats to wildlife due to fragmentation of habitat, reductions in food sources, and habitat loss which increases extinction threat.

7. Old growth in the Boundary is becoming increasingly rare and is threatened. Old Growth Management Areas (OGMA) are where old growth is supposed to be protected, but licensees are addressing legal old forest retention requirements with *young and mature* forests instead of old forests. Lack of monitoring of old growth retention by the BC government is a problem.

Summary of Recommended Actions to Undertake Immediately

1. The Boundary TSA AAC must be immediately reduced by at least 30% to bring it to what the province considers to be a 'sustainable' level.
2. Mandate baseline hydrological assessments in all watersheds before any new logging can take place. Assessments must determine if logging has contributed to increases in the frequency, duration and magnitude of peak flows +sediment transport, and how it may contribute to further severe flooding events. If so, pause or decrease logging accordingly.
3. It is a public sector function to ensure that climate change is factored into the management of public forests. It must not be an optional practice that is merely recommended to professionals. Practices reflective of climate change impacts must be legally mandated by forestry legislation and policy.
4. Lack of full scientific certainty about the potential effects of climate change on Boundary forests require the immediate application of the precautionary principle in every aspect of forestry, including determination of the AAC.
5. Stop logging within 100m of riparian zones (due to the risk of drought and the importance of water).
6. Slash piles – cease the practice of burning slash piles. Instead of creating slash piles, leave the logging debris distributed across logging sites.
7. Build or re-build roads to the proper specifications before any hauling commences.
8. Maintain ditches and culverts, deactivate roads, and restore natural drainage patterns as soon as possible after logging has ceased.
9. Government immediately implement and enforce all of the recommendations from the 2017 Forest Practices Board report regarding roads and grizzlies in the Kettle-Granby.
10. Adjust road density guidelines so they are legally binding requirements (rather than recommendations) and place grizzly and other wildlife needs as the top priority for determining road density requirements.
11. Adopt a no-net-new roads policy and strictly enforce it.
12. Legislate a system for government authority regarding enforcement and non-compliance around road building, road maintenance, road deactivation, and road rehabilitation.
13. Fund adequate staff in the Boundary watershed to monitor and address road maintenance at the operational level (boots-on-the-ground), monitor old growth, monitor grizzly populations.
14. Immediately implement the grizzly bear management plan in the Boundary watershed.
15. Take immediate action to reduce the road density to a limit of 0.4 km/km2 in the area of concern for grizzlies (as indicated on the map in the report). Make this a legally binding requirement.
16. Direct the Chief Forester to set the AAC at a level necessary to conserve biodiversity, sustain ecosystem function, and support viable grizzly bear populations.
17. Immediately create a Species-at-Risk Act for British Columbia.
18. Legally implement 100% protection of all old growth in the Boundary watershed. Retain all trees and pockets of trees greater than 140 years old, including an *immediate* response to ecosystems at very high risk of irreversible biodiversity loss.
19. Do not allow logging in Old Growth Management Areas (OGMAs).

Summary of New Path Forward (Truly Sustainable Forestry)

Using the new paradigm as a foundation, we propose the way to achieve truly sustainable forestry in the Boundary watershed is two-fold:

1. To implement **Nature-Based Planning** (NBP) across the land base

2. Install **Community Forest Boards** (CFB)that implement and manage Nature-Based Planning (assisted by public sector staff who are educated and informed in Nature-Based Planning, natural sciences, biology, ecology, and eco-forestry).

The goal of Nature-Based Planning is to manage human activities in forests so we can continue to receive their benefits without degrading the productivity and values of the natural forest. Working with nature's patterns and processes, we do not attempt to control nature. The outcome is to maintain ecological integrity by practicing ecological forestry. Knowledge of science will inform the diagnosis and prescription of how best to maintain ecological integrity. CFBs are composed of local people, give undivided loyalty to citizens, follow NPB, prioritize community economies.

To make this positive change possible, the Province must enable it either through new legislation or a pilot project in our region supported and funded by the provincial government.

New Forest Legislation is Required

What is needed to protect the people, the wildlife, and the ecosystems of the Boundary watershed, is a major intervention and change of direction by the government of BC.

An immediate change of forestry legislation is required so that forest decisions are based on ecosystem and conservation science, not politics or corporate profits.

A new Forest Act must be created. The new Forest Act must enshrine in law the new concept of sustainability that puts ecosystem integrity and resilience above all else. It must base forestry management on local administration, create open access to timber, provide undivided loyalty to the people of BC, and focus on local economic well-being.

Models already exist for making changes to provincial legislation. All it will take is the political will and brave leaders to make it happen.

The members of BFWSS are citizens of BC telling the government in no uncertain terms what we want for our community's survival. Respectfully, we ask our readers to do the same. What is at stake is too important to do otherwise.

This report is part of an ongoing search for insight, foresight, and wisdom, led by well-informed and committed citizens.

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INTRODUCTION

A quick look at BC government websites is all it takes to see that it is a widely accepted belief among government managers that the BC forest industry is sustainable. However, there is plenty of evidence that not only is the BC forest industry not sustainable, but it is also causing extensive damage to BC ecosystems, crippling rural communities, permanently closing mills and slashing jobs. Whether forest managers admit it or not, the system is defined by corporate financial statements rather than sound science, long-term decision-making, and community well-being.

The current paradigm (world view) of forestry management in the Boundary watershed[3] is highly flawed:

- the economic value of our forests is diminishing
- ecosystem integrity and resilience are diminishing
- plant and animal species are facing local extinction
- ancient forests are being lost
- local people are being negatively impacted by forestry practices
- we are losing our protection from climate change
- jobs are in decline

And yet, over the past year, forestry companies have reported record profits. Lumber prices broke records in September 2020 and again in February 2021, inching towards US$1,000 per board foot for the first time (Bennett, 2021).

In this report, we look at what is wrong in the Boundary forests, how the current system is negatively impacting our watershed, and propose a brighter future for our forested watershed. Our second report, the *Field Report*, shares examples of what is happening on the ground and makes site specific recommendations for improving forestry practices.

The vision statement in the Kettle River Watershed Management Plan (created by the Regional District of Kootenay Boundary (RDKB)) is:

[3] In this report we will use the term Boundary or Boundary watershed to refer to the watershed that includes the Kettle River and Granby River drainages. Quite often the term *Kettle River watershed* is used to refer to this area. However, we are using the term Boundary to make it clear that the Granby River drainage is included too. Boundary is a term used by locals to describe the geographic region. See Figure 1 for map of area.

'Reliable, quality water and healthy ecosystems are vital to the well-being of our communities, for quality of life and economic sustainability. Residents and visitors in the Kettle River Watershed have expressed their sense of stewardship of the Kettle River and its tributaries, and clearly wish to maintain and enhance the functions and values of a healthy watershed. Therefore, we envision a healthy, resilient and sustainable Kettle River Watershed, which functions to meet the needs and values of its communities, who in turn act as stewards of the watershed." (RDKB, 2014)

In order to have an ecologically healthy, properly functioning watershed, the forests must be intact. Tree plantations are not forests. They do not have the same structure, composition, or function as natural, aka intact or primary, forests. Protecting and restoring intact forests throughout the watershed must therefore be the top priority of watershed stewardship. The number one cause of the loss of intact/primary forests in the Boundary is industrial clearcut forestry. Clearcut forestry is the elephant in the room that must be addressed by our community.

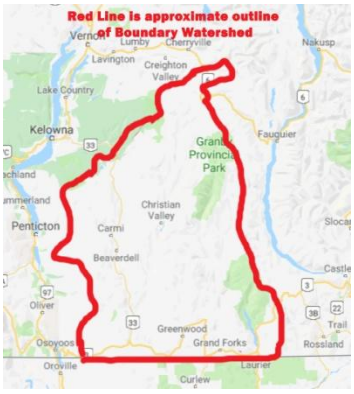
While the costs of industrial clearcut forestry are rarely explored from a community perspective, this is where the solutions will be found. The closer to the people, the better forestry will be. In this report we present the benefits of a new forestry paradigm that is implemented through Nature-Based Planning and Community Forest Boards.

The solution to creating truly sustainable forest management in BC is to focus on the outcomes that people want: ecological integrity, diverse productive forests, high quality of life, and meaningful, long-term, local jobs.

Climate change is upon us in the Boundary. In the face of an uncertain future, we need intact forests more than ever. We need to take effective action (not untested action) to achieve these desired outcomes. Vision, courageous leadership, and immediate implementation of the solutions laid out in this report are required to avoid irreversible damage.

Scientists have been saying this for decades. Now the global youth, whose future we are talking about, are demanding these outcomes as well.

We are the people who live here. We are saying it too.



Description of Our Organization

Based in Grand Forks, British Columbia, Canada, we are a non-profit, grassroots, citizen's society advocating for culturally,

economically, and ecologically sustainable forest practices in the watershed of the Boundary Area in the southern interior of BC.

Figure 1 Red line is the outline of the Boundary watershed also known as the Kettle River watershed.

As a consequence of current management practices and climate change, our forests are in crisis and as a result there are predictable negative cumulative effects to the humans, eco-systems, and wildlife of our region.

We recognize the situation is urgent and are working to restore the essential ecological patterns and processes of nature that sustain life.

The people who contributed to this report come from varied backgrounds: logging, Ministry of Forests, rural land owners, people impacted by the regional floods, environmentalists, and those who practice permaculture. In writing this report, we all worked together for a common cause. This report also is based on the best available information from science.

A Description of the Environmental Problem in the Boundary Watershed

The small city of Grand Forks is situated at the outlet of the watershed drainage basin. In 2018, the city sustained catastrophic flood damage to 400 homes, 30 businesses, and numerous farms. Experts have pointed out a connection between the increased flooding of recent years, the forest practices in our watershed, the unhealthy state of our local ecosystem, and climate change.

The composition, function, and structure of our watershed has been severely and negatively impacted by industrial forest practices.

Despite the fact that a large percentage of the land base is publicly owned, policy and operational decisions about the forests are made by timber companies who are motivated primarily by profit considerations for their owners. Ecosystem values are not adequately taken into account and there is no effective citizen voice.

The list of problems resulting from the current system is long and encompasses numerous economic, social, and environmental costs. Many are discussed in this report.

Our Goals for Addressing the Problem

- Restore and maintain ecological integrity in our forests and watershed by implementing Nature-Based Planning.

- Create a governance framework for management of the Boundary forests and watershed by citizen boards guided by ecosystem science
- Protect:
    - Our homes from future flooding and wildfires
    - Our farms and water supply from the effects of drought
    - Fish and wildlife habitat and their populations
- Mitigate the effects of climate change on our forests, wildlife, towns, farms, water supply, and local economy.
- Create long-term revenue flows to the local economy that result from managing for quality and specialty wood products (value-added) and transitioning to ecosystem based meaningful forestry jobs.

Our Agenda

Actualize (make real) a Boundary watershed that is:

- managed by the citizens who live in it and are impacted by what happens
- managed under a governance framework that embodies the principles of sustainability, ecological integrity, and social and ecological resilience (i.e. the capacity to recover from a shock)

The 3- phase process

Phase 1: Initial Report & Laying the Groundwork

- Generate an initial report to use as a starting point to move towards the implementation of citizen-managed Nature-Based Planning. That is the purpose of this document and the accompanying *Field Report.*

Phase 2: Design the Nature-Based Plan & Create a Path to Local Management

Phase 3: Establish a Citizen's Forest Board & Implement the Nature-Based Plan

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The Outdated Forestry Paradigm is Not Sustainable

The production-forestry paradigm of forest management in BC is based on industrial concepts and methods. Forests are measured in merchantable wood content rather than in complex biological relationships between ecological processes, living beings, and spatial and temporal horizons. BC's forest policies and practices are more about sustaining an industry in the short-term rather than sustaining the resource itself, in both the long- and short- term.

What is the forest industry trying to sustain? The BC forest industry, which is dominated by large multi-national corporations, seeks to sustain profits.

The determination of what is being sustained is defined by short-term, narrow politics rather than oriented to the broad long-term public interest.

The system that carries the label of sustainable forestry in BC pretends to focus on productivity. In fact, it *degrades* both productivity and biodiversity in BC. The *Falldown Effect* (see page 37) shows us the current system is not even sustainable in terms of a continuous supply of wood. This is why 70% of the mills and jobs that operated on the BC Coast in 1988 are now gone. It is why corporations are removing the highest grade of timber in BC and then moving out of BC and investing profits outside of Canada (Williams, 2018). These actions demonstrate that even corporations consider BC forest management to be un-sustainable.[4]

There is no consideration for ecological integrity, water quality, or climate adaptation and mitigation in the BC forest management system. Minimal attention is given to the multiple functions of forests, including traditional uses, and the likely economic and social stress when these uses are not well-managed. The forest ecosystem is not recognized as having a value in itself.

Where We Are Now

The problematic tenets of production forestry (clearcut and plant):

(1) Timber is the primary product, all other values are by-products

(2) Forests are to be managed for volume (a.k.a "fibre") rather than value

(3) Sustaining the short term flow of timber (Allowable Annual Cut) is more important than sustaining the long-term productive condition of a forest

(4) "Real" forestry will become possible when all the old growth is gone

(5) Clearcut logging is the solution to climate stresses that kill trees (such as pine beetle)

Other BC industries that do not find the current liquidation paradigm sustainable include: tourism (nobody wants to camp in a clearcut), hunting (animal populations are dwindling across the province because of overcutting), fisheries (loss of old forests has a negative impact on fish

[4] On February 25, 2021, Business In Vancouver published an article where a global wood business consultant said that "[Forestry] companies that want to have a future really want to be in the U.S. south." Interfor recently announced plans to buy a sawmill in South Carolina which takes their sawmill total in the U.S. to 14. (Bennett, 2021).

habitat and their populations), and traditional Indigenous economic activities that rely on intact forests.

Many communities across BC would also disagree that the model is sustainable. These include Peachland (in need of a new water treatment facility due to sediment from clearcutting) and towns whose economies have crashed as a result of losing a sawmill.

The illusion of sustainability is no longer tenable. "We have pretended that we've developed a scientifically sound base for sustainable forestry practice…on all these points we have failed. The truth is that we have had a policy of liquidating our forests.' (P. 5, Williams, 2018)

Each year the outdated paradigm is upheld, BC becomes further impoverished through the degradation of forests and the weakening of the viability of a future forest industry. Each clearcut robs future generations of jobs and the services and benefits provided by ecosystems.

Before there can be a sustainable forest economy, there must be a sustainable forest.

Below, we propose an alternative paradigm of ecological sustainability.

The Tests for Sustainability

For a forest to be managed sustainably the rate of recovery must be equal to or exceed the rate of depletion and/or loss from clearcut logging and roads.

These tests will answer the question, "Which actions achieve the desired outcomes?"

1. Ecological test (testing for ecological integrity) – Does it all function together as a system that self-renews and self-regulates?
2. Economic test – Has the value or worth increased? Are you *only* doing things that increase the value of your forest?
3. Social test – Will the policy create social cohesion? Or will it create further conflict in BC around forest practices?
4. Cultural Test – Does it create a life of security and meaning?

(adapted from Travers 2020)

What BC forestry needs is a close fit between ends and the chosen means (forest practices). This best fit can be determined by doing a pass/fail report card (before decisions are made) of combined ecological, economic, and social tests for sustainability. Once implemented there must be monitoring of lead indicators to ensure what was intended to happen, did happen. If not, then corrective action is taken.

New Paradigm of Sustainability

"Humanity is putting too much stress on nature. We have to find ways to reduce that stress so that we can find long-term sustainable solutions." (Travers, 2020)

To achieve true sustainability, forest management must change the paradigm from short-term industrial production to long-term ecosystem integrity that includes all forest values, including timber. Many people assume the economy is separate from the environment. In reality they are both part of the same system.

Degrade the environment and we degrade the economy.

We are proposing an alternative vision of forestry: ecological forestry where we conceive of the forest as home for nature and humanity rather than simply a timber factory. This type of forest management prioritizes ecological integrity and enables communities to reap the long-term services and benefits that result from resilient ecosystems.

When left undisturbed by human interference, forests heal themselves. Resilience is built into nature. Forest ecosystems evolve through stages (even after natural disturbances such as fire and insect outbreaks). In the industrial paradigm, invaluable structure and components are being thrown away. In a natural forest ecosystem, there is no such thing as an 'unproductive' forest. As long as there are live trees with green foliage, a forest will be productive. (What will vary is the rate of growth depending on the productivity of the soil, climate, and age of the forest.)

The achievement of truly sustainable forestry encompasses four essential elements:

1. Keeping and linking all the parts (ecological and social)
2. Understanding nature's patterns and processes
3. Using a long-term planning horizon
4. Public involvement to maintain community standards

If forest ecosystems are recognized as sets of relationships rather than just a timber supply, then truly sustainable forest management can be based on holistic principles and standards. This type of management recognizes the interconnectedness of the pieces that together make it possible for human communities and economies to survive and thrive.

Ecologist Aldo Leopold said, '…an intelligent tinkerer saves all of the parts'. The current production (clearcut and plant) paradigm is sacrificing too many critical pieces and parts to make it possible to support long term.

As long as the dominant silvicultural method is clearcutting, it is in direct conflict with ecological sustainability. Clearcutting removes all the above ground pieces. Nature-based and holistic practices keep all the pieces. Forest ecosystems are composed of people, other sentient beings, processes, and materials.

Robert G. Bailey's (US Forest Service) equation illustrates how (ecological) sustainability works:

SUSTAINABILITY = RESOURCE PRODUCTIVITY + ECOSYSTEM MAINTENANCE
= Capability (potential)

In BC, the current timber planning model includes only timber productivity. It ignores ecosystem maintenance and potential. Optimal management ensures that all land uses not only consistently sustain resource productivity but *also* maintain ecosystem processes and function (Bailey, 2002).

Sustainability, the capability of the natural systems to maintain themselves (Bailey, 2002).

Bailey's approach to sustainability includes the science of how nature self-renews, self-repairs, and how it sustains itself. Sustainability is the capability of the natural systems to maintain themselves (Bailey, 2002). Once humans learn to understand this science, we can move towards practices that can sustain the full potential of ecosystems (Travers, 2020).

The new approach to sustainability is about working *with* nature, not trying to control it or assuming we can 'manage' it. Forestry in BC must develop an understanding of how nature renews itself and keeps itself healthy (if humans let it). This requires that forest management prioritize ecosystem resilience.

There is also recognition that wood supply has biological limits and is not inexhaustible. The natural stockpile is not the same as it was when Europeans first came to BC. Knowledge of nature's limits is required to ensure sustainability.

"Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity."

~Aldo Leopold

Sustainability and resilience are also social demands. True sustainability means that the needs of the present are met without compromising the ability of future generations to meet their own needs. It requires that managers in government recognize the failures of the industrial model and plan for a better future.

Close interactions between all the players are necessary for sustainable management to succeed. This includes communities (Indigenous and non-Indigenous), sub-groups within communities, multiple levels of government (including Indigenous), and a broad range of businesses.

There must be a mechanism for local people to be actively involved in sustainable forest management. The application of community values is essential to effective sustainable forest management (Davis, 2007).

“Public participation in forest management is based on the hypothesis that if those whose daily lives are affected by the operation of a forest management system are involved in the decisions controlling the system, efforts can be made to protect the health of ecosystems and meet economic needs at the same time” (Lapierre as cited in Davis, 2007).

Long-term planning horizons take into account the cumulative impacts of human activity. They recognize that ecosystems have evolved over thousands of years, rather than 25- to 60-year tree farm rotations. They also respect the ecological limits that determine a forest’s capacity to self-renew.

Table 1 Comparison of Forest Management Paradigms

Comparison of forest management paradigms		
Feature	Out-dated Paradigm	New Paradigm
Paradigm	Industrial	Nature/ecosystem, community
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Decision-making	Centralized	Decentralized – community-based
Planning method	Timber-volume based	Base planning on nature's needs and community needs
Silviculture focus	Tree farms	Biodiverse species, conserve old and mature forests
Logging method	Clearcut/remove all the pieces	Selection logging (constrained by nature's limits)

How To Carry Out The New Paradigm Of Sustainability

With this new paradigm of sustainability in mind, we are proposing the way to achieve it in the Boundary watershed is two-fold:

1. Nature-based planning

2. Community Forest Boards (CFB) that implement and manage Nature-Based Planning

These two key components will be further defined and described in Section 3.

To make this positive change possible, the Province must enable it either through new legislation or a pilot project in our region supported and funded by the provincial government. Otherwise, due to constraints of the current system and a lack of funding, our community (those affected by the Boundary watershed) will be unable to implement the new paradigm and the system will continue to fail us.

Description of Region

This report covers the geographical area encompassed by the Kettle River watershed in the southern interior of British Columbia (see Figure 1). On the west side, the watershed includes the Okanagan Highland Range of the Monashee Mountains, and to the east the Christina Ranges, and extends south of the USA-Canada border into Washington State. This report addresses the Canadian portion of the watershed, which covers an area of approximately 8000 km^2 /3088 sq miles (800,000 ha). There are three major tributaries in the watershed: the West Kettle River, the Kettle/East Kettle River, and the Granby River. The overall Kettle River watershed is a tributary of the Columbia River. In this report we will refer to this area as the Boundary watershed.

The main communities in the watershed are Grand Forks, Christina Lake, Greenwood, Midway, Rock Creek, Bridesville, and Beaverdell. In 2011 the population was about 12,000 people (Stats Canada, 2011). The urban areas are concentrated in the south near the USA border with the remainder of the watershed being sparsely populated. There are five domestic community watersheds within the Boundary.

There are currently no First Nations communities or reservations within the watershed. However, nine First Nations have asserted traditional territories which overlap with the Boundary Timber Supply Area (TSA). These include: the Okanagan Nation Alliance, Lower Similkameen Indian Band, Penticton Indian Band, Adams Lake Indian Band, Okanagan Indian Band, Osoyoos Indian Band, Shuswap Indian band, Splats'in, and Westbank First Nation

(FLNRORD, 2014). The Sinixt and Ktunaxa also have traditional territories within this geographic area (Native Land Digital, 2021).

The land use is a mix of forestry, protected areas, agriculture, ranching, and rural and urban development. Tourism is an important economic driver, however, forestry and range are the dominant land uses in the watershed (Coleshill, 2017). Provincial parks include Granby Provincial Park, Gladstone Provincial Park, and the southern tip of Graystokes Provincial Park.

Throughout the watershed there are extensive resource roads and recreational trails that allow access to many streams and lakes. The Kettle and Granby Rivers have traditionally been popular fishing destinations. Tourism is robust at Christina Lake and results in the seasonal population expanding from about 1400 people in the winter to 6000 in the summer. There are three ski hills in the watershed, including Big White which is the third largest ski hill in BC.

What is a Watershed? "A watershed is the land drained by a stream or river system and/or associated wetlands and lakes. Uplands often comprise more than 99% of the watershed's area, with the floodplain and stream channel making up the rest. Uplands are associated with lowlands through the flow of water, either overland or through the soil. Vegetation slows the flow of water in the uplands so that it infiltrates the soil.

A *Properly Functioning* watershed should capture precipitation where it falls, store it in the soil profile (and move it slowly downslope to the riparian zone), and then slowly and safely release it into streams, rivers, wetlands, and lakes." (British Columbia Ministry of Forests, 2002)

Wildlife and Ecosystems

The watershed is mostly forested with a wide variety of ecosystem and habitat types. Several of the riparian ecosystems are locally rare, such as the river riparian habitat of the Interior Cedar Hemlock biogeoclimatic zone or wetland riparian habitat of the very dry Ponderosa Pine zone, which hosts numerous threatened and endangered species (Coleshill, 2017).

Tree species include lodgepole pine, western larch, spruce, Douglas fir, cottonwood, white bark pine, western red cedar, western hemlock, white pine, ponderosa pine, aspen, and birch.

The forests support a wide variety of wildlife species, including Williamson's sapsucker, northern goshawk, badger, racer and Great Basin gopher snake, plus wildlife designated as "species at risk" or "regionally significant", including: northern goshawk, Lewis's woodpecker and grizzly bear (Coleshill, 2017). See Appendix A for a list of red and blue listed species in the Boundary region. The watershed includes important ungulate winter ranges for mule deer, white tail deer, moose, mountain goat, and sheep.

There are numerous lakes and streams that support fish species such as rainbow trout, Kokanee, bass, walleye, brook trout and brown trout.

Climate

The region is characterized by warm dry summers and cold winters. Precipitation is highly variable across the watershed. The mountains and highlands, particularly in the north and east get a lot of snow, but the westernmost and southern portions of the watershed experience very dry conditions. Precipitation is generally highest during the winter months, where roughly half of the annual precipitation falls as snow, with a higher percentage occurring at higher elevations (Chernos, 2020).

Biogeoclimatic Zones

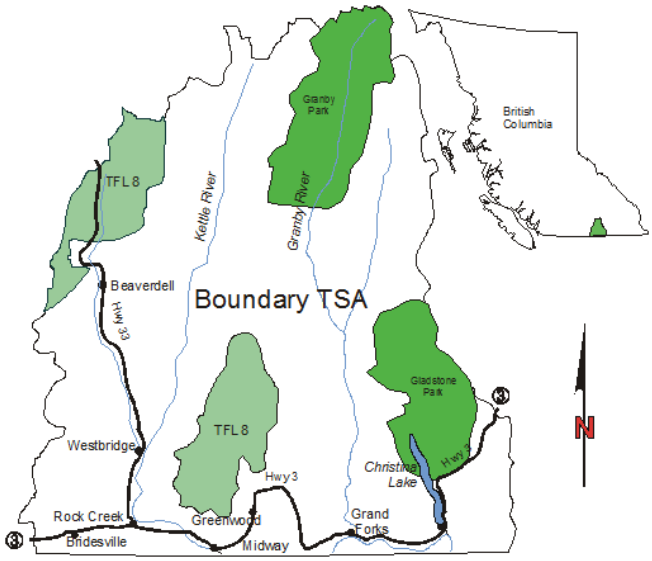
The varying Biogeoclimatic Ecosystem Classification (BEC) zones include Montane Spruce (MS), Interior Douglas Fir (IDF), Ponderosa Pine (PP), and Interior Cedar Hemlock (ICH) at the lower elevations. Engelmann Spruce Subalpine Fir (ESSF) characterizes higher elevation areas.

Forestry Units, Regulations, and Business

The provincial Forest Act and the Forest and Range Practices Act govern forestry activities. The role of the federal government in BC forests is limited.

The Boundary Timber Supply Area (TSA) covers 580,000 hectares (ha) (2239 sq miles) within the total Kettle watershed (which is about 800,000 ha (3088 sq miles) in the portion north of the USA border). About 288,000 ha (49% of the TSA) are considered to be available for timber harvesting. While the external perimeter of the TSA includes Tree Farm Licence #8 (TFL #8), Granby Provincial Park, and Gladstone Provincial Park, these units are not included in the TSA area. TFL #8 is allotted to Interfor Corporation.

The Boundary TSA's allowable annual cut (AAC) is 670,142 cubic metres, which is 16.06% of the provincial total AAC (BC MFLNRORD, 2021). Of the Boundary total, 272,286 hectares (672833 acres) is considered to be available and suitable for inclusion in the timber harvesting land base (THLB).



Map source: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/allowable-annual-cut-timber-supply-areas/boundary-tsa

The main forestry operators in the Kettle watershed include:

- Interfor Corporation
- Tolko Industries Ltd
- Weyerhaeuser/Weyco
- Tolko
- BC Timber Sales
- Nk'Mip Forestry Corporation
- Mercer Celgar Pulp
- Ossoyos Indian Band Development Corporation
- West Boundary Community Forest

See Appendix B for map of land ownership in the Boundary watershed. See Appendix C for distribution of tenures.

West Boundary Community Forest (WBCF) is the lone Community Forest License (issued in 2015) and it operates on public forest land mainly around Greenwood. WBCF is a corporation, with the City of Greenwood and Village of Midway as equal shareholders. Its day-to-day operations are managed through a contract with Vaagen Fibre Canada (WBCF, 2017).

There are two large-scale mills: the Interfor Sawmill in Grand Forks and Vaagen Fibre Canada mill in Midway. Vaagen Fibre is a non-tenured sawmill that relies on open market purchasing of logs, moulding, and timber framing. The Vaagen mill produces dimensional lumber (2x4, 2x6, 2x8). The majority of their lumber goes to Colville, Washington to be planed, wrapped, and sent to market. The rest goes directly to Alberta to make rig mats for the oil industry. (D.

McMaster, personal communication, November 2, 2020). Vaagen also operates mills in Washington and Idaho.

There is also a smaller scale mill and woodlot at Son Ranch which is a family run forestry operation that focuses on selection logging, custom milling, kiln drying, shaping. There is also a good number of smaller scale woodlots, which are area-based tenures.

SECTION 1: IMPEDIMENTS TO OUR GOALS

How we got here and what is happening now

British Columbia has a long history of public ownership of forests. Ninety-four percent of the land in BC is public (Crown) land. Before 1912, rights to public timber were acquired in two ways: (1) outright grants to private owners, and (2) cutting rights in temporary tenures, which reverted to the Province once logged.

The Forest Tenure System

Between 1912 and 1945, some important changes in the administration of public timberlands occurred. This included establishment of Forest Reserves on public land to prevent conversion to non-timber uses, competitive bidding of timber sales, creation of pulpwood tenures, payment of a royalty on the timber logged in the temporary tenures, establishment of a forest research function, conducting fire prevention and suppression, timber scaling and minimizing logging waste. Until 1945, most logging was on private land and the temporary tenures.

During World War II, there was increasing concern about what would happen to the economy after the war. Policy makers were concerned about a return to the instability and insecurity of another economic depression. The solution, they thought, was to regulate the timber supply to ensure a sustained yield of timber, i.e. an approved annual cut (AAC). BC has done that for seventy years, and the contribution of forestry to the BC GDP has declined to 3% in 2020, down from about 25% in 1947 when sustained yield forestry began.

In the mid-20th century, forest tenure policy became focused on stimulating economic development in rural areas. Companies were granted timber rights (tenures) on public land in exchange for building local mills to create jobs in the regions where the timber was being cut. The tenure system was supposed to serve economic and social needs in rural BC. About 2003, when deregulation occurred, the requirement ('appurtenancy') that licensees maintain a local mill in order to retain forest tenure on public land

Exporting Jobs

"The removal of appurtenance requirements from tenure agreements has enabled large timber companies in British Columbia to export minimally finished wood products, as well as logs to mills outside the region where logs are cut, including outside the country. This situation is akin to exporting jobs, as well" (Hammond, 2014).

was eliminated.

In Grand Forks, this change will have a negative impact, if a major mill closes and logs are taken elsewhere to be milled. Currently, there is already a quantity of logs cut down in the Boundary being hauled to mills outside the Boundary.

The initial idea when the forest tenure system was established was known as “scientific management.” What this meant was simplification of a complex forest through clearcutting and tree farms. It was believed that this would transform a chaotic, natural, and diverse forest into something “predictable”. Over time, what happened was that as the commercial timber was logged out, mills would permanently close.

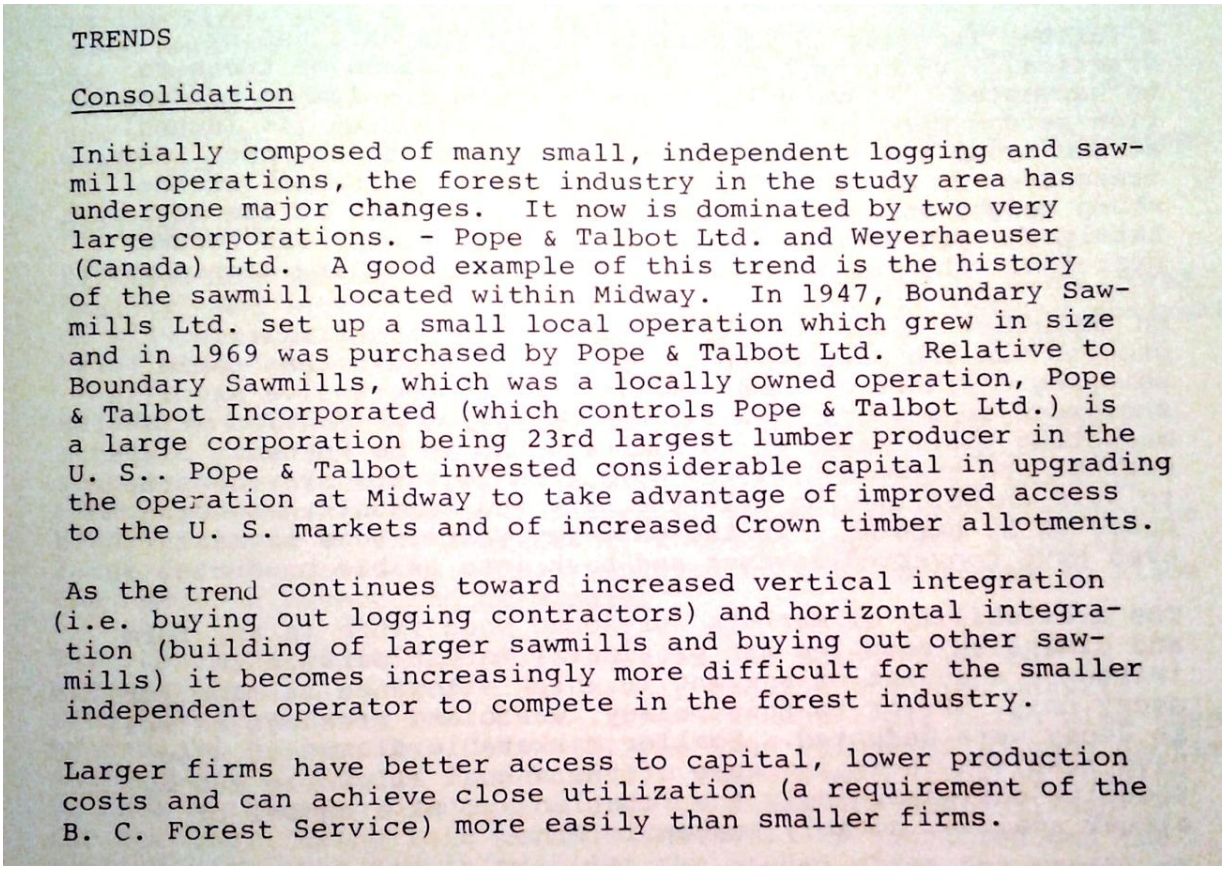
The problems with such a system continue to this day and are recognized by unions. In 2019, the United Steelworkers union wrote, “…any notion of a social contract that tied logs to communities was decimated. B.C.'s forests were no longer viewed as a resource belonging to the people of this province that should be harvested in a way that maximizes employment opportunities and benefits for British Columbians.” (United Steelworkers (USW), 2019)

Unlike the Agricultural Land Reserve (ALR), from which land can be removed for other uses, timber volume or land cannot be removed from a forest tenure holder for other uses without compensation. From 2003 to 2017, tenure holders were permitted to sell their rights to public timber to other private interests, without prior approval of the Minister of Forests.

Shutting Down Competition for Timber

Between the 1950s and 1980s, timber rights became increasingly concentrated with a few large companies. This eliminated the competitive efficiency of the marketplace. While small operators, independent loggers, and communities wanted more opportunities to access logs and to make wood available on the open market, corporations successfully argued for the status quo. The number of small operators declined over time.

Figure 2 "Increasingly difficult for the smaller independent operator to compete…" (Excerpt from Kettle Valley Rural Study, Province of BC, 1979, p.65)



TRENDS

Consolidation

Initially composed of many small, independent logging and sawmill operations, the forest industry in the study area has undergone major changes. It now is dominated by two very large corporations. - Pope & Talbot Ltd. and Weyerhaeuser (Canada) Ltd. A good example of this trend is the history of the sawmill located within Midway. In 1947, Boundary Sawmills Ltd. set up a small local operation which grew in size and in 1969 was purchased by Pope & Talbot Ltd. Relative to Boundary Sawmills, which was a locally owned operation, Pope & Talbot Incorporated (which controls Pope & Talbot Ltd.) is a large corporation being 23rd largest lumber producer in the U. S.. Pope & Talbot invested considerable capital in upgrading the operation at Midway to take advantage of improved access to the U. S. markets and of increased Crown timber allotments.

As the trend continues toward increased vertical integration (i.e. buying out logging contractors) and horizontal integration (building of larger sawmills and buying out other sawmills) it becomes increasingly more difficult for the smaller independent operator to compete in the forest industry.

Larger firms have better access to capital, lower production costs and can achieve close utilization (a requirement of the B. C. Forest Service) more easily than smaller firms.

It has now gotten to the point where there are six regional monopolies of BC public timber supply. This monopolistic control undervalues BC public timber by 2 to 4 times and is the root cause of log exports (Travers, 2020).

Allowable Annual Cut (AAC) Rules the Forests

Forest management and forestry legislation in BC have as their priority the potential flow of raw logs out of the forest, a.k.a the timber supply. The Allowable Annual Cut (AAC) determinations made by MFLNRORD controls the maximum rate of cut.

When it comes to determining the AAC, the primary consideration has always been the flow of timber. All other non-timber values are considered constraints on the timber supply.

For example, in the current legislation (FRPA), it is only 'without unduly reducing the supply of timber' that the BC forest industry is required to consider protecting water, biodiversity, wildlife, riparian zones, and watersheds.

Unduly is a subjective term that is not clearly defined in legislation. The ambiguity of this policy has led to a degradation of biodiversity caused by simplification of a formerly diverse forest.

Since the early 2000s to the current day, as natural forests has been cut down, there has been a simultaneous increase in the area of BC forest impacted by fires, insects and disease. This has meant a further decline in the amount of commercial timber in the province. However, the provincial AAC (including the AAC in the Boundary) has not always been reduced to account for these unplanned losses.

Tree Farms (Plantations) Replace Natural Forests

In the mid-20th century, forestry became focused on creating tree farms of even-aged tree species. In these tree farms, the forest industry tends to plant mostly fast-growing, commercially valuable trees species instead of a biodiverse combination of native species.

Old growth was logged at an increased rate and replaced by plantations with shorter rotation ages. The intention was to increase the uniformity of a forest and make it more like a factory. Uniform plantation harvests are much more easily mechanized than a natural diverse forest. (This "limitation" can be completely overcome by log sort yards (see page 121).

Forests could now be rapidly depleted by the combination of machinery, businesslike corporate administration, and organized labor. BC forest practices in the 20th century have been described as a liquidation conversion (Rayner et al).

BC's plan since the 1950s has been to liquidate all reachable so-called 'decadent and over mature' old growth forests to convert them to tree crop plantations. Since the 1970s, in BC there are tens of thousands of hectares where 90% plus of old forest (greater than 200 years old) has been converted to 90% young forest (less than 50 years old) (Pojar, 2019).

In the Boundary, much of the forest is now less than 50 years old. See map (Figure 7) on page 53 for the amount of logging in the Boundary since 1971.

In the Boundary, the result of this system is that timber yields from original mature and old forests have not and will not be repeated for a thousand years either in terms of volume, quality, or economic value. Even if the new tree plantations were left unlogged for centuries, climate disruption makes the likelihood of BC forest ecosystems ever matching their former

condition extremely low. Trees in even-aged plantations will not grow in the same way as natural forests did in previous centuries – this will impact the quality and volume of wood coming out of the forests.

From the 1960s to the 1990s, as the supply of old growth and primary forests became depleted, the forest industry shifted from using large diameter trees to smaller and smaller logs. In this way, corporations were able to continue to use highly mechanized technology with fewer employees for extracting resources while not spending more money on research or more jobs.

What the people of BC used to call *logging timber* had now become industrial tree farming.

The Falldown Effect (Overcutting)

"The 'falldown effect,' the decline in timber production as the old growth is depleted, is promoted as if it were a natural phenomenon when it is, in fact, a stunning admission that the forests have been drastically over cut every year since modern forestry was implemented in the 1940s." (Dr. W. Davis in Marchak et al, 1999).

Before Europeans began logging large volumes of timber, BC forests had slowly been building volume for centuries. In the logging of original old forests, humans obtained a rich harvest for each hectare logged. However, due to overcutting of old forests in BC, future harvests have to be based on much younger and smaller trees. Thus, the volume per hectare logged will be much less as will the value.

In 1980, former Chief Forester, the late John Cuthbert of the BC Forest Service described the *Falldown Effect* as such, "From the second crop we will be cutting much younger trees. So the volume in the second rotation will be less per acre than from the old stockpile. That old stockpile was a bonus, a gift from nature. But we won't have it the next time around." (BC Forest Service, 1980)

Figure 3 A logging truck travels west through downtown Grand Forks. March 2021. Photo courtesy Jennifer Houghton.

Another way of putting it is: the *Falldown Effect* refers to the planned reduction in annual timber supply from logging lower volume second-growth as old growth is depleted by logging.

It was postulated that intensive silviculture/planting tree farms would ameliorate falldown, but in reality, it did not. The *Falldown Effect*, a result of intentional overcutting, demonstrates the dismal error of this assumption. By the 1990s, government was estimating that future harvests would be 20% to 30% below the Allowable Annual Cuts of the time (Hammond, 1991).

The result of this falldown, since the 1990s, includes the economic fallout of mill closures and 'decaying community life'. (P. 53, Davis, 2007).

Falldown/Overcutting in the Boundary

In 1998 the Boundary AAC allocated by the Ministry of Forests to tenure holders was 25% higher than the Ministry itself deemed to be physically sustainable. By Ministry calculations, there was insufficient timber to sustain the level of logging currently undertaken. See Table 3 below.

Table 2 Overcut for the Boundary TSA 1998.

In 1998, the overcut for the Boundary TSA was 25% and for TFL 8 was 13.28% (Marchak et al, 1999).
AAC 700,000 M^3 - LTHL 520,000 M^3 = Overcut 140,000 M^3
Overcut percentage 25%

LTHL = Long Term Harvesting Level, defined as a harvest level that can be indefinitely maintained under a particular forest management regime.

Source for AAC and LTHL: B.C. Ministry of Forests. 1998. "AAC Listing by Timber Supply Areas and Region" (as read in Marchak et al, 1999).

By this measure, neither governments nor companies holding tenures have adequately restocked the logged-over forests in the Boundary.

Falldown is not a natural ecological process. Instead, it is a planned decline that was imposed on BC forests by policy. It is the result of overcutting old growth at rapid rates and stressing natural ecosystems instead of logging within nature's ecological limits.

The quality of logs used to manufacture lumber has also declined. Old and mature trees produce higher quality and stronger wood than young stands growing at low to moderate levels of stocking. These younger stands of conifers typically produce wood that warps, shrinks and twists. These properties make this wood unsuitable for speciality wood products like mass timber for manufacturing engineered wood products.

The Supremacy of Clearcutting and its Devastating Impacts on Ecosystems

In industrial forestry the vision for tree plantations is to repeat rotations of clearcutting and re-planting that take place over time spans as short as 35 years. In contrast, natural forests can take between 200 to 1000 years to become old forest or go through the stages of succession.

Clearcutting reduces or eliminates essential pieces, structures, and processes that develop in natural forests, including bacteria, fungi, insects, mammals, birds, water, nutrients, layers of humus/rotting organic materials, and standing dead trees. The supply of large fallen trees, critical for creating layers of rotting organic materials, storing water, and supplying habitat, is often exhausted after the first clearcut.

See pages 50-57 for specific problems with clearcuts across BC and in the Boundary.

Forest managers sometimes attempt to justify clearcutting by preserving small groups of old or mature forest inside large clearcut areas (which are often up to thousands of hectares in size). However, these isolated fragments do not retain enough forest structure and interior forest to provide habitat, food, protection, or travel corridors (important for reproduction) to species already at risk. These patches, weakened by wind and heat, also do not provide anywhere near the same degree of hydrological function as extensive, connected areas of intact forest with undegraded soils.

The Outcomes of the Industrial Forestry System

Economic Decline, Mill Closures, and Job Losses

The forest industry now accounts for a mere 3 percent or less of the BC gross domestic product.

There has been a decline in number of workers in the forest industry since 1980, in spite of an increase in volume of logs, sawn lumber, and pulp produced. Since 2000, 55,000 jobs have

been lost. In 2019 alone, MFLNRORD confirmed that more than 4,000 forest industry workers across 27 communities lost their jobs (Boynton, 2019).

The forest industry now provides only 1.9% of employment in BC.

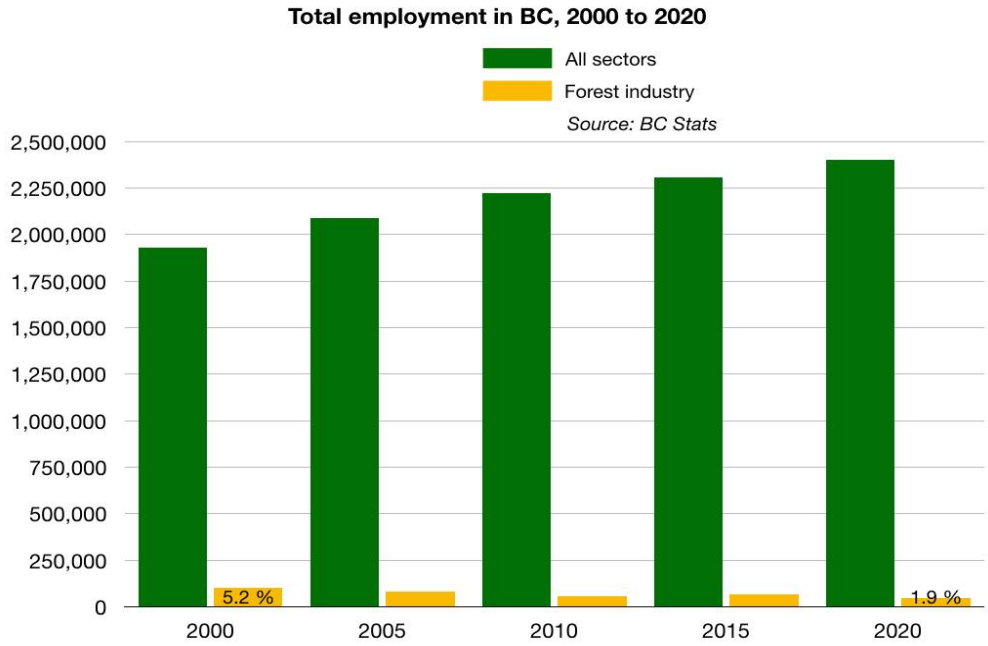


Figure 4 Forest industry employment in BC 2000 - 2020. Table courtesy of David Broadland

Forestry Employment in the Boundary

In 2013, according to the Chief Forester, about 150 people were directly employed in mills and woodlands operations in the Grand Forks and Midway areas (we were not able to find any updated government numbers); and the contractor workforce involved in forestry was roughly equivalent to or somewhat greater than the number directly employed by local mills and forest companies. (BC MFLNRORD July 2013). [5] This is a decrease from 1979, when logging and milling wood products employed more than 1,000 persons in the RDKB Area E alone (Regional District of Kootenay Boundary, 1979).

[5] It is difficult to determine exactly how many people are employed in mills and forestry in the Boundary. In 2020 it was reported that the Interfor Grand Forks mill temporarily cut production and laid off 40 workers (BC Local News online, March 19, 2020)and during a Midway Mill shutdown 40 people were laid off.((BC Local News online, April 20, 2020) However, the Vaagen Mill manager reported that the combined employment of the Midway mill and the West Boundary Community Forest was 181 people including contractors (D. McMaster, personal communication, November 2, 2020). Interfor reported that it employs 120 people in Grand Forks/Area D in 2020 (Community Futures, 2021).

At the time of the 2006 Census, forestry constituted roughly 16 percent of the area economy. (BC MFLNRORD, July 2013). By 2020, Community Futures Boundary was reporting that Agriculture, Forestry, Fishing, and Hunting accounts for only 11.3% of the total population of those employed in Grand Forks/Area D (Community Futures, 2021).

BC Sawmills Close While Major Companies Invest in Other Countries

Since 2000, over 80 BC sawmills province-wide have permanently closed (USW 2012). In the BC interior, 16 mills have closed since 2010 (Bennett, 2019).

Also, since about 2010, BC forest companies have been investing their profits in the purchase of mills in the USA and Sweden. The United Steelworkers (which represents a large number of forestry workers in BC) raised the alarm, "Fewer companies are controlling more of the harvest of public timber in B.C. and taking their profits out of the province to fuel expansion, particularly in the U.S. South where labour is cheap… Our province, our people and our communities are paying a heavy price for this approach." (USW 2019)

Today these same BC forest companies own more mills elsewhere in the world than they do at home. For example, Interfor, which operates the Grand Forks mill, continues to export raw logs and owns 13 mills in the United States (USW 2019). "B.C. sawmills are closing because of a lack of logs, yet the level of log exports out of B.C. to the U.S. is near historic highs" (USW 2017).

In June 2020, the Boundary Creek Times reported: "OmniTRAX, the American owner of the Kettle Falls International Railway which connects Grand Forks to Laurier, Wash., announced in March that it planned to discontinue all operations along the Canadian stretch of the line within the next three years." The article reported that approximately 70 percent of Interfor Grand Forks' product gets shipped by rail and to ship by truck will add another $1.5 million or so per year.

This raises the question: how long will Interfor keep its Grand Forks mill open?

Economic Vulnerability in the Boundary

Downturns, falldowns, monopolies, and a lack of economic diversification make forest dependent communities like Grand Forks vulnerable.

The 2010 *State of British Columbia's Forests Report* examined BC communities that obtain a high proportion of their income from timber-based industries. 'Forest Sector Vulnerability' is the calculation used to show the relative sensitivities of the local area economies to downturns in timber-based industries.

The Grand Forks-Greenwood area has a high level of activity in forestry relative to the rest of the province: the region obtains 23% of its basic income from the timber industry (and only 3% from tourism).

This puts the local economy in the second ***'Most Vulnerable'*** category if the forest industry has a downturn. (British Columbia, Ministry of Forests, Mines, and Lands, 2010)

Summary of Outcomes

The decision to clearcut an intact forest ecosystem is essentially irreversible. Old growth forests, once clearcut, are unlikely to return to their original condition. This is an even more frightening prospect in the era of climate crisis.

After almost 100 years in existence, the results of a forest management system that combines private tenures, tree farms, planned decline in timber supply, shriveled market competition for logs, and increasing mechanization are:

- a reduction in the value of BC forests
- mill closures
- job losses
- economic decline
- diminished ecological function and productivity and biodiversity losses

The good news is that by retaining *public* ownership of the land, British Columbians, and the citizens of the Boundary, keep open their options for land use. This can allow for diversified local economies. It also allows for changes to the way public forests are managed.

Government Policy and Legislation Support the System

The choice to clearcut and liquidate BC's biodiversity, cannot be blamed entirely on corporate executives. At the root of this issue lies the fact that BC legislation encourages and sanctions this system of forest management. Corporations that are liquidating old growth have the fallback position of 'its all being done in accordance with BC laws' (including the Forest and Range Practices Act which was enacted in 2003 and remains the major forest legislation in BC).

Despite the terrible results, legislation continues to support and encourage this management system of diminishing forestry returns.

In the early 2000s, with heavy lobbying by the forest industry and the establishment of an administration sympathetic to the forest industry, the Forest and Range Practices Act (FRPA) was enacted. FRPA brought about a new era of deregulation that continues today. Stumpage rates were lowered, raw log exports increased as the timber economy weakened, and salvage logging was intensified during the 2003 to 2015 mountain pine beetle outbreak. FRPA also removed the requirement for government to maintain a forest inventory.

All this happened concurrently with a massive reduction of government forestry staff, reductions in monitoring, and elimination of the Forest Research Branch. This era also saw the replacement of the small business forest enterprise program by BC Timber Sales. In addition, the Forest Service, which used to serve the public well with decentralized regional offices, ranger stations in many small communities, and public servants actively involved in local forestry decisions, was eliminated in 2012.

The following are characteristics of BC forestry legislation and policy that are problematic:

Overall

- There is no vision or leadership from government – government subsidizes marginal wood products manufacturing such as wood pellets and maintains the status quo by means of a deregulated role for the Ministry,
- There are minimal environmental standards in the legislation to protect ecosystems.
- Non-timber forest values are framed as constraints on timber production, rather than being maintained successfully in forest stewardship plans. Objectives in these plans are not measurable or verifiable and thus enforceable, according to a 2015 Forest Practices Board report.

Legislation and policy focus on maintaining the timber supply and the timber industry rather than ensuring the well-being of nature and rural forest communities.

- The staff of MFLNRORD can identify cumulative effects of over-logging but cannot manage them.
- The forest management legislation is based on a 1947 model of sustained yield, which is irrelevant in a time of climate change.
- The broad public interest is left out of the forest management legislation. Uses like water supply, water quality, clean air, biodiversity, and capacity to mitigate climate change are secondary on all BC public forest land.
- Decisions are based on politics and are not adequately informed by science. What is good for the industry is assumed to be good for everyone, including the forest.
- The hidden and deferred costs of logging are externalized to the public, i.e. the costs of flooding, loss of drinking water, long-term ecological consequences. Corporations that profit from the logging do not have to cover the costs to the community caused by logging. Communities end up being left with less, not more.
- Forest management decision-making is aligned with corporate priorities rather than community well being and its fundamental responsibility for maintaining ecological integrity.
- Legislation, policy, and policy makers favor oligopolistic private control of public resources, in all regions of the Province.

Government management and roles

- **Insufficient Monitoring:**
    - Very little meaningful compliance and monitoring of operations by the Province.

- **Limited Research + Gaps in Data**
    - Research is increasingly commissioned by corporations rather than government.
    - The Ministry of Forest Annual Reports, with detailed performance data, was terminated in 2003, and have not been reinstated by the current government.
    - The Ministry of Forest Research Branch was terminated in 2011
    - Timber inventories are out of date due to a lack of up-to-date detailed inventories for forest resources.
    - Some data being used is incorrect (see Britneff and Watts below p. 47)

Industry Control of Public Forests

- Industry lobbyists have more access to, and regularly meet with, government decision-makers than community groups or citizens do. For example, BFWSS has asked to meet directly with the Minister of Forests, Deputy Ministers, or Assistant Ministers but has always been referred to District Managers who have little real decision-making

authority.

- The corporate lobby has a major influence on government legislation and policy (COFI and ILMA). For example, in the first 6 months of 2020, COFI submitted 30 reports of active lobbying to the BC government (BC Office of the Registrar of Lobbyists, online, 2020).

- There is no legislation in place that creates a legal mechanism for providing checks and balances that hold timber companies accountable for damage to the public interest.

- **Professional Reliance**
  - The Professional Reliance Model leads to government managers seeing their primary duty as advocating or facilitating for industry (Haddock).
  - Government sets forest management objectives or results to be achieved, but professionals hired by forest companies decide how these objectives or results will be met.
  - Dual loyalties of employees and consultants are inherent in the BC forest management system. This creates conflict of interest between the employees of the employer and serving the public interest for professionals. Professionals act as advocates for their clients rather than for the public good

- **Lack of Government Authority**
  - In most circumstances, government can only make recommendations to industry rather than having any authority to enforce or penalize.
  - Some legislation actually restricts government's authority over natural resources on public land.
  - Accountability actions are reactive rather than proactive, i.e. government reacts after the damage has already been done and usually only when a complaint is lodged .

Lack of Community and Citizen Involvement

- The legislation allows little opportunity for communities or locals to establish or influence the outcomes of land use practices. For example, citizens no longer have the opportunity to review road or cut block plans (as they once had).
- Community values are not represented, e.g. environmental values, culturally important sites, the need to address climate change, water quality.
- Members of the public and local governments have little or no access to scientific information or forestry data in the Ministry.

- Professionals with little connection to the land have a much more significant role in land management outcomes than the Indigenous governments and communities themselves.
- There is very little real involvement of Indigenous people.
- Decision-making is centralized rather than community-based.

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Effect of Legislation and Policy on Business

- BC has few manufacturing facilities to produce value-added products. Small businesses typically cannot get access, at competitive prices, to public timber.
- There is little investment in new value-added forest products mills.
- There are no regional log markets to ensure the full value of public timber is realized and paid to the Province.
- There are few opportunities for small- to medium-sized forestry operators to operate on public land.

Legislation and policy fortify the problematic forest management system in BC. The tenure system, low stumpage rates, high grading[6], and subsidies allow corporations rather than the public to collect their fair share of the full value of BC public forest assets.

The tenure system, enshrined in law, gives industry the power to control forest management. As long as the present tenure system remains, the power dynamics will be the same: an uneven playing field where companies hold the power and communities (both Indigenous and non-Indigenous) are vulnerable. Until the tenure system is deconstructed, any changes to forestry legislation are mere window dressing.

BC government policy and decision makers choosing to implement a strategic vision of managing for ecological integrity can change all this.

[6] See High Grading definition and problems in Glossary

SECTION 2: COSTS BEING IMPOSED ON THE BOUNDARY BY THE CURRENT SYSTEM

In this section we report on some of the ways the system of BC forest management is negatively impacting the Boundary watershed, ecosystems, and residents. We share a picture of how the system effects the province overall as well as the specifics in the Boundary. BFWSS has also included Recommended Actions to correct the specific problems identified in this chapter (most of these recommendations can be implemented within the current legislation and policy). In the next chapter we present a plan to addresses the problems as a whole.

Unsustainable Practices in the Boundary

Overcutting and the AAC

There is evidence that the information used to determine the AAC for the Boundary TSA could have been miscalculated. This means that the logging over the past 6 years may have been higher than even what the BC government has determined as 'sustainable'. This potential overcutting will continue until the next AAC determination in 2024. The last determination actually predicts a falldown in timber supply.

In a 2009 report, the BC government Forest Inventory Branch (FAIB) indicated that some of the modelling for the Boundary TSA over-estimated stand volume by approximately 20%. However, the Chief Forester did not consider this possible over-estimation when setting the AAC for the Boundary TSA in 2014. (Britneff and Watts, 2018)

A 2018 report looked at the Boundary TSA to "assess the adequacy of forest inventory data used for the AAC determination." (Britneff and Watts, p. 84, 2018). The report authors, Watt and Britneff[7], found that the inventory data for the Boundary TSA is not up to date: "the inventory is based on photographic interpretations between 1954 and 2009, with the majority

[7] Watt is a recognized expert in forest inventory, growth and yield modeling with 40 years forestry experience. Britneff had a 40-year career with the B.C. Forest Service during which he held senior professional positions in inventory, silviculture, and forest health.

occurring in the late 1980s" (Britneff, 2016). This means that the enormous changes that have occurred in Boundary forests over the past 40 to 60 years (fires, insects, clearcut logging) have not been adequately considered in the determination of the cut.

Watts and Britneff's other findings for the Boundary TSA include:

- Currently, the timber supply review process does not account for climate change. It does not assume a precautionary approach to estimating future tree mortality in light of potential increases of insects and disease accompanying climate change.
- Some of the assumptions in the growth models are over-stating future timber volumes and have not been modified to account for the impact of climate change (Britneff and Watts, 2018).

The authors concluded that FLNRORD, " Fails to consider and properly account for uncertainty in its forest inventory data and in its growth models"; should place more emphasis on field monitoring; and, "mismanages forest inventory data and growth models and misuses uses them in the timber supply review and annual allowable cut determination processes in ways (namely errors, omissions and misrepresentations) that are not in the public interest and are incompatible with principles for sustainable forest management." (Britneff and Watts, p. 101, 2018)

In the past, others have expressed concern over the unsustainable level of cutting in the Boundary TSA, including the Chief Forester in 1996, when he said, "there is some risk of overestimation" of the projected harvest level (p. 37) and the timber supply in the Boundary TSA is much less stable than indicated in the BC Forest Service analysis (BC MOF 1996).

We have seen no evidence that management and working plans of Boundary forest licensees assume no decline in productivity following clearcutting. This assumption is clearly wrong and another reason the Allowable Annual Cuts are too high to sustain the timber economy. If AACs are set using scientific knowledge (as the forest industry claims) they should support this reduction in the actual available timber volume in their timber supply plans.

Accuracy Concerns about Inventory Data for TFL #8 and Inventory in General

In 2020, BFWSS reviewed Interfor's proposed Tree Farm License #8 (TFL #8) management plan for harvesting scheduled to occur until the next TSA review is done in 2021.

BFWSS is concerned that Interfor is relying on old data and methodologies for determining where, how much, and when to log. It appears that Interfor is using outdated Vegetation

Resource inventory (VRI) stand height data used to calculate the Equivalent Clearcut Area (ECA) and adjacency rules for new blocks when they could be using the LiDAR instead.

VRI, Vegetation Resources Inventories, is a photo-based inventory design consisting of photo interpretation and ground sampling. The VRI for the Boundary area is one of the oldest in the province – much of it is from 1980 to 1989. (See Map in Appendix D.) This has resulted in stand heights used in harvesting determinations being incorrect.

Innumerable changes have happened to the forests in the Boundary in the past few decades, including the Rock Creek fire of 2015, beetle infestations, and extensive clear cutting. It is imperative that inventory calculations be done using updated forest information rather than relying on thirty to forty year old photos and samples.

The practice of relying on outdated and possibly incorrect data is no longer supportable in the era of climate change and the damage from the unprecedented amount of flooding (see map on page 29 for TFL#8 location)

Equivalent Clearcut Area Concerns for TFL#8

The extent of disturbance on the land (i.e. the area that has been clearcut logged and burned, while accounting for regrowth) is referred to as the Equivalent Clearcut Area (ECA). ECA helps to determine how much forest cover is returning through time as trees grow back. This approach is measured in the percent of a watershed in clearcut/disturbed area over the total watershed area. The assumption is that the greater the area disturbed the greater the potential hydrologic change from the long term patterns of peak and low flows.

The magnitude of serious adverse affects to a watershed will only be observed when disturbances to the forest begin to show negative changes in water courses and parameters like rate of flow, water levels, sediment transport and so on.

ECA levels of 30% to 40 % are often referred to as the upper limit before negative hydrologic (stream) impacts will occur. For example, if a forested watershed has an ECA of 25% that means that 25% of the normal full hydrologically functioning forested area is not functioning properly. If it has an ECA of 75% that means that serious overcutting of the watershed has occurred. In other words, the higher the ECA, the less the historical hydrological function is present.

In examining the Assessment Units (AU) related to TFL #8, it appears to have an ECA greater than 25%. This is a problem because the cumulative affect downstream could create negative hydrological impacts. Almost two-thirds of the AUs have an ECA greater than 30% which is a

serious concern because the range of 30-40% is the upper limit where negative impacts are likely to occur. The average ECA of the 9 AUs within TFL#8 is 34%.

See Appendix E for a map of the Assessment Units and more detailed explanation.

ECA Concerns Across the Whole Watershed

In 2021, MFLNRORD released the '2019 Analysis of the Kettle River Watershed: Streamflow and Sedimentation Hazards' report, in which they note that there are **'measurable changes in streamflow at ECA values greater that 20-25%'** (Boon as cited in Van Rensen, 2021, p. 23, our bold).

Based on the bolded statement above, it is alarming that there are many Assessment Units with an ECA value over 40% and some over 50% in the watershed. See Table 3 below and see Appendix F for maps and more cause for concern around ECA in the watershed.

The role that harvest-related ECA plays in the frequency of significant flood events must be addressed by the BC government.

Table 3 ECA in the Kettle watershed

CE_ECA_PCT	Hectares	Percent
0 - 10%	66,767	9%
10 - 20%	203,170	28%
20 - 30%	272,330	38%
30 - 40%	171,243	24%
> 40%	75,316	11%

Data source: BC MFLNRORD

Massive Clearcuts in the Boundary and Plantation Forestry

Clear-cutting is a method of logging and regenerating trees in which all (or most) trees are cleared from a site and a new, mostly single species, even-age stand of timber is grown. The impacts associated with clearcutting are detrimental because of the relationship between

structure (e.g. standing trees) and the functioning of ecological processes like energy capture and storage through photosynthesis, capture of precipitation and cycling of water, and cycling of nutrients following forest succession that leads to a later stage of forest development.

Figure 5. Clearcut at Williamson Lake in the Boundary 2018. Photo courtesy Stan Swinarchuk.

Portions of trees not hauled offsite for processing are usually discarded into slash piles on site to be burned. Dead trees, downed trees, branches, treetops, 'residue', and brush are also usually scraped off the land and placed into slash piles. The BC government requires that the forest industry 'dispose of leftover slash and wood residue to reduce fire hazards.'(BC Industrial Burning). The regulations currently allow 24 to 30 months for companies to 'clean up' debris piles (BC Wildfire Act 2012). Slash piles are usually burned on site.

Figure 6. Slash pile at Grano Creek in the Boundary 2018 with a man standing in front to demonstrate the scale. Slash piles of this scale are a common sight across the Boundary. There is no justifiable reason for cutting down trees that are merely going to be burned. Photo Courtesy Stan Swinarchuk.

Slash burning produces greenhouse gas (carbon dioxide) emissions and local air contaminants. And yet, it is not an uncommon practice in the Boundary region to clearcut mature growth, retrieve (high-grade) only a certain percentage of the volume as saw logs, and place the rest of the trees into huge slash piles to be burned. BFWSS members have witnessed many instances of merchantable timber that had been cut and left behind to be burned as slash.

Since the 1970s, clearcutting has been the primary logging method used on the Timber Harvesting Land Base (THLB) on public land in the Boundary watershed. The map below indicates the amount of clearcutting by decade in the Boundary watershed from 1971 to 2017. This also presents a clear picture of how much of the land base across the watershed consists of trees less than 50 years old.

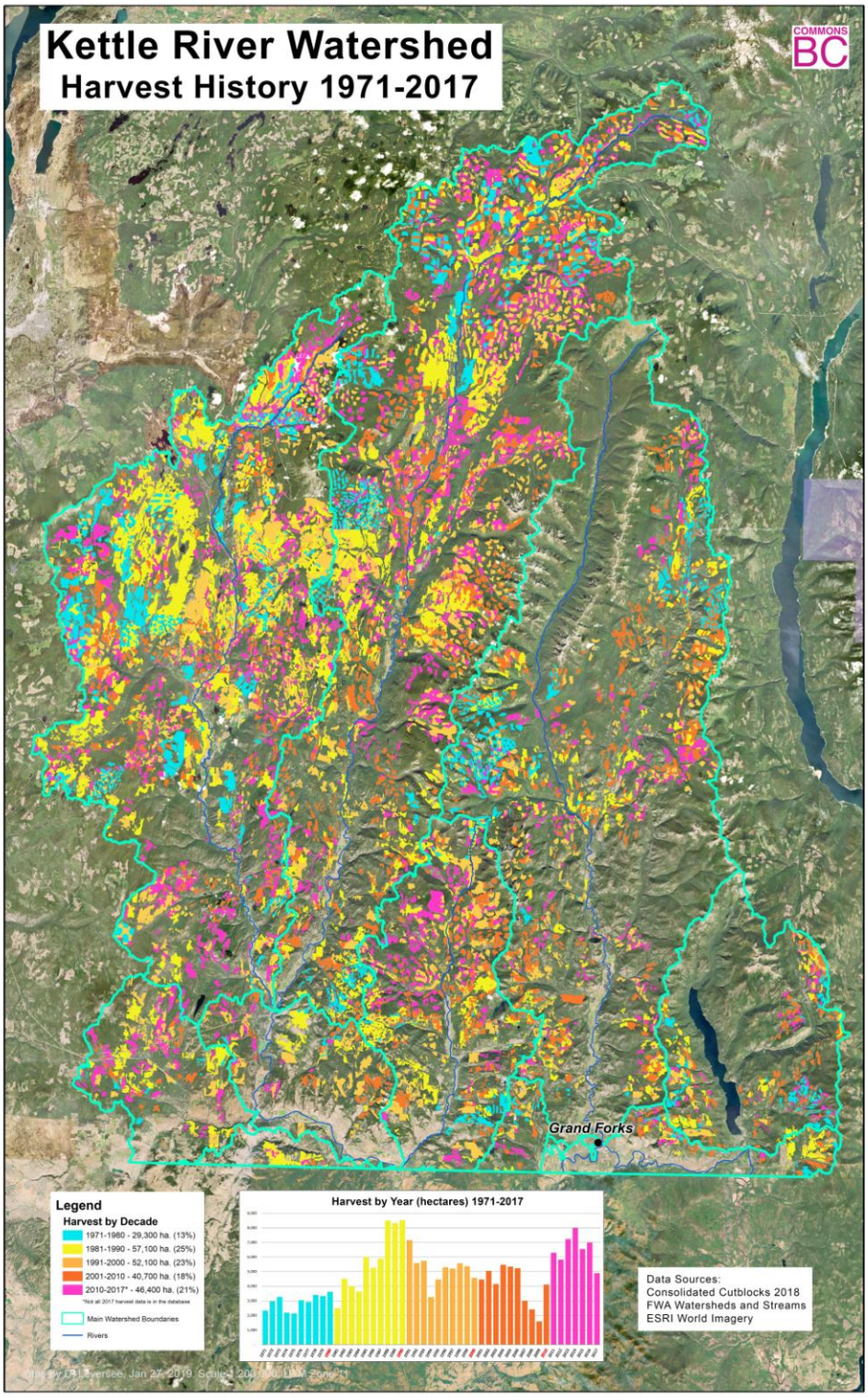

Figure 7. Cutblocks in the Boundary watershed from 1971 to 2017. The blue lines inside the main watershed outline are subwatersheds. Map courtesy David Leversee.

Clearcutting adds stress to nature in many ways:

- it removes the moderating effect of forests on the land
- increases peak flows when large portions of watershed are cut
- allows snow to accumulate in the openings during winter, which will then melt quickly in the spring, causing increased flooding
- it fragments forests negatively impacting wildlife habitat requirements diminishes food supplies and shelter for wildlife
- reduces biodiversity
- reduces response of forests to disturbances (insects, disease, fire, logging) (Brooks and Grant)
- exacerbates forest decline in the face of climate change (Brooks and Grant).

To clearcut without recognizing these predicable consequences is both unnecessary and irresponsible. A margin of safety (i.e. retaining old forests) below the ecological carrying capacity, will protect nontimber values at the landscape scale and create options for the future. This margin will provide a higher standard of care in public forests.

It is a basic fact that restoring a damaged ecosystem is colossally more difficult than preventing it from being damaged in the first place.

It is time to put a stop to clearcutting the Boundary region and find an alternative.

Hundreds of Cutblocks are Over 40 Hectares

Under the Forest Planning and Practices Regulation (FPPR), cutblocks are supposed to be limited to 40 hectares in the Kootenay-Boundary Forest Region. However, forest licensees are allowed to harvest larger cutblocks because they have discretion in how they address the forest values that are not regulated. And they are creating huge cutblocks.

BFWSS members have observed numerous cutblocks in the Boundary watershed that are hundreds of hectares in size. In the past several years, there have been over 100 clearcuts over 40 hectares in the watershed and dozens above 140 ha (the 3 meter adjacency rule is also frequently violated with ‘contiguous’ cutblocks covering hundreds of hectares) Thus far, there have been no consequences issued by the government to licensees who are doing this.

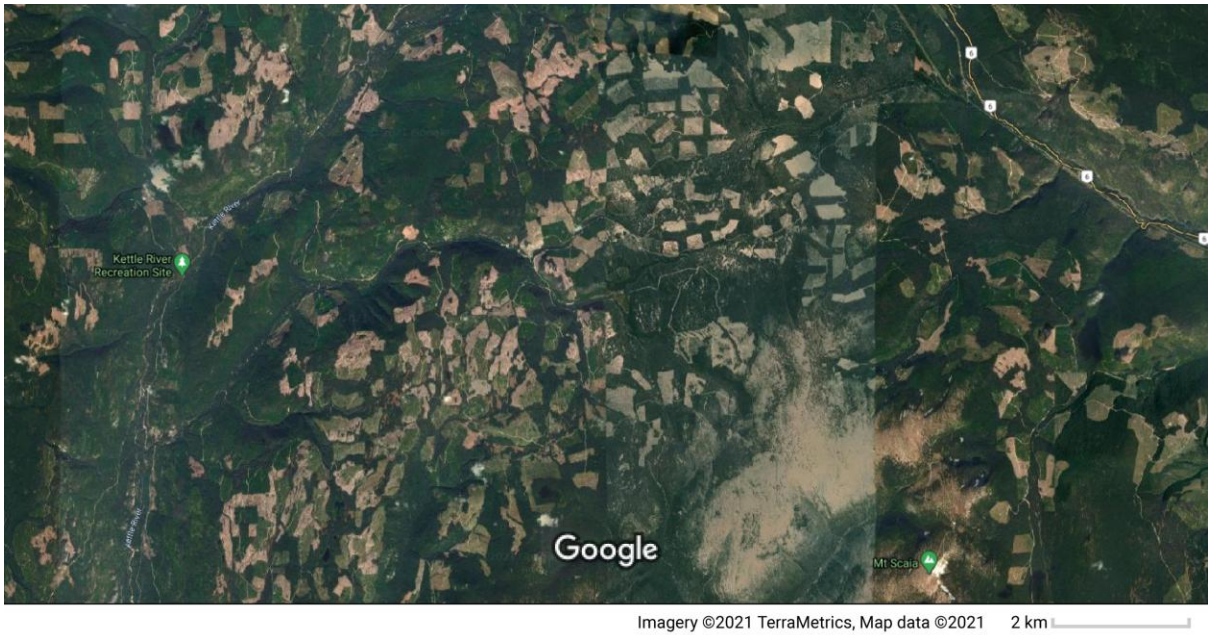

Figure 8 Examples of contiguous cutblocks over 40ha. Image shows logging in the upper Kettle River Valley. The Kettle River is on the left side of the image. 1 sq km = 100 hectares (0.4 sq km = 40 ha). Clearcuts are in grey, beige, and light green. By leaving small strips of un-logged forest in between blocks, licensees can get away with cutblocks over 40 ha.

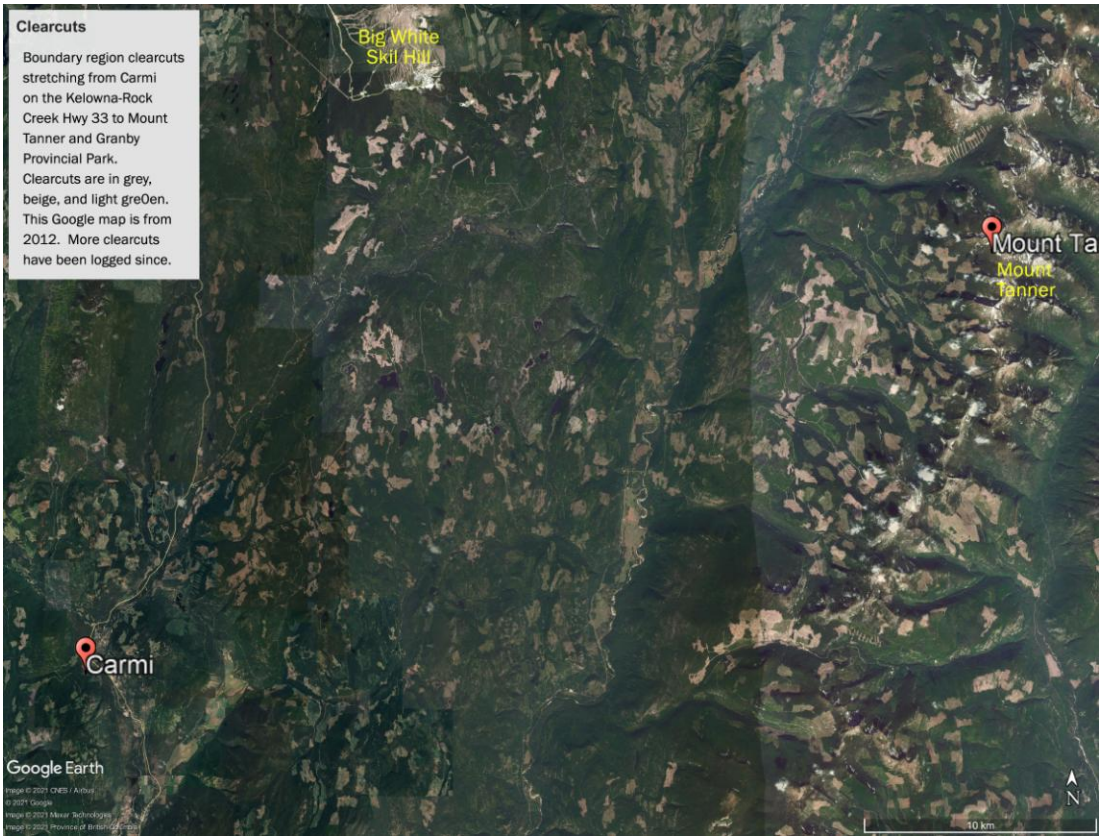

Figure 9 The massive expanses of adjacent clearcut blocks in the Boundary covering an area of approximately 240 sq km. Clearcuts appear as grey, beige, and light green.

A 2016 the Forest Practices Board investigated a complaint about a cutblock in the Dry Creek watershed in Interfor's TFL#8 that was 454 hectares in size and about 2 km wide. A local hunter was concerned that the size would negatively impact water and wildlife. The stand contained a mix of marginally economic sawlog and pulp timber (Forest Practices Board (FPB) 2016).

Among the FPB's conclusions, "… Interfor did not meet all the requirements of section 64 of the Forest Planning and Practices Regulation which, when a cutblock size exceeds 40 hectares in this area, requires the licensee to design timber harvesting to be consistent with the structural characteristics and the temporal and spatial distribution of an opening that would result from a natural disturbance. The Board could not conclude whether the result on the ground adequately manages wildlife habitat and biodiversity at the landscape level." (p. 10, FPB, 2016)

Figure 10 A portion of the Dry Creek clearcut in fall 2020. Photo courtesy Daniel Pearce.

Figure 11 A portion of the Dry Creek clearcut. Photo courtesy Al Grant.

BFWSS acknowledges that in rare situations, the 40 ha might warrant exceeding. However, with the introduction of Professional Reliance, we believe the size judgment has been seriously abused. There are no legal restrictions on the size of cutblocks and industrial forest professionals can get caught up in a conflict of interest (dual loyalties) between professional ethics and their responsibility to their employer.

Ecological Consequences of Clearcutting

A BC study by Simard et al, quantifies the losses as tree retention in logging operations declines from 100% retention to 60% to 30% to 10% down to 0% retention (a clearcut).

With decreasing retention:

- Carbon stocks, regeneration/productivity, and biodiversity all decrease
- Fire risk goes up

Conversely, the more trees that are retained, the more carbon stocks there are, the more regeneration there is, the more biodiversity there is, the less fire risk there is (Oct 2020b).

Simard et al also found that (2020a):

- Carbon stock in soil declines with harvesting intensity
- Species diversity and richness decline with logging intensity. An average of 10 species disappeared with clearcutting and 5–7 with partial cutting.
    - Species losses occurred among mosses and lichens. Mosses and lichens play crucial roles in water retention, nutrient cycling, erosion mitigation, and they provide sites for germination of seeds, habitat for vertebrates, and invertebrates. There are a number of mosses in the RDKB which are categorized as blue-listed, which means they are at risk and their status is of special concern.

- Most of the regeneration occurs within 15 meters of the parent tree (i.e. leaving trees so that they are no more than 15m apart will enhance regeneration).

  It is a commonly observed practice in the Boundary cutblocks to leave trees spaced much further apart than 15 m.

There are other practices in the Boundary that are problematic for the ecosystem, including the increase in logging to make pulp that is burned to make electricity and fire 'mitigation' measures that are actually increasing fire risk (see BFWSS Field Report).

Figure 12 A clearcut in the Boundary watershed demonstrating how few trees have been left as mother trees. July 2020. Photo courtesy Jennifer Houghton.

Affect of Clearcutting and Climate Change on Regeneration in Douglas Fir Forests

There are Interior Douglas Fir forests throughout the Boundary (a map can be found **here**).

A 2020 Forest Practices Board investigation found that *clear-cutting and climate change are a threat to fir reforestation* in the dry interior Douglas-fir (IDF) forests. The FPB reported that seedlings are being deprived of the moist shade they need in order to grow in hotter summers. Over-reliance on clearcutting was one of the reasons for the poor regeneration success.

The FPB reported that while best management practice guidelines were available, forest professionals and forest workers did not always follow them (2020a). Once again, we see problems when there are no legal requirements to protect ecosystems.

RECOMMENDED ACTIONS AROUND AAC, ECA, CLEARCUTTING

It is too late to undo the ecological and economic damage done by the clearcutting and overcutting that has already occurred in the watershed. The outdated and incorrect AAC determination is incongruous with the 2018 catastrophic flooding event, overall increased flooding of the past few years, forests losses due to fire, insects and disease, the massive amount of logging over the past 20 years, and is conceivably dangerous to the local community in an era of climate volatility. Given all these uncertainties and potential inaccuracies, immediate action must be taken.

In the words of Anthony Britneff, "…a truthful and honest assessment of what our forests contain is fundamental to making Allowable Annual Cut (AAC) determinations" (Britneff and Watts, 2018).

AAC determinations carry a risk of serious or irreversible harm to local economies and to ecosystems and therefore require use of the best available knowledge.

For the Boundary TSA, it is essential that inventory is reviewed for accuracy, the Timber Supply Review methodology used in support of AAC, and the AAC determination be reviewed immediately. (The last AAC calculation was done prior to the 2018 flood and is not required again until 2024.)

1. The Boundary TSA AAC must be immediately reduced by at least 30% to bring it to the what the province considers to be a 'sustainable' level.

2. Immediately undertake a study to determine how much to further reduce the AAC to bring the ecosystem back to a functioning state.
3. Mandate the use of the most recent technology (such as LiDAR) and up-to-date information to calculate inventory.

5. Mandate baseline hydrological assessments in all watersheds before any new logging can take place. Assessments must determine if logging has contributed to increases in the frequency, duration and magnitude of peak flows, increased sediment transport, and how it may contribute to further severe flooding events. If so, pause or decrease logging accordingly.

6. Hydrological assessments must be based on standardized science and performed by independent scientists not in the employ of licensees.

7. The Province must mandate methods that licensees use for ECA calculations that are appropriate to the local watershed conditions.

8. Pause logging in areas with ECA higher than 25% until the ECA is at 15%.Government must mandate that any increase in cutblock size more than 25% above 40 ha must be adjudicated by an independent professional not in the employ of the forest industry.
9. Mandate that further logging is not permitted in watersheds/sub-watersheds that have been clearcut until that watershed/sub-watershed has resumed its ecological function.

10. Forests in the Boundary must no longer be logged faster than they grow back.[8]

11. Immediately undertake a pilot project in the Boundary that utilizes selection logging instead of clearcutting.

12. Mandate that licencees must manage forest resources in a way that prioritizes the public interest over private interests (typically profit).

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[8] Forestry students know this is as the growth/depletion performance ratio. (Mean annual increment) X (Hectares of young forest in the most recent year) compared to the actual volume logged in that year (depletion – scaled data plus waste assessment data). Data to determine this performance ratio is available from existing forest planning data. When this ratio is less than 1.0, this forest is not being managed sustainably, and corrective action is required.

Ecological Risks of Continuing with Current Forest Management System

Flooding and Impaired Hydrological Function

Impacts of Flooding on the Community

In May of 2018 Grand Forks was hit by 'the most catastrophic flood BC has ever experienced' (a phrase used by the BC government). In addition, the Boundary has suffered three higher than average level flood seasons since 2017. To put the 2018 flood level into historical perspective, in the 1930s, peak flows in the Kettle River were around 25,000 cubic feet per second, in the 1950s to 2010 around 30,000 cubic feet per second, and in 2018 the peak flow was around 49,000 cubic feet per second (Parfitt, Mar 13, 2019).

In 2018 there were approximately 400 homes in and around Grand Forks impacted by the flood, as well as dozens of businesses, multiple farms, ranches, and rural homes throughout the Boundary.

Figure 13 May 2018 flooded Grand Forks homes.

While the sum total of the long-term economic impacts of the 2018 flood on the local economy is unknown, the table below displays a portion of the monetary costs:

Table 4. The mounting costs of the 2018 Grand Forks Flood

Approximate costs of the 2018 Grand Forks flood:	
DFA [9]	$6,334,240
Business losses (at fall 2018)[10]	$39,000,000
Red Cross (at Apr 2019)[11]	$5,200,000
New Flood Infrastructure (DMAF)	$53,000,000
Buildings - Structural and Contents	$48,300,000[12]
RDKB flood response costs	$10,914,850[9]
Lost wages	$2,452,232[9]
TOTAL 2018 Flood Costs	**$165,201,322**

In addition to the above, there are ongoing business losses, including the long-term impact on retail traffic (lost sales) in downtown Grand Forks, costs to local governments, long term costs to homeowners, and losses to the overall economy due to flood victims leaving town. (For various reasons, a number of homeowners either did not have access to insurance or DFA and were not able to rebuild.) It is estimated that there has been a significant decrease in property values of up to 39% as a result of the 2018 flood for those homes and businesses that were flooded (Nor-Ex Engineering, 2019).

There is a $53 million flood infrastructure project that will not be completed for years and will only protect parts of the Grand Forks downtown area. This will leave many homes, businesses, and farms at serious risk for future floods.

[9] DFA: Disaster Financial Assistance provided by the BC government. Statistic is from British Columbia Economic Development Association report, 2018

[10] From BCEDA, 2018

[11] From BCEDA, 2018

[12] Nor-Ex, 2019

And the potential for future flooding is high. The Province's 2019 *Preliminary Strategic Climate Risk Assessment* predicts increasing severity and occurrence of floods across BC. A MFLNRORD report stated that climate change projections for Kootenay Boundary include (2016a):

- greater risk of flooding during extreme weather events
- rapid snowmelt periods
- possible altered timing and magnitude of floods
- possible increased streamflow flashiness, sediment delivery, and channel instability
- the possibility of current 50-year floods becoming 5-year events

The Connection between Forests, Floods, and Hydrology[13]

Hydrology examines how water cycles and is distributed. Three key elements in hydrology are quality, quantity, and timing of flow.

Although soil and water move around naturally on a landscape, clear cut forestry activities accelerate these rates. Forestry's hydrologic impacts are becoming more and more severe as climate changes and more clearcuts are added.

In a 2020 discussion about the relationship between BC forests, clear cut forestry, and hydrology, Martin Carver, Hydrologist and Fluvial Geomorphologist, described how the functioning of forests affect water quality, quantity, and timing of flow:

1. forests minimize sedimentation
2. forests moderate the flow regime
3. forest canopy intercepts snowfall and causes it to sublimate (change from solid to vapor)
4. live tree roots keep soils in place on steep ground
5. intact soils store base flows of water
6. forests are a natural filtration system

Old forests perform significant hydrological functions. They protect streams and stream banks and stop them from destabilizing; and, are better able to withstand wildfire (thus keeping forest structures intact).

[13] For an excellent summary of the 2018 Grand Forks forestry and its relationship to forestry see: Sprawling clearcuts among reasons for B.C.'s monster spring floods, Parfitt, B., Mar 13, 2019, https://thenarwhal.ca/sprawling-clearcuts-among-reasons-for-b-c-s-monster-spring-floods/. Also see the presentation Forests, Forestry, Floods by Herb Hammond and Fred Marshall. https://www.youtube.com/watch?v=VWTta19epcM

In the mountainous province of BC, forests have stabilized landscapes and kept material from moving for centuries, but now "with forestry, we dig up the ground with roads and we concentrate and redirect water, we cause surface erosion and land sliding, and material is remobilized"(Carver, 2020)

Many stresses brought about by climate change will be compound the stresses that clearcut forestry brings about. When you add them together they result in more severe outcomes, particularly when the level of road building and compacting of soil by skidders is significant. "With climate disruption we are seeing increased drought, flooding, wildfires; and in forested watersheds the typical outcome of that would be higher peak flows [and] earlier peak flows. When climate change and clear cut logging work together they cause significant outcomes with escalating magnitude." (Carver, 2020)

Carver pointed out the two largest hydrologic effects of industrial clear cut forestry: sedimentation and changes to the flow regime.

In clearcuts:

- snow melts faster
- road ditches redirect water to streams faster
- changes associated with logging lead to hydrological changes like higher peak flows, earlier peak flows, and lower low flows.

Peak flow is the maximum flow rate that occurs within a specified period of time, usually on an annual or event basis. Increases in peak flow can cause major flooding events. In the Boundary, the spring peak flow, generated primarily by snowmelt and rain-on snow, is the single largest hydrological event.

Clearcut zones accumulate 30 to 40% more snowpack than intact forests and snow melts 30 to 40% faster on clear cuts than in intact forests (Hammond 2019).

The level of disturbance (disturbance defined as clear cut logging, other human activity, plus fires, disease, or insects) in a watershed impacts stream flow, sediment delivery, channel stability, riparian function, and aquatic habitat. Field observations confirm that these impacts are happening on a widespread basis in the Boundary watershed.

Examples include a major road washout at the 'Shopping Centre site' on Boulder Creek Forest Service Road (at 6km), as well as myriad road maintenance issues (see Appendix G for the BFWSS 2019 roads report). During the 2020 spring freshet, the Arthur Creek bridge was lifted up and carried 1 km downstream due to the extreme high water levels and velocity (see BFWSS field report).

In 2018, there was a major land slide at West Boundary Creek located downslope of clearcut logging. In addition, long time local fishermen have observed: (1) the recent formation of 'islands' in the Kettle River that did not exist prior to 5 years ago, and (2) The level of river bottoms in the valley basin are rising due to increased sediment delivery.

Figure 14. Islands forming in the Granby River. While it is true that rivers naturally change over time, there is increased sediment coming into the rivers from clearcut logging in this watershed. The amounts and full impact of the sediment are unknown until a thorough hydrological assessment is done of the watershed. Photo courtesy Stan Swinarchuk.

A 2020 hydrological model designed for the Kettle River watershed found that "increasingly large forest disturbance can have substantial impacts on both average peak flows and large destructive floods" (p. 1. Chernos, et al, 2020).

The report concluded, "Under increased forest disturbance, median and extreme peak flows increased. Scenarios that disturbed higher elevations had approximately double the flood response relative to disturbance at lower elevations. Finally, 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 disturbance increase average peak flows and the probability of large, destructive floods. In addition, the location and elevation of the disturbance is an

important consideration in determining in the hydrologic response experienced, where the hydrologic effects are greater at higher elevations." (Chernos, et al, 2020, p. 28)

See Appendix H for additional information related to re-growth rates of logged areas and how fast logged areas regain hydrologic properties.

To give an indication of the relative impact of fires versus clearcutting as a 'disturbance' in the Boundary watershed: medium-high severity burned areas from 2015 to 2017 cover 1,920 ha compared to 21,754 ha of clearcuts (Source: BC Stats). Like post-fire landscapes, clearcut zones are devoid of vegetation and are vulnerable to flash flooding, mudslides and debris flow. In this example, it is clear which one contributes more.

Other literature and studies linking forestry and flooding includes:

- Forest disturbance has been shown to increase the likelihood of very large peak flow events (ie. 100-year return periods) which can cause flooding with potential impacts on infrastructure and human life (Schnorbus, M. & Alila, Y. 2004)
- Deforestation consistently causes more floods – both big and small. The amount of water flow into streams is not only dependent on how much snow falls; it is also dependent on the speed of the snowmelt. When trees are removed, the snow melts faster (Green, K., Alila, Y. 2012).

Figure 15 Snow accumulating on high elevation clearcuts in the Boundary. Photo courtesy Stan Swinarchuk.

Streams are Not Functioning Properly

In the Boundary watershed in 2017, the Forest and Range Evaluation Program (FREP) found that 36.9% of all streams sampled were not properly functioning and/or at high risk after harvesting by the forestry industry; and that, this riparian damage is due to insufficient regulation, enforcement, incentives, and awareness in forest management (BC FLNRORD FREP 2017).

Another FREP report stated that: "Logging was the main impact for the 13 "high" or "medium" impacted streams, with low retention, falling and yarding and machine disturbance being the main causes. Sediment from roads also impacted 5 of the 13 "high" or "medium" impacted streams (BC FLNRORD FREP 2013).

In 2019, a government pilot project was completed in the Kootenay-Boundary region to develop and test a methodology for evaluating riparian/stream condition at a watershed scale. In the Kettle River drainage, the Boundary and Rock Creek treatment watersheds were found to be not properly functioning. The level of impairment was significantly higher in these two watersheds compared to all the others in the study, mainly due to a high amount of human-caused riparian disturbance. (Nordin, 2020, p. v). In each of the Boundary Creek and the Rock Creek watersheds there are more than 100 road crossings over streams (Nordin, 2020).

A complete and thorough study of the hydrological functioning of the Boundary watershed has not been conducted – only small segments have been investigated. The level of functionality of the entire watershed is therefore unknown but many indicators signify that it is at risk.

While one branch of FLNRORD is warning that streams in the watershed are not functioning, the Chief Forester's Office is not applying these warnings to the determination of the AAC, nor is there any compliance or enforcement being done to ensure licensees are adapting practices appropriately.

A Tool for Improving Forest Management and AAC Determinations

The ecological term "proper functioning condition"(PFC) of a forest defines the percentage of its area that is functioning properly, at risk, and impaired. PFC is a state of resiliency, for example in the case of riparian areas, that allows an area to produce desired values, such as waterfowl habitat and forage (Prichard, 2003).

The Chief Forester says one of her objectives is to assess relevant forest practices in AAC determinations. The concept and process for determining the base case in setting the AAC would be significantly improved if there was a classification of watersheds into (1) functioning properly, (2) at risk, and (3) impaired. A tool for doing this already exists in the form of PFC assessments.

PFC assessments would provide an ecological base case for further analysis, planning, and setting the AAC. PFC assessment is a qualitative assessment based on quantitative science. It refers to a "consistent approach for considering hydrology, vegetation, and erosion/deposition (soils) attributes and processes to assess the conditions of riparian wetland areas" (p.1, Prichard, 2003).

The USDA Natural Resources Conservation Service, in the USA, has developed a method to evaluate the condition of riparian wetland areas using PFC assessments. This tool could be adapted could be adapted for use by the BC Chief Forester to provide an ecological base case for setting the AAC. See Appendix I for more details.

RECOMMENDED ACTIONS REGARDING FLOODS AND HYDROLOGY

1. Government must conduct in depth hydrological assessments using actual field data (not modeling) for watersheds/subwatersheds currently scheduled and targeted for logging in the near future before any further logging is done. The assessments must determine if logging has contributed to increases in the frequency, duration and magnitude of peak flows, sedimentation and sediment transport, and how it may contribute to further severe flooding events.

2. The Chief Forester use a Properly Functioning Assessment tool to provide an ecological base case for further analysis, planning, and setting the AAC (see example in Appendix I).

Risks and Impacts of Climate Change

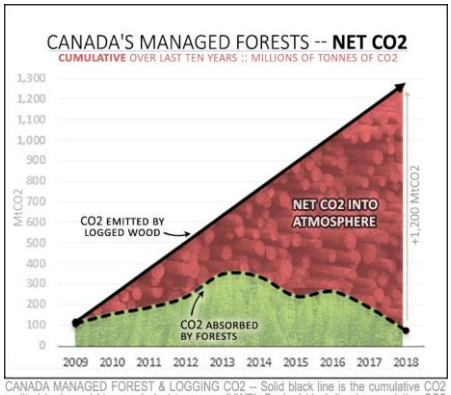
The Link Between Climate Change and Forests

Forests play a crucial role in mitigating climate change. They help to moderate the influence of water flow, changing temperature, and increasing carbon dioxide emissions.

Forests remove carbon from the atmosphere and store it as above- and below-ground organic matter (living and dead) (Pojar, 2019.) "Climate scientists generally agree that maintaining intact, natural forest ecosystems is an important way to mitigate the impacts of global warming/climate change" (Hammond, 2014). Reduced deforestation and rapid reforestation are considered the most effective approach for mitigating climate change (Simard et al, 2020b).

Across the planet, forests used to be healthy enough to absorb more CO2 than they produced but that is no longer the case. The Council of Canadian Academies, which identifies forestry as one of the top six areas of risk in Canada from the effects of climate change stated, "The rate at which forests are anticipated to change is estimated to be beyond the natural capacity for forest species to sufficiently adapt," the report warns (Council of Canadian Academies, 2019, p. 24).

Figure 16 Canada's Managed Forests Net C02



CANADA MANAGED FOREST & LOGGING CO2 -- Solid black line is the cumulative CO2 emitted by logged biomass in last ten years (HWP). Dashed black line is cumulative CO2 absorbed by Canada's managed forest lands (net flux). Data from National Inventory Reports 2019 & 2020, with full time series for some values provided to author by Environment Canada. CHART by Barry Saxifrage at VisualCarbon.org & NationalObserver.com. October 2020

Overall, Canada's forests actually emit more carbon than they absorb. Over the past 10 years, logging emissions from Canada's managed forests add up to over 1,200 million tonnes of CO2 (MtCO2). (Barry Saxifrage. Using data from National Inventory Reports from 2019 and 2020, with some values from Environment Canada,)

During the same period, managed forests absorbed less than 100 MtCO2. This is less than one-tenth of what the logging industry emitted. (See graph). (Saxifrage 2020)

As a combined result of climate change logging activities, such as clearcutting, road building, and slash burning, BC forests are turning into carbon emitters rather than carbon sinks. This is because more is being cut than is being put back (or growing back).

Conditions in the forest are now such that annual carbon emissions from forest management in BC are nearly three times higher than all the Canadian oil sands projects combined (Broadland, Aug 2020).

The *removal* of forests from clearcutting is not the only way that forest management plays a role in the climate crisis, however. Changes to forest *composition* have also reduced BC forests' ability to store carbon. "Logging primary, mature, and old forests and converting them to secondary, managed forests can reduce total carbon storage by 40-50% or more…" (Pojar, p. 1). Old forests store more carbon. A map of the harvesting in the Boundary watershed clearly shows how little of the forested area is now over 50 years old (see map on page 53).

Climate Crisis in Boundary forests

In the Boundary, significant ecological change due to climate change has already been observed. Climate change is stressing forests through higher mean temperatures, longer-lasting droughts, and more frequent and extreme weather events (FLNRORD 2016). Stress –

both natural and human caused - further diminishes our forests' capacity to moderate climate change. It is a vicious cycle.

Climate derived ecosystem changes are already happening and are having a marked impact. The climate in the Boundary region has already changed noticeably over the past hundred years and is expected to continue to change. (BC MFLNRORD, 2016)

Climate change projections for Kootenay-Boundary region include (BC Ministry of Environment, 2019. BC MFLNRORD, 2016):

Precipitation

- Winter, spring, fall - will increase by 10-25%
- Summer - will decrease by up to 30%
- Snowpack will decrease at lower elevations
- Snowpack may increase at high elevations
- More rain on snow events [that can cause accelerated runoff]

Floods

- Greater risk of flooding during extreme weather events and rapid melt periods
- Possible altered timing and magnitude of flood risks
- Cumulative effects may increase streamflow flashiness, sediment delivery, and channel instability
- Earlier spring and summer peak flows
- The possibility of current 50-year floods becoming 5 year events

Fire

- A significant increase in fire frequency
- More frequent, severe, and extensive wildfires in areas that become very dry

Drought

- increased drought probability
- Potentially significant moisture stress for tree species. [This is already being seen in cedar in the Boundary.] As a result, tree regeneration will be increasingly difficult in many low elevation areas
- Drought stress will make trees in the region more susceptible to a wider range of insects and disease

Species, Habitat, Biodiversity

- Many tree, plant, and animal species in the region are already in decline
- Habitat is already degraded and fragmented by past human activities
- Extinction threat is likely to increase for species already in decline due to habitat loss
- Few species and ecosystems will be unaffected by climate change
- Species may die out, move, or be displaced by encroaching species

Trees

- Tree mortality is expected
- Some dry ecosystems may shift from forest to grassland
- "Western red cedar is also showing significant declines on drier sites due to moisture stress. Significant declines of these tree species have unknown implications for ecosystem function." (BC MFLNRORD, 2016)

The 2016 Kootenay-Boundary BC Government Extension Note asserted that "Salvage harvesting following wildfires and insect infestations can exacerbate impacts of fragmentation and climate change." (BC FLNRORD, 2016).

These threats make the protection of primary and old forests that capture and store water better than younger forests and clearcuts in the Boundary even more critical.

What the Province is Doing and What should be done in Boundary Forests

There is a large body of scientific literature that documents the impact that industrial logging has on the severity and frequency of many of these climate risks (Wood). The BC government has important work to do to ensure that forests are managed responsibly in the face of climate change.

In a 2018 report, the Office of the Auditor General of BC, asserted that "the B.C. government is not adequately managing the risks posed by climate change. " (p.4) government is not adequately managing the risks posed by climate change. " (p.4)

The Auditor General report noted that, "Adaptation is not incorporated into key legislation – the Forest and Range Practices Act, or the Forest Planning and Practices Regulation. As such, licensees are not legally required to include adaptation in Forest Stewardship Plans (FSP). There is a risk that use of this model may not be sufficient to ensure that FLNR's climate adaptation goals are met."(P. 110, 2018).

The Auditor General recommended that the BC government respond to climate change via both mitigation and adaptation; and, that the BC government include climate change considerations in legislation, regulation, approvals and permitting processes.

In 2019, the BC government introduced the Clean BC plan, as part of the province's goal to cut GHG emissions by 80 percent by 2050. However, the plan lacks specific measures to reduce forest carbon emissions and it does not mention forest conservation or reductions in logging at all. In addition, the Forests Ministry has made no public assessment of the impact of forest management on climate change.

A report authored by Dr. Peter Wood says the provincial government can mitigate climate related disasters like flooding, droughts, fires and heat waves by swiftly reforming the province's forestry practices and protecting and restoring intact forests (2021).

It is unacceptable that BC's current Chief Forester has rejected the view that including the likely consequences of climate change as part of her AAC determinations is necessary. For example, in a 2019 timber supply review for the Lakes TSA, she very bizarrely stated that the uncertainty of climate change means that the AAC determination cannot take into account the uncertainty of climate change (as seen in Broadland Aug 2020).

As noted above, the inventory models used by the BC Forest Inventory and Analysis Branch (FAIB) cannot account for climate change and often rely on outdated data. This is wilful blindness. At the same time as MFLNRORD scientists are reporting that BC forests will likely experience increased tree mortality, reduced growth in dry ecosystems, and reduced utilization due to climate change, the Chief Forester and FAIB are not taking climate change into consideration when determining inventory numbers or AAC.

RECOMMENDED ACTIONS REGARDING CLIMATE CHANGE

1. Since the BC government 2016 report on climate change in the Kootenay-Boundary is entitled "*Adapting natural resource management to climate change in the Kootenay Boundary Region: Considerations for practitioners and Government staff*" the Province must mandate that forestry practices are enacted according to the sombre statements made within that document.

2. It is a public sector function to ensure that climate change is factored into the management of public forests. It must not be an optional practice that is merely

recommended to professionals. Practices reflective of climate change impacts must be legally mandated by forestry legislation and policy.

3. Lack of full scientific certainty about the potential effects of climate change on Boundary forests require the immediate application of the precautionary principle in every aspect of forestry, including determination of the AAC.

4. Regarding CO2 emissions, the safest overall policy option is to require logging emissions to not exceed what managed forests absorb. This strategy would mean putting an end to the logging of old growth and primary forests in the Boundary. There must be a shift to the logging of second growth only (where selection logging is used across the majority of the areas rather than clearcutting.)

5. Immediately cease the practice of clearcut salvage logging in pine-mixture stands with other tree species. Selection logging to remove the dead pine would be acceptable where machine use would not initiate erosion or compaction. The intent should be to leave as much of the forest structure intact as possible and to permit the live trees that remain to expand into the growing space of the trees removed and to recover their former vigor.

6. Stop logging within 100m of riparian zones (due to the risk of drought and the importance of water). [14]

7. Slash piles – cease the practice of burning slash piles. Instead of creating slash piles, leave the logging debris distributed across logging sites.

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[14] See Failure to Enforce: How Canada Allows BC Logging Companies to Destroy Salmon Habitat, Natural Resources Defense Council, April 2001, Accessed here: http://www.vancouverislandwaterwatchcoalition.ca/cgi-bin/show_article_attachment.cgi?TY=ar&ID=3156&F=Failure_to_Enforce_NRDC.pdf&X=1541062542000/Failure_to_Enforce_NRDC.pdf

Figure 17 Slash pile and clearcut in the Boundary 2019. Photo courtesy Stan Swinarchuk.

Problems from Forest Roads in the Boundary

There are now over 16,000 km of forest roads in the Boundary and more are being built. This proliferation of forest roads in the Boundary is wreaking havoc on ecosystem function, structure, and composition. Multiple reports indicate the innumerable problems with forest service roads in the watershed, including reports about the devastating consequences of road density on grizzly bear populations and the ways that roads are negatively impacting streams. BFWSS conducted a report on roads in the Boundary watershed in 2019 that is summarized below.

BFWSS Forest Service Road Report

BFWSS members with decades of forestry experience travel extensively throughout the Kettle River Watershed and observe road conditions. In spring and summer of 2019, BFWSS members

inspected 13 Forest Service Roads (FSR) in the Boundary TSA. Some were BCTS roads and some were corporate licensee roads. See Appendix G for the detailed report.

BFWSS found that all 13 roads were:

- inadequately maintained
- damaged by industrial use
- have suffered years of neglect

Common problems included: road lacking crown, berms left behind by graders, ditches fouled, culverts plugged, road surfaces washed and scoured, roads collecting water, lack of brushing, and bridge problems. Only one of the roads, Burrell Creek FSR, had been recently graded.

These seemingly small issues have the potential to create larger hydrological problems across the watershed in a cumulative manner. Properly built, regularly maintained roads can mitigate some of the problems.

According to the BC Auditor General, Forest Service Roads (FSR) lack safety and risk the environment. The 2021 audit on the management of FSRs concluded that the FLNRORD did not manage safety and environmental risks on FSRs in accordance with its policies. In 2019-20, the BC natural resource districts received only about 25% of their budget requests for maintenance on roads they had deemed as priority. Plus, about $9 million worth of high-priority maintenance and repair work was unfunded (2021).

It is interesting to note that government practiced road closures and deactivation before Professional Reliance was entrenched by policy in 2003.

Negative Impacts of Forest Service Roads

1. Hydrological impacts

A survey of literature and scientific studies shows considerable links between hydrological problems and forest roads:

- Soil erosion and surface erosion bringing more sediment supply to water courses
- Soil compaction increases erosion and transport
- Reduced soil infiltration rates where roads are built
- Increased slopes accelerate water movement
- Removal of the vegetative cover that impedes water flow
- Reduced interception of subsurface flow important to maintaining late summer stream flows.
- Increased sediment transportation as a result of increasing the volume or the velocity of storm runoff (Grace, 2002).

There is also the problem of significant slope failures and landslides due to the combination of road building and clearcutting. See photo of West Boundary Creek landslide below.

Figure 18 West Boundary Creek slide with clearcut logging at the top of the mountain. Photo courtesy Daniel Pearce.

2. Riparian areas

Numerous studies indicate roads near watercourses cause problems in riparian areas, including losses in riparian habitat and tree cover that can affect water temperature (Bowler, Mant, Orr, Hannah, & Pullin, 2012), the presence of wildlife (Gyug, 2000), and sedimentation affecting water quality (Rashin, Clishe, Loch, & Bell, 2006). (As cited in: Kettle River Threat Assessment, Coleshill, 2017).

Poorly constructed and maintained roads can cause significant environmental changes to aquatic systems both close to the activity and further downstream. Elevated levels of sediment input (when sediment inflow exceeds the background level) and turbidity caused by logging activities and road construction can jeopardize the survival of aquatic organisms (Birtwell, 1999).

The Kettle River Threat Assessment (Coleshill, 2017) lists problems in riparian areas in the watershed and makes recommendations for improvements to practices. BFWSS fully supports the recommendations. Here are some of the specific concerns around forest service roads:

- With over 10,000 stream crossings in the Boundary, resource roads increase the impact of disturbance related to sedimentation and habitat fragmentation.
- Logging and road building allows more access for livestock and off-road vehicles to riparian areas and watercourses, creating greater risks of riparian vegetation degradation, erosion, and sedimentation. This results in negative cumulative impacts on the watershed from multiple activities.
- Road establishment, improper use and maintenance, and insufficient removal and remediation have lasting impacts of sediment delivery at stream crossings.
- Loss of stream function combined with impacts from roads and development at stream crossings creates cascading downstream effects.
- 221 km of resource roads within riparian areas are on unstable or potentially unstable terrain.
- 5107 km of resource roads are within stream riparian areas, with an associated density of 1.93 km/km
- 2407 km of roads are within wetland riparian areas, with an associated density of 2.03 km/km2.

3. Damage to Soils

- Reduction in soil productivity
- Accelerated soil erosion
- Soil displacement and compaction (forms of soil degradation)
- Soil erosion may result in nutrient loss

There is no government approval required for road permits. Forest Stewardship Plans (FSPs) are the only operational plan approved by government. These plans do not identify where logging and road building will occur. Road density standards are voluntary in the Boundary TSA.

Citizens have no ability to review road permits prior to construction. Members of the public may file roads complaints to the Forest Practices Board after the damage has been done. Although the Board must investigate them, its recommendations are not legally binding.

Pass Creek Hydrology Report

The circumstances surrounding the Pass Creek Hydrology report are a good example of the problems facing the Boundary forests. Pass Creek, which flows into the Granby River, is located north of Grand Forks. The area has been logged extensively.

Figure 19. The Pass Creek watershed area has been extensively clearcut both recently and over the past few decades. Clearcuts appear as grey/beige and light green. The Granby River is on the right of the image. Google Earth image.

In 2019, Statlu Environmental Consulting was contracted by British Columbia Timber Sales (BCTS) to do a hydrology study of the Pass Creek drainage and its associated drainages. BCTS plans to log in this drainage over the next several years. A typical forest hydrology study predicts the impact of logging on the water as it moves through the drainage.

Statlu carried out their fieldwork in the fall of 2019. In January of 2020 they provided their report to BC Timber Sales (BCTS.) The report identified serious problems the roads could have on the hydrology in the watershed.

> For example, ““The second source of hydrologic risk to the watershed is posed by the existing road system. …. many sections of the road network in Pass Creek have substandard drainage management.
>
> …Ditches do not have sufficient capacity to contain water and are blocked or non-existent in places, so diverted water runs down and erodes road running surfaces, removing fine sediment in the sand and gravel range.
>
> … These road sedimentation issues are localized in some parts of Pass Creek and Rock Candy Creek. They present moderate risk to water quality in Pass Creek, particularly to domestic water licenses.
>
> … Some of the existing roads in the watershed present moderate hydrologic risk to downstream water. Specifically, segments of main roads in Pass and Rock Candy Creek are close to the valley bottom streams, and some road ditches and drainage networks

> are either not present or not adequately maintained. As a result, fine sediment is generated from the road network and reaches the streams." (Brayshaw, 2020)

BCTS staff visited the drainage in the spring of 2020 and pointed out some minor road problems and brought them to an operator's attention for action. Following that field trip, no further action on the road problems identified in the report appear to have been taken by March 2021. BFWSS contacted BCTS in September 2020 to follow up on the road repair work and was informed that due in part to COVID restriction on BCTS '*working communication relationships'* (R. Hanson, personal communication, 2020), detailed planning on road repair work was delayed.

In November 2020, BCTS advised a BFWSS Board member the roadwork would be held over to be performed next season. The Board member responded to BCTS expressing frustration over the year long delay (which will include another freshet season) in having the work completed. To date, BCTS has not responded. A BFWSS member who is familiar with the terrain at Pass Creek predicts the road system will wash out in at least two places in the spring.

The Pass Creek road problems have the potential to contribute to increased erosion, sediment being carried into streams and rivers, culvert and bridge blowouts, and problems for residents downstream. The cumulative effects of the Pass Creek and other site problems have the potential for causing serious hydrological dysfunction in the watershed.

As indicated above, roads play a major role in forest hydrology, including the fact that they are bare, unvegetated surfaces, mostly on steep grades. Road impacts on hydrology can be mitigated by proper construction, regular maintenance, and vigilant observation. This is where BCTS and timber licensees are falling short in the Boundary.

To date, the government has not undertaken a study to find out if decades of road neglect and road problems in the Boundary watershed did or did not contribute to the catastrophic 2018 flood.

Cumulative Effects of Forestry

Cumulative effects are the incremental changes in forest condition caused by humans (e.g. roads, clearcutting, etc).

Both the Forest Practices Board and the BC Auditor General found that the Province is not addressing cumulative effects effectively. In 2014 the FPB noted that of 31 professional watershed assessments studied by the board, not one "fully evaluated" the "cumulative hydrological effects" of logging operations in community watersheds.

In 2015 the BC Auditor General's audit of MFLNRORD concluded that the government did not give the ministry "clear direction or the powers necessary to manage cumulative effects when deciding on natural resource use".

What citizens of BC need is legislation that requires performance *outcomes* not *methods*. Outcomes are the actual consequences of actions. Without knowing the consequences of forestry actions, claims of practicing sustainable forest management cannot be relied upon.

Forest Road Impacts On Grizzly Bears In The Boundary

The circumstances of the Granby grizzly bears serve to represent the plight of all wildlife species in the Boundary. Ecosystem failure is impacting other species in the same ways.

In 1999, Dr. Brian Horejsi, wildlife and ecology scientist, published a report on the endangered grizzly bear population in the Boundary. At that time, he estimated that there were fewer than 50 and possibly as few as 30 bears greater than 2 years of age in the study area, which covered most of the eastern portion of the Boundary watershed, including Granby and Gladstone Provincial parks (Figure 22 for map). He concluded that there is imminent danger of genetic and demographic isolation of the Boundary bears.

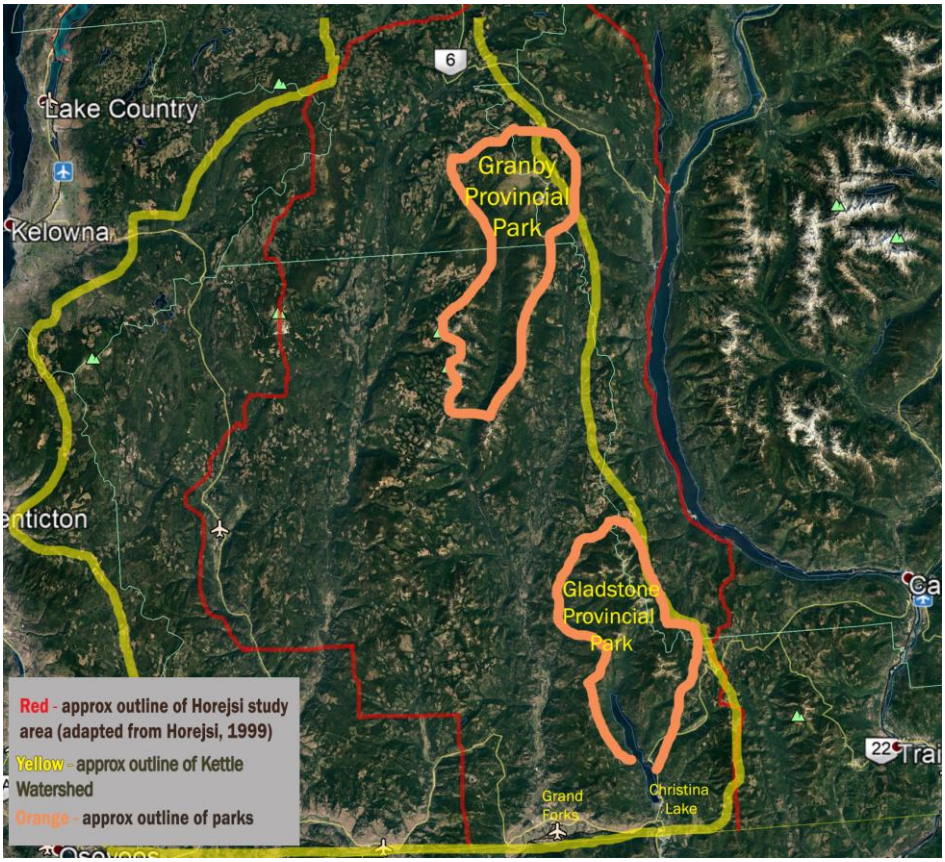


Figure 20. Outline of Horejsi grizzly study area, Boundary watershed, and Granby and Gladstone Provincial Parks.

Horejsi stated, “The human industrial endeavor that presents the greatest threat to bears and bear habitat is roads. Roads bring people to bear habitat with lethal consequences for bears; mortality can be up to 4 times greater than for bears that avoid roads. Roads also leave an ecological and behavioral footprint that displaces bears and disturbs the dynamics of bear - habitat interaction. Effective bear habitat and viable bear populations cannot be maintained without a comprehensive long-term strategy based on 1) protection of large wilderness (roadless) areas combined with 2) a short-term road density limit objective of 0.62 km\km2, leading eventually to 3) a long-term road density limit of 0.4 km/km2 necessary for long term persistence.” (p. iv, 1999)

Figure 21. A grizzly running from humans in the Boundary. Photo courtesy Wayne Tblus.

Horejsi noted, “The Boundary Study Area is fragmented by an extensive and intensive road system…. Although the physical footprint of this road system may seem small, the negative role the road system plays in the ecology and behavior of grizzly bears extends and intensifies the ecological footprint dramatically.” (p. 23, 1999)

And “Roads and the human activities associated with them produce a Zone Of Influence (behavioral and ecological footprint) that bears respond to behaviorally. The most common reaction is avoidance (leading to displacement) but disruption of activity within the ZOI is also common. “ (Horejsi, p. 28, 1999)

Horejsi made a number of recommendations to protect the Boundary grizzlies, including specific ones regarding road building: “Establish a short-term Road Density goal of 0.62 km/km2. The long-term goal will be about 0.4 km/km2” and “Initiate an active road retraction program to achieve the short-term road density goal within a few years.” (p. viii, 1999)

And yet, years later, “based on road data from 2012, approximately 61% of the range of Kettle-Granby population has road densities of over 0.6 km/km2[1]” and that “current science indicates that this is the threshold beyond which road densities would have a significant adverse effect on the population viability of grizzly bears”. (Ng, H. p.14, 2016)

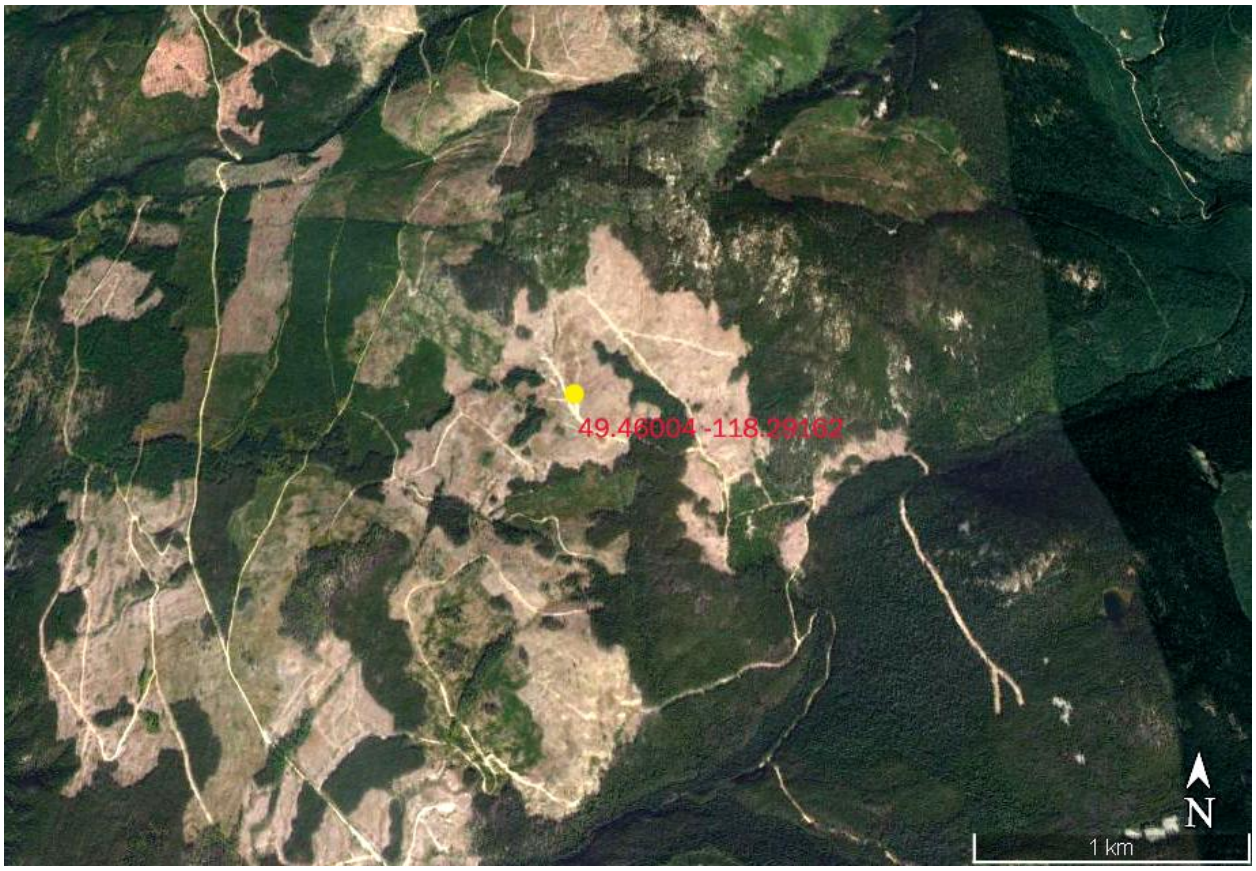


Figure 22 Extensive network of roads and clearcuts in a portion of the study area just north of Gladstone Provincial Park. Google Earth image.

Horejsi also recommended that all existing roadless areas be protected from any industrial or other human use.

Nonetheless, since the 1990s there has been continuous forest service road building and logging in the study area.

In 2017 the BC Forest Practices Board (FPB) concluded that the Kettle-Granby grizzly bear population is at risk and that "construction of industrial roads is a significant concern for bear management" (p. 3, FPB, 2017).

"Going back to the 1980s, studies have identified a link between roads and bear behavior and mortality. Roads create access for the public, including hunters; affect the movement and distribution of bears; influence bear behavior, body condition and survival; and contribute to fragmentation of habitat and bear populations.(p. viii). Although access management planning was identified as a priority focus in the [1997 Kettle Boundary Land Use Plan] strategy, "other than access closures in two areas near Granby Park, it did not happen." (p. 3, FPB, 2017)

The FPB summarized its findings as such: "We found that government did not make road density targets a legal requirement in GAR Order 8-373, due to industry concerns about increased delivered wood costs. Government did not complete several planning initiatives and licensees did not implement the road density targets because they were not a legal requirement. The result is that road density continues to exceed the recommended targets in much of the area despite the identified risk to the grizzly bear population.

We are concerned that road densities exceed recommended targets in the specified area and have increased in some areas, despite the policy direction established by the statutory decision maker in the order. Licensees did not follow the standards because they are not legally binding". (p. i-ii, FPB, 2017,)

WHAT HAS HAPPENED WITH BOUNDARY GRIZZLIES AND ROADS SINCE THE 1990s

See Appendix J for a detailed timeline of government communication regarding grizzlies.

- The BC government has not implemented any of the Forest Practice Board's 2017 recommendations to protect grizzlies.
- Clearcut logging has continued to fragment bear habitat.
- No bear management plan has been created, despite the government 'committing' to one in 2018.
- Road density has increased.
- As at November 2020, there has been no monitoring of the population (District Manager, Selkirk District, BC MFLNRORD, personal communication, Nov 10, 2020).

Instead of effective protection, thus far, the government's ideas (rather than actions) have included:

- suggesting further subsidising of private companies using public money
- suggesting giving public sector responsibilities to the private sector
- conducting meetings to figure out how to engage the public to talk about roads
- suggesting that private companies not be held responsible for ecological problems caused by their activities
- the Chief Forester refused to address threats to grizzlies in the AAC determination

In 2017, the FPB concluded that the Kettle-Granby grizzly bear population would likely remain at risk until action is taken to reduce road density and reduce road use around valuable grizzly bear habitat (FPB, 2017).

Government has been putting corporate considerations over ecosystem values and the public good (which requires the presence of grizzly bears in the ecosystem) and stalling on any effective action that would protect grizzlies.

The government's response to a serious concern about a species at risk in the Boundary has, in essence, been to do nothing.

RECOMMENDED ACTIONS FOR ROADS

Many roads are in poor shape and in need of repair or maintenance. This is a condition that has been building over the last decade with no end in sight under the current government and forest industry operating policies and procedures. The Boundary region is in trouble without some changes in how forest management is carried out.

In regards to the 13 roads inspected by BFWSS in 2019 (see Appendix G), we ask that:

1. those who have used these roads for timber harvesting repair them, or close and deactivate them, and

2. all industrial use of these road systems be suspended until adequate remedial work is done

Operational

3. Build or re-build roads to the proper specifications before any hauling commences

4. Maintain ditches and culverts, deactivate roads, and restore natural drainage patterns as soon as possible after logging has ceased

5. Minimize sediment introductions from roads and ditches during construction, maintenance, logging, and deactivation

6. Ensure culverts are placed and spaced so that natural drainage is maintained

Overall Recommendations

7. Government implement and enforce all of the FPB recommendations from its 2017 report regarding roads and grizzlies in the Kettle-Granby (see page Appendix J)

8. Adjust road density guidelines so they are legally binding requirements (rather than recommendations) and place grizzly and other wildlife needs as the top priority for determining road density requirements.

9. Close non-legacy/secondary roads to public access once logging has ceased and planting is finished. (Legacy roads are the main roads through the drainage.)

10. Fully deactivate roads in sensitive wildlife habitat areas once logging has ceased and planting is finished.

11. Water in the ditches should be returned to the natural drainage patterns. This will permit the base flows of natural drainage and storage to return to the pre-logging condition (instead of ditch water directly flowing into creeks).

12. Adopt a no-net-new roads policy and strictly enforce it.

13. Create an approval mechanism for road permits.

14. Mandate a process by which citizens can view and give input on road permits prior to construction; and, mandate that licensees provide road location and construction specifications to the public on request.

15. Legislate a system for government authority regarding enforcement and non-compliance around road building, road maintenance, road deactivation, and road rehabilitation.

16. Immediately undertake studies to discover the ecological, economic, and social consequences of the extensive road system in drainages with ECAs over 30%, ensure that methodology, results, and data are freely available to the public.

17. Create an active road management plan and road ledger to provide information about the roads over their lifetime.

18. Fund adequate staff in the Boundary watershed to monitor and address road maintenance at the operational level (boots-on-the-ground).

19. Government must dedicate funding to ensure that all of the above is addressed.

Species at Risk

No Species at Risk Act to Protect What we Have

In 2004, the government designated grizzly bears as a species-at-risk under the Forest and Range Practices Act (FRPA). Astonishingly, BC is one of the only provinces in Canada without legislation dedicated to protecting and recovering species at risk.

Without meaningful legal habitat protection, the risks to wildlife from forestry activity cannot be mitigated through minor policy changes. BC must have species-at-risk legislation that has legal priority over forestry legislation.

There are significant risks to wildlife due to the infamous 'unduly clause' in FRPA, i.e. if wildlife objectives unduly restrict the timber supply, they are not taken into consideration in logging operations. This means that industrial logging can occur at rates that ignore species survival.

In addition, any existing biodiversity and wildlife management objectives that do exist in forestry policy and legislation will be ineffective because they were developed without considering climate change.

In the Regional District of Kootenay Boundary (which has significant overlap with the Boundary watershed area) the species at risk include[15]:

Table 5 Red and Blue Listed Species in Kootenay Boundary

Animals	**Plants**
52 red listed	35 red listed
106 blue listed	49 blue listed
Total 158 animals	Total 84 plants

Source: B.C. Conservation Data Centre, 2020
See Appendix A for full list.

[15] In BC, species and ecological communities are assigned to one of three lists, based on their provincial Conservation Status Rank (BC Conservation Data Centre) .

- Red-listed species and ecological communities are Extirpated, Endangered, or Threatened in British Columbia.
- Blue-listed species and ecological communities are of Special Concern (formerly Vulnerable).
- Yellow-listed species and ecological communities are secure.

Examples in the Kootenay-Boundary Regional District

Blue-listed species include: grizzly bear, wolverine, spotted bat, cutthroat trout, and sharp-tailed grouse.

Red-listed species include: American badger, pallid bat, burrowing owl, and Merriam's Shrew Monarch.

Logging Threats to Wildlife

1. **Fragmentation** of forested landscapes as a result of logging and roads reduces available habitat for vulnerable species and limits the ability of these species to move. Ecologically and behaviorally functional networks are required to ensure species survival (Horejsi, 1999). These networks were already being destroyed in the Boundary by industrial logging activities in the decades prior to 2000 (Horejsi, 1999).

There is an important wildlife corridor between the Granby and Gladstone Parks. Unless logging is restricted there, grizzlies and other species will slowly fade away in the watershed. See Figure 20 for the location of the parks.

2. Industrial logging impairs the **productivity of wildlife habitat**. Impacts are spread throughout the system in a cumulative way. A little bit of habitat destruction leads to a large negative impact on grizzly populations (Horejsi, 1999). This negative impact can be extrapolated to other species since they are all part of the same ecosystem.

3. **Extinction threat** is likely to increase for species already in decline due to habitat loss as ecosystems change in response to **climate change** (BC FLNRORD, 2016). This makes it even more critical to control the one factor that humans have absolute control over – logging.

The increase in species at risk, like COVID 19, is an early warning signal that excessive stress is being put on nature. By programming the near total elimination of mature and old growth forests in the Boundary, industrial clearcut logging is facilitating the destruction of biodiversity. **This must stop immediately.**

RECOMMENDED ACTIONS FOR SPECIES-AT-RISK AND GRIZZLIES

Government must:

1. Immediately implement the grizzly bear management plan in the Boundary watershed.

2. Take immediate action to reduce the road density to a limit of 0.4 km/km2 in the area of concern for grizzlies (as indicated on the map above). Make this a legally binding requirement.

3. Build no new roads in the area of concern (as indicated on map above).

4. Road construction, deactivation, and access controls must be guided by the science on grizzly bears in the area of concern, including finding ways to reduce road use in the entire Boundary watershed.

6. Use every opportunity to protect bear habitat. Legislation protecting bear habitat from logging must be written that overrides the 'unduly' clause in FRPA that enables licensees to prioritize the timber supply over grizzly survival.

7. Immediately appoint a regional lead (with a science background) to work directly with industry.

8. Due to the significant risk to the Kettle-Granby grizzly population, monitor the grizzly situation immediately and adjust legal requirements for protecting them (including road targets, habitat targets, connectivity targets).

9. Direct the Chief Forester to set the AAC at a level necessary to conserve biodiversity, sustain ecosystem function, and support viable grizzly bear populations. By supporting grizzly populations (a species for which there is data), other species in the watershed will also benefit and rebound.

10. Due to the detrimental effect of clearcut logging on habitat, productivity, biodiversity and connectivity, logging practices must immediately shift from clearcutting to selection logging in the area of concern. Logging practices must prioritize high levels of tree retention, habitat, and connectivity corridors to enable species survival.

11. Immediately create a Species-at-Risk Act for British Columbia.

Old Growth in the Boundary

What is old growth?

Old growth forests can vary according to location, species, forest structure, tree species, and tree size and age. While old trees in the Boundary are not the 10-foot diameter red cedars that people typically visualize, old and mature forests do exist in the region. In the Interior, the province of BC considers some types of forests old growth if they contain trees over 140 years old. The Boundary has trees up to 250 to 300 years old of different heights and diameters.

Figure 23 The edge of an old growth Cedar-Hemlock forest in the Boundary. Wayne Tblus and Stan Swinarchuk, BFWSS members, show appreciation for a hemlock tree that is about 250 years old. July 2020. Photo courtesy Jennifer Houghton

In the Boundary region, the old growth stands include high elevation Engelmann Spruce-Subalpine Fir (ESSF) forests that grow very old, but rarely reach the stature of lower elevation stands due to short seasons and soil conditions. These forests grow extremely slowly and once clearcut, run the risk of never growing back again due to the forces of climate change.

Figure 24 A high elevation old growth Sub Alpine Fir forest in the Boundary that was clearcut. The snowpack at this elevation used to get to about 15 feet deep. The growing season is extremely short. July 2020. Photo courtesy Jennifer Houghton.

Why is old growth important?

Old growth forests strongly influence important aspects of the hydrologic cycle (Franklin et al, 1998). Watersheds vegetated by old forests produce well-regulated flows of high quality water (Franklin et al, 1998). The structurally complex canopies not only accumulate deep snowpacks but also slow the melting of snow well into the summer months.

Ecologically, old growth forests include more than old trees. Precious and rich, old growth forests have complexity that includes dead standing and downed trees, multi-layered canopies with openings that allow light to hit the forest floor.

Glacier Donuts

Our resident 'old-time logger', Stan Swinarchuk, calls the ice circles that form underneath the canopy of conifers *Glacier Donuts.* Snow under the tree canopy melts then freezes repeatedly and becomes ice around the drip line of the tree forming rings of ice. Years ago, those ice donuts used to remain well into August. The ice would melt slowly back into the soil throughout the summer. Stan isn't seeing those glacier donuts so often these days.

Figure 25 Multi-layered canopy of a Cedar-Hemlock old growth forest in the Boundary. Photo courtesy Jennifer Houghton.

Old forests support diverse communities of plants, animals, and micro-fauna, and high quality habitat for specialized species, like woodpeckers, marbled murrelets, and spotted owls. "Ecologically, old growth forests are natural ecosystems that have developed sufficiently to include the structural complexity and functional values designed by a landscape's natural disturbance regime. Where natural disturbances are rare, the whole forest can be much older than their oldest trees. These forests replace themselves over time as small gaps open and fill with new young trees, providing a dynamically stable environment for centuries." (p. 16, Price et al).

Old growth is an essential component for the late stages of forest development. In order to be truly sustainable, forest management must include the four stages of development at the landscape scale (1) preforest (2) young (3) mature (4) old. (see Franklin's 4 stages below)

4 Stages of Forest Development (from Franklin et al, 2018)

Forest ecosystems undergo continuous development following a disturbance (such as fire, insects, or disease) in response to either internal or external processes. These stages occur at the scale of the stand or larger landscapes (for example, in the tens or thousands of acres). The sequence of development consists of gradual changes. The initiating disturbance makes resources available via standing and down dead trees and also leaves a biological legacy in the form of organisms and structures from the pre-disturbance patch or stand.

The 4 stages are labelled based on the level of forest maturation:

1. Pre-forest stage: trees are not the dominant form of plant life; openness or lack of overstory tree dominance; possibly a rich legacy of snags and logs; vegetative reproduction of surviving plants and establishment of new plants from both on site (seed banks) and off-site seeds, fungi, or bacteria; both annual and perennial species may dominate followed by shrubby species; often has high species diversity and rich variety of habitat niches, complex food webs (due to legacies or survivors from the pre-disturbance forest); warmer conditions; this stage ends when overstory tree canopies dominate the majority of the site

2. Young Forest stage: trees resume strong dominance – forest canopy closure; often are simple tree structures of relatively uniform-sized trees; post-natural disturbance there are often abundant structural legacies (e.g. snags and logs); water yields and summer low flows decline; does not provide highest level of soil stability because root systems are not fully developed; lowest biodiversity of the 4 stages; herbivory-based food webs poorly developed or absent; vertebrates may use dense young forests for hiding or thermal cover; variability in intensity of competitive processes depending on disturbance type or original forest type; sites with lower tree densities have significant understory plant communities

3. Mature Forest stage: tree densities decline from Young Forest stage; initiation of increased decadence and spatial heterogeneity; overstory trees achieve most of their growth height; gap creation counteracts tendency toward uniform tree spacing; understory plant communities re-establish or expand; high levels of primary productivity continue – significant accumulations of wood

4. Old Forest stage: typically the most functionally and structurally diverse stage: array of live and dead tree sizes; large old trees of one or more species, spatial heterogeneity; unique habitat niches; highest levels of biodiversity; decadence is an important feature; high levels of functionality, productivity, and significant influences on hydrologic and geomorphic processes

Industrial forestry writes off and/or eliminates the two last phases: Mature Forest Stage and Old Forest Stage. Without these last two phases, species that depend on them for food and habitat will disappear.

Jerry F. Franklin, K. Norman Johnson, and Debora L. Johnson. 2018. "Ecological Forest Management." Waveland Press. Pages 56 to 64.

The old and mature forests in the Boundary provide cultural, social, and economic values, support biodiversity, and store critical amounts of carbon. "Landscapes dominated by mature and old forests can store several times as much carbon as intensively managed, industrial forest landscapes"(P.7, Pojar).

Mature forests store carbon in living and dead trees, build exceptional and rare soils, and provide food (such as lichen) for diverse species. The structure and composition of their soils and forest floors also provide hydrological stability and thus aid in flood mitigation.

Old and mature forests in the Boundary represent unique ecosystems that support specialist species, processes, and functions. Once they are lost, they are not likely to return due to the threat of climate change.

Figure 26 A high elevation old growth forest in the Boundary that contains rare, at-risk Whitebark Pine. This forest area has been flagged for logging. July 2020. Photo courtesy Jennifer Houghton.

Boundary forest landscapes are fragmented due to clearcut logging, including in the grizzly bear range. "…In the context of grizzly bear security in a heavily fractured and widely degraded ecosystem these remaining old growth and mature stands can be expected to play a disproportionate role in providing bears security for bedding and travel." (P. 56, Horejsi, 1999).

Old and mature forests are also important suppliers of non-timber forest values, including:

- economic diversification and local employment from products that include food and traditional medicines

- recreational values including adventure and ethno/eco-tourism which support economic diversification through non-consumptive use opportunities, e.g., wildlife viewing, eco and ethnobotany tours, guided hiking and biking tours, guided interpretive education and awareness.

Ecotourism in the Boundary has the potential to contribute to the local economy but only if the old and mature forests are intact. Tourists are not likely to want to hike or camp in clear cuts.

Summary of Old Growth Benefits

Old forests in the Boundary:

- Have higher biodiversity values than immature stands and mono-culture tree plantations
- Mitigate the effects of climate change
- Provide critical habitat for species at risk
- Provide high value wildlife habitat
- Offer resistance and resilience to climate change because of their high genetic diversity and structural complexity
- Provide vital carbon sinks and store much more carbon per hectare than younger forests.
- Provide ecosystem functions, e.g. hydrological functions
- Provide potential for economic diversification via non-timber benefits

Failure to Protect Old Growth in the Boundary

A 2020 independent report demonstrates that in much of the Boundary watershed, old forest makes up less than 10% of the total area of "a BEC[16] variant within a landscape unit" and in many areas it makes up less than 1% (Price et al). In other words, old growth in the Boundary is at dangerously low levels.

The BC government designates Old Growth Management Areas (OGMA) as areas containing forests to be managed for old growth, i.e. areas where old growth is to be protected. Forest licensees are required to maintain legally established OGMAs when preparing Forest Stewardship Plans (FSP). The BC government requires that OGMAs, in combination with other areas where clearcut logging is prevented or constrained, be used to achieve biodiversity targets (BC Data Catalogue).

The Kootenay Boundary Higher Level Plan Objectives (KBHLPO) requires OGMAs include specified amounts of old growth categorized by age-class, biogeoclimatic zone, and biodiversity

[16] BEC = Biogeoclimatic Ecosystem Classification

emphasis option (FPB, 2012). OGMAs in the Kootenay Boundary are designated in areas with multiple values such as important wildlife habitat and other non-timber resources (FPB 2016). Thus, it is stupefying that, at the same time, the KBHLPO also includes provisions for using a proportion of younger age stands to meet the old-growth targets. This is double speak.

Government made a concession "to reduce impacts to timber supply by enabling the amount of old-growth in low biodiversity emphasis option landscape units to be reduced by up to two-thirds (referred to as a *drawdown*)" (FPB 2012, p. 19.)

The FPB reports that the two-thirds *drawdown* is being fully applied in the Kootenay-Boundary (2012). This means that licensees are addressing legal old forest retention requirements through conservation of *young and mature* forests, even though some old forest exists that could be protected to help meet the old targets.

However, old growth is in danger of disappearing. In the Kootenay-Boundary region there is insufficient old forest to meet legal targets in 29-72% of landscape units within or outside of OGMAs (Price 2019).

Another problem is that most of the OGMA areas in the Boundary are classified as 'non-legal' and hence the licensees all too regularly log them because it is both convenient and "legal".

Overall in BC, government's Forest and Range Evaluation Program (FREP) is not assessing the effectiveness of old-growth retention. "The lack of monitoring is constraining in a number of ways. First, little information is available on the attributes and status of retained old growth. Second, government has not monitored the condition of OGMAs and therefore does not know whether effects such as windthrow, forest harvesting, road construction or cattle grazing are compromising the integrity of OGMAs. The lack of effectiveness monitoring hampers government's ability to understand if it is achieving the desired outcome of old-growth retention, namely conserving biodiversity."(P. 27, FPB)

Lack of monitoring also means we do not know how much true old growth is protected or if it is even possible to meet legal old growth targets. There is also no clear information about whether important forest ecosystem networks (FEN) for species connectivity are being implemented.

Price et al (2020) compiled data to indicate where there is risk to forest biodiversity due to sufficient reduction in natural amounts of old forest. Most of the Boundary forests are in the High to Medium-High risk categories, whereby **there is less than 30% of the natural amount of old forest remaining** (p. 31).

There are significant threats to ecosystems associated with this low level of old growth. "The habitat change/ threshold literature demonstrates that absolute amount of habitat matters, particularly at low amounts. This means that in ecosystems with naturally low amounts of old forest, dropping down to 30% of that small amount may lead to old forest being so scattered and patchy on the landscape that it does not provide all the functions expected from it — for example, security habitat for a species may be too scattered across the landscape to be functional if there is very little of it in total." (P. 17, Price et al, 2020).

Studies of habitat change suggest that risk to biodiversity and ecological function is high when less than 30% remains (p.17, Price et al, 2020).

RECOMMENDED ACTIONS FOR OLD GROWTH

With the climate crisis, risks to wildlife and biodiversity, degree of recent flooding, and risks of future flooding, old growth protection must be a priority in the Boundary. Also, mature and primary forests must be retained to use for recruitment of future old forests.

Our top two recommendations:

1. Legally implement 100% protection of all old growth in the Boundary watershed. Retain all trees and pockets of trees greater than 140 years old.

   There must be an *immediate* response to ecosystems at very high risk of irreversible biodiversity loss.

   It is imperative to the public interest that this be applied without delay to the specific areas in our region listed below. There are others that are not listed. However, any areas that meet the criteria of 'very high and near-term risk of irreversible biodiversity loss' must be included. This includes any cutblocks that have already been laid out.

   - July Creek cutblocks (Mid Boundary Community Forest cutblocks)
   - Wildlife Corridors between Granby and Gladstone Parks
   - East Patarageous – the entire ridge at the top where Whitebark Pine is growing. It is naturally regenerating and it does not successfully regrow in plantations (The cutting permit identifier there is: CP480 Blk16 RD16.1 RP#1 POC STN1 Smfz WP/Js 7.7.20)
   - Slopes of Grano Canyon, Cochrane, Hellroarer, Goatskin
   - Burrell Creek watershed
   - McRae Creek watershed by Christina Lake

2. Do not allow logging in Old Growth Management Areas (OGMAs).

Price et al (2020) made some specific recommendations on old growth. We support them all. Below some are paraphrased and condensed:

Recommendations for OGMAs:

3. Recruit the oldest available mature forest where no old forest remains for OGMAS.

4. Ensure that forest retained in OGMAs represents the best old forest available for each zone.

5. Ensure OGMAs are functional.

6. Immediately remove the low Biodiversity Emphasis Option target "drawdown" that reduces targets in low biodiversity emphasis option areas by two-thirds in all zones.

7. Fix arithmetic errors - Stop double counting protected areas in old forest targets.

BFWSS supports Gorley and Merkel's recommendations from *A New Future for Old Forests: Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems (2020)*. We have blended some of those recommendations with our own below.

We advocate for these recommendations to be applied to the management of *all* forests in the Boundary, not just old growth.

8. Prioritize Ecosystem Health and Resilience. Declare the conservation and management of ecosystem health and biodiversity of forests as an overarching priority. Enact legislation that legally establishes this priority.

9. Monitoring and Evaluation. Establish and fund a more robust monitoring and evaluation system for updating management of old forests.

10. Update biodiversity targets, so that biodiversity is prioritized, and targets for retention and management of old and ancient forest.

11. Create a silviculture program aimed at developing logging alternatives to clearcutting that maintain old forest values.

Switch from: Predominately clearcutting which focuses on minimizing cost to the industry
To: Use silviculture systems that manage for multiple values

Gorley and Merkel stated in their report, "Our recommendations are shaped by a recognition that society is undergoing a paradigm shift in its relationship with the environment, and the way we manage our old forests needs to adapt accordingly."

Conclusions to Costs of the Current System Chapter

The primary objective of forest management should be to maintain the ecological integrity of the forest ecosystem. This matters to people because biodiversity and productivity are the source of what we value. BC logging peaked in 1988 and has been declining ever since: the root causes of this decline must be corrected.

What is needed to protect the people, the wildlife, and the ecosystems of the Boundary watershed, is a major intervention and change of direction by the government of BC. Nothing less than a complete transformation of human actions in watersheds will create the desired outcome of ecosystem integrity.

As long as the corporate narrative remains the primary influencer of policy, corporations are left to monitor themselves and make short-term profit their primary objective in the watershed, all other benefits (ecological, economic, social) will continue to weaken and deteriorate.

In the sections above, BFWSS explored some issues impacting the whole watershed as well as some localized problems. BFWSS has made specific recommendations in regards to flooding, hydrology, roads, climate change, old growth, and species at risk. These are recommendations that can be implemented within the current legislative framework.

While these recommendations are important and we want to see them implemented, they are, in essence, like band aids being applied to symptoms.

The government of BC must address the origin of these symptoms – forestry legislation and the out-dated paradigm that it stems from. Currently, the legislation:

- Gives private interests control of public land. These private interests are the tenants and the Province needs to act as the landlord and owner it is for the benefit of all British Columbians.
- Makes maximizing the supply of timber a higher priority than maintaining ecological integrity and economic diversity of the human economy

An immediate change of forestry legislation is required so that forest decisions are based on ecosystem and conservation science, not politics or corporate profits. In the following chapter, "New Path Forward", we describe a model for forest land management that puts an appropriate emphasis on ecosystem integrity and inclusive decision-making. Both of these serve the interests of the people of the Boundary better than what is happening now.

The current tenure system has come with major costs: ecological degradation and economic loss to rural communities. Government policy must immediately restructure the timber economy to shift from volume to value and from quantity to quality. Our proposals for changing the forest policy in the New Path Forward incorporate requirements for protecting ecosystems while minimizing financial losses to communities and ensuring the creation of new forestry jobs. The intent is to ensure the benefits of the changes in the "New Path Forward" exceed the costs of maintaining the existing system.

SECTION 3: THE NEW PATH FORWARD (TRULY SUSTAINABLE FORESTRY) FOR CREATING NEW OUTCOMES

Nature-Based Planning

Our objectives for the Boundary watershed are:

1. To implement **Nature-Based Planning**[17] across the land base

2. Manage the Nature-Based Planning through a community-based board or committee comprised of local people (who are assisted by public sector staff who are educated and informed in Nature-Based Planning, natural sciences, biology, ecology, and eco-forestry).

The goal of Nature-Based Planning (NBP) is to manage human activities in forests so that we can continue to receive their benefits without degrading the productivity and values of the natural forest. It is about working with nature's patterns and processes, not attempting to control nature.

Figure 27 Results of small scale selection logging in west Boundary in the 1990s. Clumps of trees were left to provide shelter for deer. 25 years later there is food, shelter, and habitat for deer. Photo taken July 2020. Photo courtesy J. Houghton.

[17] Nature-Based Planning is a type of landscape planning that is known by other names, including Ecosystem Based Conservation Planning (EBCP), ecosystem based management, ecosystem-based forestry, and ecosystem management. In this report we will refer to it as Nature-Based Planning except when referencing the work of other authors who have used different terms.

The end or outcome is to maintain ecological integrity by practicing ecological forest management (which is the method). Ecological forestry lets nature do the work.

Knowledge of science will inform the diagnosis and prescription of how best to maintain ecological integrity while using a forest. Sound organizational principles provide the knowledge essential for good planning, management, and decision-making. The planning process requires a clearly stated and well-defined set of goals.

In ecological forest management policy makers and practitioners will:

1. Ask, "What is right for both the forest ecosystem and the people in the community?"

2. Develop action plans

3. Take responsibility for their decisions and actions;

The overall intent is to transform from the industrial production forestry paradigm, with its hidden and deferred costs, to community-benefiting, pay-as-we-go ecological forestry.

The Priorities and Elements of Nature-Based Planning

The top priority in nature-based planning is to protect and restore ecological integrity by keeping all the pieces. The aim is to maintain and, where necessary, restore a forest's natural[18] ecosystem composition, structure, and function (Hammond 2009). We work with nature and let it continue to take care of itself and self-renew.

This means that in silviculture, the priority is to first decide what trees to leave, and then we are left with which trees can be logged. Once the needs of the forest are taken care of, then practitioners can decide what to manufacture in their mills. The key is to manage for quality and value in everything that is done. In other words, we find ways to better use a forest without degrading nature.

Franklin describes ecological integrity in this way:

> "A forest ecosystem has integrity when its major components - biota, structures and functional capacities are present. When it lacks important attributes - key

[18] Throughout the remainder of this report, the term natural refers to pre-industrial ecological conditions, i.e. prior to the simplification, homogenization, and degradation of ecosystems by clearcut logging.

> organizational groups, essential structures, or critical functional capacities - it can be viewed as being incomplete or lacking integrity. Sustaining the integrity of the forest is a central tenet of ecological forest management. We mean by this, sustaining its essential elements and capacities, not necessarily a specific condition or species." (2018, p. 24)

What is important is maintaining the capacity of a forest to rapidly recover (vigor and health) from natural disturbances and logging which, together with the stresses of climate change, will shape the ecological condition of a future forest.

Forests are viewed as systems, rather than individual components. Nature functions in wholes and patterns of wholes. Consequently, forest practices must ensure the natural process of photosynthesis that captures and stores energy and carbon dioxide, plus the capture, storage, and cycling of water and nutrients is not impaired, and that the natural process of forest development (succession) proceeds at *pre-logging* natural rates of change and recovery.

It is through the process of forest succession that nature forwards the structure and functions of a forest into later stages of development, like old growth. The qualities of these later stages of forest development provide options for society. Clearcutting throws these options away,

Most importantly, Nature-Based Planning creates different outcomes than industrial clearcut management. The industrial model creates a landscape that is less valuable over time and reduces jobs. Forest management rooted in NBP not only preserves the value of landscapes over time but also preserves community jobs. NBP, therefore, is a form of sustainable forest management. This type of planning recognizes the relationship between ecosystems and economies. When we take care of the ecosystem, we take care of the economy.

NBP has a basis in a similar understanding of forests as traditional ecological forest management. Traditional Indigenous forest practices were based on the recognition that forests are alive and full of complex relationships among the species (including humans), the soil, the water, and the air. A cumulative body of knowledge, practice, and belief shaped traditional Indigenous practices. For thousands of years, Indigenous people in BC practiced a reciprocal relationship with forests – using forests at the same time as remembering to give back. Forest management was built on a kincentric view of the world, which regards other species, and even rivers and mountains, as generous relatives with whom humans have a reciprocal, rather than an exploitative relationship.

Traditional Indigenous practices in BC demonstrate a management system that was sustainable in the long term. Traditional forestry management not only stewarded the natural resources, but it facilitated a caring ethic and it involved local and intimate knowledge of the ecosystems,

season changes and patterns; not to mention a spirituality that in Western cultures and industrial systems, seems to have been lost.

Principles for Nature-Based Planning

Ecosystem Principles to Inform Forest Management (from US Department of Agriculture Forest Service, Haynes, 1996):

- *"Ecosystems are dynamic, evolutionary, and resilient;*
- *Ecosystems can be viewed spatially and temporally within organizational levels;*
- *Ecosystems have biophysical, economic, and social limits;*
- *Ecosystem patterns and processes are not completely predictable."*

Measuring Outcomes of Nature-Based Planning

The following goals can be used to provide benchmarks against which to measure the outcomes of forest practices (some have been adapted from USDA, Haynes, 1996, P. 24)[19]:

1. Maintain evolutionary and ecological processes such as ecological functions, disturbance regimes, photosynthesis, hydrological function, and nutrient cycling.

It is critical to not attempt to remake or remodel nature's parts or processes to fit arbitrary industrial clearcutting

Recognition of ecosystem complexity includes identifying and understanding:

- the multiple functions of woody debris
- "legacies" from previous stands maintain site productivity, biodiversity and regenerative capabilities;
- complex interactions among organisms (such as rodents and spiders)
- the way tree species interact to maintain resistance to disease (Brooks and Grant)

2. Manage ecosystems using multiple ecological domains, evolutionary time frames, and a range of spatial scales.

[19] Overcutting or timber falldown is no longer occurring on the USA National Forest System lands. Falldown (overcutting of timber) is still occurring in BC. Since the 1990s a number of US Forest Service decision rules have been developed so they can manage ecologically. We include some of the principles and goals used in the USA as a basis for this change in forest management there. See US Forest Service 2018 in References.

Ecological timeframes do not correspond to timeframes of politics or industrial processes. The scale of the ecological patterns and processes are much longer temporally and range from very small scales to the larger landscape scales than typical industrial forestry.

Natural forest processes and patterns often take place over 200 to 1000 year cycles rather than the 25 to 80 year rotations that industrial forest management uses. The frequency of change depends on the Natural Disturbance Type. For example, wet ecosystems have a much slower rate of change than dry ecosystems. Some researchers suggest that for forest planning, the timeframes should encompass multiple natural generations of trees (Holt 2001).

3. Conservation of biodiversity is required for ecosystem integrity and resilience.

4. Manage ecosystems to encourage social resiliency and economic resiliency (i.e. the degree to which those systems can adapt).

The resiliency and vitality of the ecosystem contribute to the resiliency and vitality of social and economic systems.

Forest managers must consider how present actions will affect our range of choices in the future (Brooks and Grant).

Forest management must include an evaluation of social benefits, values, and costs associated with treatments of forest ecosystems (Brooks and Grant).

5. Analyse the role of forests in society in ways that go well beyond timber supply. For example, ecosystems can be managed for the human sense of "place".

6. Use ecological constraints or limits for decision-making.

There are ecological limits to the rate of productivity and the capacity of ecosystems to provide goods and services. People cannot make demands on ecosystems that exceed their biological or physical limits.

Some of the things that define ecological limits to human use include "the habitat and reproductive needs of species, the shape of the land, how steep the slopes are, soil depth, soil texture, the amount of moisture present (both wet and dry conditions cause ecological limits), and local climatic conditions." (p. 27, Hammond 2010)

7. Manage ecosystems to maintain the mix of ecosystem goods, functions, and conditions that society wants.

> This requires an understanding of the social acceptability of management actions. Planning therefore must encompass the limits of social standards as well as biophysical limits.
>
> Many of the benefits people want from ecosystems, such as water, wildlife biological diversity, their role in mitigating climate change, depend on forests remaining intact, rather than having entire components removed from them (Brooks and Grant).

8. Manage based on scientific knowledge, including an understanding of the complexity and diversity of forest ecosystems and how ecosystems change through time to later stages of forest development.

> Ecological decision-making is based on the best available science. To provide this information, research needs to be promoted and funded by the public sector. Reinstating the BC Forest Research Branch, closed in 2011, is required.
>
> Scientists can play the role of identifying uncertainties and pointing out complexities of systems to managers, rather than helping managers use fertilizers and pesticides to temporarily increase production at a significant and increasing cost.
>
> The science will also regularly test the hypotheses we use to make forestry decisions.

9. Monitor, learn, continuously improve, and re-plan.

> Evaluations are done regularly to allow learning from outcomes. This involves monitoring, evaluating, trial and error, data analysis, data collection, continual adaptation and readjusting. It includes a willingness to learn from mistakes. The idea is to produce results, not just measure outputs.
>
> Monitoring determines whether implementation achieves its objectives and whether assumptions are correct. This information can then be used to reassess, alter decisions, change implementation, or maintain current management direction.

10. Apply the Precautionary Principle to account for uncertainty in the time of climate crisis.

> A lack of predictability is built in to natural ecosystems. Nature is diverse and complex and this leads to uncertainty in seeing outcomes. Nature does not function like a factory with programmed production like consistent production of a commodity. A buffer is needed to allow for uncertainty to reduce the risk of failure where the relationship between cause and effect is hidden from us.

Land management policies and practices should provide sufficient flexibility for managers to respond effectively to all unanticipated effects of previous decisions.

We also need to acknowledge that long-term yields of goods and services will remain unpredictable.

We also need to acknowledge that clearcut logging is not the best silvicultural practice in mixed species stands, such as occurred in the 2003 policy response to the mountain pine beetle outbreak. Silvicultural researchers then and now have determined that clearcutting in mixed species stands eliminate the opportunity for intermediate size trees of species other than pine to provide a timber supply in 15 to 50 years. This option in the Cariboo Chilcotin in the response to the mountain pine beetle outbreak, stole from future BC generations.

If the ecological consequences of an activity are unknown, then the activity must either be eliminated or modified. In the case of forest management this means erring on the side of protecting ecosystem integrity rather than protecting the supply of timber. Application of this principle is absolutely critical in the era of climate change where uncertainty about what is going to happen is the only certainty.

How to Put Planning into Practice: Designs and Ecoforestry

The process of Nature-Based Planning includes ground work to discover, and then map out: ecologically sensitive areas, human use areas, areas to protect, habitat zones, wildlife corridors, riparian zones, timber zones, areas to restore, culturally significant areas, areas to log and not to log.

Forest Ecologist, Herb Hammond's process involves creating networks of areas, which delineate what gets left/protected at small to large scales. For example, at each scale there would be protection of rare ecosystems, linkages between reserves and ecosystems, connective corridors for animals, old growth forests, unique and critical habitats, and small streams. At smaller scales large living and dead trees are specifically protected (2009). In this way, representative parts and processes are reserved at all scales.

Once the design indicates where logging can take place, ecoforestry is one of the methods used under NBP. Site specific harvesting regimes are chosen to achieve timber objectives with minimal impact to the ecosystem. There are a variety of possible selection logging methods

and silviculture systems that can be used at each stand. [20]Forest health is ecologically defined as the rate of recovery following a disturbance. This rate of recovery is highest when there is a carryover of dead and decaying wood from the previous forest. This concept was developed post Mt St Helens 1980 volcanic blast by Dr. Jerry Franklin. The greater the amount of biological legacies, the faster the recovery. Well-planned and conducted selection logging will do this.

Selection logging methods might retain:

- Live trees of various sizes, ages, and species
- standing dead trees
- large downed logs
- patches of trees
- patches of habitat
- forest patches to protect interior forest conditions (shade, cool, moisture)
- below ground fungal & root networks (which facilitate the sharing of nutrients, water, and carbon, and store carbon)
- habitat elements like moss and lichen
- mother trees (the trees that provide seed, shade, and other conditions to aid the growth of new trees)

All of the above can be categorized as biological legacies being forwarded to the future.

"Biological legacies are defined as the organisms (including reproductive structures), organic materials, and biological derived patterns in soil and vegetation from the pre-disturbance ecosystem into the post-disturbance environment" (p. 52, Franklin et al 1998)

Community Forest Boards are a Critical Element of Nature-Based Planning

The development of Community Forest Boards (CFB) that manage public forests are an integral part of Nature-Based Planning. Nature-Based Planning involves an acceptance that people are part of, not separate from, ecosystems.

NBP is a way of providing for the development of diverse, community-based sustainable economies. Community-based economies require the direct involvement of local people in decision-making.

[20] *Selection* logging is partial cutting of a forest to achieve a desired result. In contrast, *selective* logging is where a forest area is logged without any purpose specified, which makes *selective* vulnerable to 'high grading', i.e. taking the best and leaving the worst.

NBP is best practiced through decentralization of operational decision making, rather than top down decision making. This gives those impacted by decisions the ability to learn, stop doing what is not working, and to improve the planning. CFBs allow this to happen while centralized one-sized-fits-all decision-making does not.

Development of CFBs will require organizational and legislative change. At the outset, methods for public participation in the development of CFBs must be created.

Implementation may also require change in the nature of agencies and the equalization of power relationships. NBP requires collaborative decision-making and acknowledgement of power imbalances (Holt 2001). CFBs are a model that can facilitate this.

The concept of community must be defined at the initial stages of the planning. Considerations for determining what community means include: the place or ecosystems involved, the diversity of interests, a determination of who is accountable for consequences, and who is affected by the decisions.

Community Decision-Making for Forests is Already Being Done in the UK and the USA

The UK government made a choice to transfer management responsibility of public forests in Scotland to local communities. They did this to help maintain rural settlements whose sustainability is threatened by demographic change, to boost social cohesion, and support businesses run by local people (Rollinson, 2010). In 2010, at a presentation at UBC, the Director General of the UK Forestry Commission stated that "it is second nature to us to encourage local participation in our decision-making" (Rollinson).

In the USA, legislation (including the National Forest Management Act and the Forest and Rangeland Renewable Resources Planning Act), have encouraged the involvement of a more diverse cross-section of the population taking an active role in planning forest management (Brooks and Grant).

Features of Community Forest Boards (CFB)

- Oversee forest management regarding the local land base/watershed. Enable local people to have a role in the forest management decisions that affect them
- Composed of local people who are impacted by decisions about their land base
- Prioritize and operate under the principles, goals, objectives, and standards of Nature-Based Planning
- Give undivided loyalty and unconditional allegiance to citizens (the public land owners)
- Will be legislated under Provincial law which clearly sets out standards, principles (based in NBP), accountabilities, responsibilities, enforceability. They provide a legally binding role for communities to establish meaningful forest management standards.
- Guided and advised by independent science-panels who are also guided by the principles, goals, objectives, and standards of Nature-Based Planning
- Communicate with regional forestry offices and Ranger Stations regarding monitoring and compliance
- Prioritize community-based economic development
- Must provide a method for finding solutions when there are disagreeing parties, i.e. a set of rules that everyone accepts at the outset

Since the Boundary watershed crosses jurisdictional lines, the implementation of the NBP and the development of CFBs depends on partnerships among governments, land managers, the scientific community, and stakeholders.

Benefits of Community Forest Boards

- Allow for planning to be an inclusive community-based process; the public participates in defining objectives
- Have the potential to increase social cohesion (and address conflict)
- Take cultural and community values into consideration, including those of Indigenous people
- Allow for innovation and creative-problem solving when faced with challenges that are unique to the local ecosystems
- Allow for problems and challenges to be resolved more quickly than centralized decision-making, e.g. Locals can acknowledge that long-term yields of goods and services may remain unpredictable more easily than bureaucrats who do not live in the region

- Management based in the community allows for adaptability and application of the precautionary principle when dealing with the unpredictability associated with climate change
- Provide sufficient flexibility for managers to respond effectively to any unanticipated effects of previous decisions.

Successful and Unsuccessful Examples of Nature-Based Planning

In the following section we explore a few examples of NBP, how community-based economies and jobs can be supported, and lessons learned. We begin by exploring a successful model in the USA.

Menominee Tribal Enterprises: Sustainable Forest Management Done Right

In 1854, the Menominee people were forced to move off traditional territories by the arrival of the settlers, and were confined to their current 235,000-acre reservation in Wisconsin, USA. The Native American Tribe decided that they must grow and log timber in order to survive on their limited land base. They chose to practice economically and ecologically sustainable forestry.

As a result of their philosophy and practices, even though they have harvested 2.25 billion board feet since the 1800s, they have more timber standing now than there was when they began harvesting 150 years ago (Johnson et at, 2012).

Their forests are managed using an approach that blends traditional cultural beliefs with forest science. The basic concept is to log timber at a pace where *the amount harvested never surpasses the forest's natural capacity to replace it.*

"The goal of forest management is to provide for maximum diversity in the forest (species composition, age class distribution, structural diversity both within and between stands), habitat diversity, and to optimize growth and saw log quality of the forest timber resource." (Menominee Tribal Enterprises, 2012)

Menominee Tribal Enterprises (MTE), which manages forest operations, is owned, controlled, and managed by the members of the Menominee tribe. The Tribal Enterprise is not federally

subsidized (MTE website). The Enterprise employs approximately 125 people, who are mostly tribal members, plus 180 woods workers (MTE, 2020).[21]

Menominee Forest Management Favors Species Diversity

The Menominee use the concept of Allowable Annual Cut, but the AAC is determined differently than in BC. For MTE it is based on a type of silviculture prescription which ensures that the forest is managed based on sustainability and log quality, rather than on a volume basis. The Menominee AAC is constantly recalculated to incorporate both timber and non-timber values (MTE, 2012).

The Menominee desire continuous timber harvest but, unlike sustained yield models in BC which result in monoculture tree farms, sustained yield on Menominee land results in "a mosaic of forest cover types that cater to a wide variety of multi-use activities" including hunting, gathering, sugar maple camps, and camping. (Menominee Tribal Enterprises, 2012, p.21) Also, the Menominee logged forests still have a 'pristine' natural look unlike the unattractive patchwork of moonscaped, dried-out, lifeless clearcuts across BC.

Marshall Pecore, Menominee forest manager says, "You've got to have these different ecological types meshing and working together. We maintain stands of hemlock, which is not desirable in the marketplace, but is an important part of the ecology. If we keep a lot of diversity — species diversity, vegetation diversity — then we'll have a healthy ecological forest." (Johnson et al, 2012)

[21] These employment numbers are close the number of people employed in forestry the Boundary watershed. The difference is that the Boundary TSA AAC is 670,142 M^3 and the MTE AAC is 47,195 M^3 (USDA 2017) which is 14 times smaller.

Menominee sustainable forestry management vs. BC industrial forestry management		
Management	**Menominee forestry**	**BC forestry**
Dominant goal	Maintain the diversity of native species and habitats	Maintain a constant timber supply
Control	The Tribe has had control of forestry management for over 150 years	Private interests have always controlled public forest management
Monitoring	• Government agencies work with the Tribe – including a monitoring role and providing technical help. • People of the community are involved in monitoring	• The BC government greatly reduced monitoring programs and staff in the early 2000s • Industry is left to monitor itself • No mechanism for local people or Indigenous groups to monitor forestry itself
Decision base	It is a decentralized, regional system, whereby decisions are specifically geared to the ecosystem and local economy.	Centralized decision-making, few regional ministerial offices. One-sized fits all, top-down approach
Decision-making power	Local people who are directly connected to the land-base are making land use decisions; local knowledge incorporated into forestry	No mechanism for local people to be directly involved in land use decisions or incorporate local knowledge
Stand Management	Unique management objectives for specific small stands based on forest stand characteristics	One-size-fits all management objectives imposed on forest stands across BC
Silviculture	Maximize health and sustainability of each stand; based on unique characteristics of each stand	Focus is on quickly getting commercially valuable species to the free-growing point
Employment	• More boots-on-the-ground in the woods. • Employment in a community mill	Increasingly mechanized - fewer and fewer jobs in the forest and in mills (2% of employment in BC).
Logging practices	Lowest quality trees are selected first. Leave the best trees for the future. Least-cost clearcutting is not permitted.	• High grading predominates • Clearcutting dominates
Mill	Supplies local manufacturers as well as exporters	Wood is shipped outside of local area, province, or country

The difference between the two jurisdictions is in the attitude and the practice. In BC we take the best (highest quality) trees by clearcutting ('*high grading*'[22] at the landscape level), whereas, the Menominee take the worst first and leave the best trees for the future.

By prioritizing species diversity and ecosystem health, the Menominee have provided their community with continuous timber production for 150 years. They have enacted a paradigm of sustainability that creates different outcomes from their forests than the outcomes generated by the industrial paradigm in BC public forests.

The Great Bear Rainforest: Hope and Failure

The BC government claims that the Great Bear Rainforest Agreement (GBRA) made in 2016 prioritizes the implementation of Ecosystem Based Management (EBM) across the landscape. In reality it does not. We are sharing this story as a precautionary tale for our community and others in BC where EBM is desired by the residents.

The Great Bear Rainforest is a 6.4-million-hectare planning area on the west coast of BC. The ecosystems are unique because of their highly diverse plant, animal, and marine life. There are approximately 18,000 people living in the region in scattered rural communities.

The Agreement formalized the conservation of nearly 3 million hectares of land and placed another 550,000 hectares of land into a new zone where special 'ecosystem-based management' was supposed to take place. It established conservation areas and a type of logging that was supposed to be different from what had previously been done in the region.

<u>What is good about the Great Bear Rainforest Agreement</u>

- It resulted from a collaboration of government, industry, First Nations, and environmental organizations.
- The high degree of involvement of environmental groups in the planning process was unprecedented in BC.
- In theory it is shaped by Indigenous sovereignty, ecosystem values, and provides First Nations communities with stable economic benefits.
- It is supposed to protect ecosystems.
- It is supposed to implement ecosystem-based management on the ground.

<u>The Reality: It is Not Ecosystem-Based Management</u>

- **No real change in observed logging activity**. People who live in the region are finding that "logging looks virtually indistinguishable from the logging that initially galvanized

[22] See Glossary for definition and problems of High Grading

conservation organizations and First Nations to try to protect the coastal rainforest in the first place." (Parfitt, 2019.)

- Since **no logging data is available to the public**[23], it remains to be seen exactly how the operations on the ground are more environmentally friendly than previous logging, if at all.
- **Protected areas do not contain timber of economic value**. The parts of the GBR that were protected under the 2016 agreement are mostly in the northern region, are difficult to access, and do not contain any timber of economic value. It is likely these areas would not have been logged even with the agreement.

  In a comparison of data from before and after the Great Bear Agreement (GBR) was finalized, Ray Travers, RPF (ret), could detect no real change in hectares logged or the approved rate of logging (AAC). Travers questions if the area available to log changed at all as a result of the GBR Agreement (Ray Travers, personal communication, Nov 5, 2020). The question remains: how much forest has actually been protected from logging as a result of this Agreement?

- **Old growth is being logged.** The agreement proposes logging of 2.5 million cubic metres of old growth forests every year for the next 10 years (Hunter, 2016). Jody Holmes, a biologist and project director with the Rainforest Solutions Project, said that the agreement, "opened up an enormous loophole" that allowed the logging companies "to harvest every last stick of big, older trees," while simultaneously claiming that they were meeting their conservation targets (Parfitt, 2019).
- Companies have **permission to build roads through 'protected' old-growth forests** through a loophole in the Agreement (Parfitt, 2019).
- There is **no mechanism in place for monitoring, overseeing, or enforcement** of ecosystem-based management requirements.
- **Constraints on Indigenous sovereignty and losses for the people**. The Kwiakah people, whose territory is in the southern part of the region, are actually losing land to logging as a result of the agreement. 54 per cent more is being logged than before the agreement (Gies, 2019). Chief Qwatsinas, of the Noxell First Nation in Bella Coola, wrote that "… The First Nations who are caught up in these processes have essentially relinquished their sovereignty and historical status as a First Nation." (2010).
- **Huge amounts of wasted timber.** The Narwhal analyzed data and found that forestry companies log the best and leave the rest. Large numbers of trees are being cut down and left behind. "… Interfor — one of the world's largest lumber companies — logged a little more than 493,000 cubic metres of wood…in the first 10 months of 2019. During that same time period, the company reported leaving behind nearly 115,000 cubic metres of logs. Meaning for every four trees logged and taken to market at least one tree was left behind

[23] In November 2020, BFWSS requested GBR logging reports for the past few years from the Province of BC and were told via email that no such reports existed.

to rot in the forest from which it was logged… There is reason to believe, however, that the actual levels of wood waste are far higher than the numbers that the provincial government tracks." (Parfitt 2019). Selection logging methods would leave trees standing and not create this type of waste.

- Instead of undertaking pure government to government negotiations, BC made the choice to continue to champion **private corporate interests**. Private forest products companies were granted equal standing with scientists, residents, and Indigenous groups and governments in the negotiations. Five corporations (BC Timber Sales, Catalyst Paper Corporation, Howe Sound Pulp and Paper, Interfor Corporation, Western Forest Products Inc) were given a seat at the table during negotiations between the BC government and First Nations governments.

Lessons to Be Learned

BC communities, both Indigenous and non-Indigenous, can take away two important lessons from the Great Bear experience.

1. The outcomes, which by all indications are not aligned with ecosystem-based management principles, demonstrate the **conflict between private interests and the public good.** For forest management to be truly sustainable, communities must demand that private companies not be given the same standing (in negotiations or decision-making) as the governments that represent the interests of the people. Forestry decision-making must prioritize ecosystem integrity, which in turn protects the interest of the public and community economies.

2. **Monitoring, oversight, and enforcement** must not be left to private interests on a *volunteer* basis. Communities must demand these responsibilities be written into agreements and legislation as *obligations*. Public sector monitoring must be expanded and well-funded. Legislation must include enforceable consequences for non-compliance.

Harrop-Proctor Community Forest: Success When Community Values Rank First

The Harrop Proctor Community Forest (HPCF), east of Nelson, is a BC example of successful community-driven nature-based forestry.

HPCF came into being because a group of local residents decided they wanted their at-risk ecosystem to be logged on their terms. They applied for and received a community forest license based on a low level of cut. This operation is run as a co-op.

Run by local people, it is an example of forestry operations being managed under community values, which are different from those that drive large-scale industrial forestry. HPCF applies

nature-based forestry to its operations. The Harrop Proctor 'value proposition' is to keep the land intact and the ecosystem functioning. From there they take their timber in smaller quantities. In this way, their timber is available over the long term.

Their approach is to decide what to keep (e.g. in old growth stands and habitats for endangered species like caribou) before deciding what to take. Before logging, the question they ask is, "Is it economically, ecologically, socially beneficial to go in there?" (BC Rural Centre).

The logging methods used are selection and small patch cuts. In this way the forests maintain biodiversity, old trees, and habitat for wildlife. This method leaves more trees on site and means that very little planting is required (Rothkop, 2020).

In addition to the logging operation, HPCF owns a mill which produces a variety of secondary wood products, including value-added flooring, paneling, and wood siding, which can be sold to local residents and businesses.

At HPCF people who live close to the mill and forest operations fill the jobs. Jobs in the woods in the woods include managers, planners, road builders, contractors, equipment operators (excavators, etc), a few local tree planters, brushing operations, and truckers. Also, as a result of the type of logging they do, extra planning jobs are created.

HPCF creates more jobs than conventional forestry. In BC, the provincial average for forestry jobs is 0.8 jobs per 1000m3 of wood harvested, while Harrop Proctor creates 3.4 jobs per 1000 m3 of wood harvested. (Rothkop, 2020).

More Employment from Lighter Touch Forestry

In a study done on central BC, employment created via industrial clearcut logging methods (conventional heavy equipment) was compared to light equipment skidding and falling methods and a selective silviculture prescription.

The study found that the lighter touch logging generates approximately 1.8 times the employment and close to 2.5 times the wages and benefits as industrial clearcut logging (Cirque, 2002).

HPCF also generates enough revenues to cover expenses and payments (BC Rural Centre).

HPCF serves as an inspiring model for other BC communities. It successfully incorporates the ecosystem-based values of residents, a sustainable supply of wood for local residents, and provides local and sustainable jobs.

SUMMARY OF BENEFITS FROM HPCF MODEL:

- More jobs
- Revenues benefit the local economy

- Ecosystem integrity
- Steady supply of timber
- Local businesses can access local timber

Is a Community Forest a Sustainable Option for the Boundary watershed?

Community Forest Agreements (CFA) were developed in the 1990s as a new type of forest tenure that departed from the traditional industrial model. CFAs are allocated a very small percentage (about 2%) of the BC AAC. A CFA is an area-based forest licence (a type of tenure) granted to legal entities representing community interests. Like other tenure holders, CFAs must pay provincial stumpage fees.

Benefits of CFAS

Community forests have the *potential* to provide social, economic, and ecological benefits, including:

- Economic development based upon local initiatives, innovation, and entrepreneurship
- Increase small business development in rural areas
- Employment in rural communities
- Increased public involvement in forest management
- More ecologically sustainable forestry practices
- Opportunities for local and traditional knowledge to be incorporated into forestry
- Log rates and locations within the tenure can be set to meet locally determined objectives and interests
- Management objectives can vary from placing a high priority on timber production to prioritizing watershed protection or education or recreation

Problems with CFAs

1. High timber volumes

Community forests have AAC requirements and must agree to log at a rate dictated by government. There is pressure to clearcut rather than having the option of using less environmentally damaging logging methods.

2. Undervaluing public timber

A big constraint of Community Forests is the undervaluing of public timber caused by the regional monopolies, which reduce the full value of the timber sold to major licensees.

3. Low value products

Some community forests are producing low-value products (fenceposts, sawdust, and rough-cut lumber) at a net loss to the province (Miller). Community forests are too small scale to compete with larger timber industry players producing similar low-end products in far greater quantities.

4. Logging in sensitive ecosystems and old growth forests

Community forests are permitted to operate in so-called sensitive areas that "may not otherwise be accessible for timber harvesting due to local opposition" (BCCFA, 2020, p. 28). These sensitive areas include domestic and community watersheds; riparian areas; unstable terrain; and critical wildlife habitat; and areas identified as sensitive by the community. (BCCFA, 2020).

5. Unsustainable model

Most CFAs operate on the same unsustainable corporate industrial model as private licensees. They are logging at economically unsustainable rates, i.e. leaving little to no timber harvest for the future.

What is the potential for a CFA in the Boundary?

A serious potential problem with CFAs is that local governments see them as revenue sources they never had before so there is a strong tendency to focus on the revenue rather than how and where the logging is taking place. This limits the potential for a new Boundary CFA to be truly economically and ecologically sustainable.

The risk of creating a new CFA in the Boundary would be that it gets co-opted by industrial forestry due to the influence of government bureaucrats who favor that model. There is no long-term ecological, social, or economic benefit to the Boundary community of creating a CFA that operates under the out-dated unsustainable industrial model.

Also, on most of the timber harvesting land base (THLB) on public land in the Boundary watershed the rights to log (the tenures) have been granted to large corporations. There are very few (and possibly no) areas of public land that are currently available for a new Community Forest License. Unless legislation is changed to make public land available for a new CFA, the option is unavailable.

One of the possibilities for a new CFA in the Boundary is to disband BCTS and grant that tenure to a new CFA.

In summary, for the Boundary to reap any benefits, a new CFA would have to:

1. operate under Nature-Based Planning principles; and

2. prioritize community values; and

2. cover a large portion of or the entire Timber Harvesting Land Base (THLB) in the watershed.

Employment Benefits of Nature-Based Planning

Changing Forestry Outcomes to Create More Jobs

Rather than eliminating jobs, a shift to the new paradigm of true sustainability (Nature-Based Forestry that is managed by Community Forest Boards) merely changes the outcomes of forestry jobs.

Under the new paradigm, employment benefits are driven by:

1. Allowing more small- to medium-sized operators access to public timber (eliminating regional monopolies).

2. An increase in the number of public and private sector jobs in planning, monitoring, and research.

3. Decentralizing forest management (re-opening local forest offices and local ranger stations, creating regional independent science panels to inform Community Forest Boards).

3. An expansion of public sector science-based jobs.

4. Switching to selection and partial logging methods and eliminating clearcutting creates long-term jobs.

5. Enabling a competitive, open marketplace.

6. Maintaining a supply of good quality wood that can be accessed by small-businesses to manufacture value-added wood products (instead of dimension lumber like 2x4s, wood chips, and pulp).

A switch to nature-based forestry does not mean less forestry work. It simply changes the way forestry work is done as well as the outcomes, benefits and costs of the work.

Figure 28 Creating BC Community Jobs with Forestry Reform

The types of forestry jobs under Nature-Based Planning and management can include:

- Forest and ecological restoration - repairing, bringing back, re-establishing, reintroducing, planting, and placing of species and ecosystem structures, e.g. re-establishing habitat for animals and fish, restoring conditions for beavers to dam water and create water storage
- Planting deciduous trees as fire buffers
- Restoring natural drainage patterns, including road and culvert work
- Road rehabilitation
- Preparing and designing plans
- Forest Inventory, analysis, and modelling
- Monitoring and compliance
- Science-based jobs
    - Monitoring ecosystem function, wildlife, biology, climate change effects
    - Watershed science
    - Cumulative effects (CE) studies - Effective CE analysis depends on having accurate, consistent, ongoing, real time data. This means regular consistent work for scientists and forest techs.
- Logging jobs using selection logging and partial cutting methods, light equipment – falling, skidding
- Trucking
- Communications
- Training
- Education

Creating Local Jobs with Value-Added Manufacturing + Regional Log Markets

Lumber retailers, small value-added businesses[24], and craftspeople in the Boundary have little to no access to timber cut from local public forests.

"Regional log markets would allow mid-sized and small manufacturers to access the available supply of timber. Local residents would find employment both in the woods under the administration of local forest trusts and in private sector manufacturing plants—niche, value-added and primary. " (Britneff, 2021)

It is critical to note that old growth has more potential for value-added than second growth grown at moderate levels of stocking. If all the old growth is clearcut, there will be nothing left.

What is a log sort yard and how is it different from the current model of log sales in BC?

BC's timber industry is based on industrial scale volume, while the Vernon project was based on small- and medium-sized operations.

Log sort yards are operated as an open market. They are centrally located sites where logs harvested by contract loggers are unloaded, scaled, cut to length, graded, and sorted into bins. Sorting is done by species, dimension, quality, and potential uses (e.g. building logs, poles). A prospective buyer can examine the wood and tender a price. The successful bidder is chosen using a sealed bid competitive transaction. If the wood comes from public land, the money goes to the Province, If the logs came from a woodlot, the woodlot licensee gets the proceeds.

In the current system:

1. Very little BC public timber is actually sold in a log market. BC has six regional timber monopolies, which control about 60 percent of the Allowable Annual Cut (AAC). The exception would be BC Timber Sales, which sells about 20% of its annual volume logged on the open market via a bidding process (successful bidders log the timber themselves). In order to get the wood for their mills, sometimes the major companies front bidders or contractors.

2. The allocation of most BC timber is controlled through the AAC apportionment process. The Ministry of Forests decides which company gets what portion of the volume of timber approved in the AAC in each TSA, TFL, etc.

3. The largest timber volumes are not sold. The licensees, usually by a contract logger, log them and the logs are delivered to the companies' mills. The licensees are then billed via the harvest billing system and they pay stumpage to the Province.

[24] See glossary for definition of value-added.

The Vernon Log Sort Yard: More Jobs, More Returns for BC Taxpayers, Access to Logs by Small Business at Competitive Prices

The Vernon Log Sort yard was a project financed by the Small Business Forest Enterprise Program of the Ministry of Forestry (MOF) and ran from 1993 to 2002. It was an experiment in making publicly owned timber available to the public of BC through an open log market rather than concentrating it in the control of a few corporations. It encouraged the development of value added businesses. Timber was supplied via competitive logging by government contractors which incorporated partial cutting and selection logging systems rather than clearcutting. The log sort yard also contributed to small business development and job creation in the region.

The Vernon Log Sort Yards was a financial success, e.g. from 1999 to 2000 it produced a Net Profit (less stumpage revenue) of $337,606 (Vernon Log Sort Yard, Financial Statement, 1999-2000).

The operation provided small local buyers access to wood they would not have otherwise had for the manufacturing of log homes, furniture, flooring, and other specialty products. Small operators added enormous value to the logs they accessed at the yard. They were able to create specialty value-added products like guitars, arrow shafts, and upscale wine boxes. Buyers came from as far away as 250 miles (Jenkins and Smith).

Jim Smith, the Small Business Forester for MoF, under whose program the log sort yard was managed, gives examples of creative and profitable uses of the log sort yard's products: a so-called 'inferior' log that was worthless in a commodity market was sold for $1100 and used as a feature log in a log home. A saddle-maker created $60,000 worth of saddle trees (a support for horse saddles) from two Douglas fir logs (Smith, 2020).

"The log yard gives access to public timber by entrepreneurs at a competitive price. The logs are sold to the buyer with the greatest bid. This is free enterprise in action, where the right log is purchased (in an arm's length log market) by the right mill (manufactures the greatest value) at the right price (competitive bid). This is a very conservative solution to an important economic problem which should appeal to conservative policy and decision makers" (personal communication, Ray Travers, Nov 10, 2020).

If it was a success, why did the government shut it down in 2002? Its success was a threat to the entrenched forest tenure system, which gave (and still gives) corporations control of BC public forests. Their powerful influence on the BC government resulted in the Vernon log sort yard - which was beneficial to small business but a danger to big business - being shut down.

According to Ray Travers, "In my opinion, the BC government terminated this project because it was an embarrassment to Canada during the USA/Canada softwood lumber dispute. Canada was arguing (and still does) that we do not subsidize our public timber. This project was proving that selection logging could protect the public values in a forest, while also generating two times plus public revenue. The log yard was easy to terminate, all the Province had to do was stop doing the road layout and selection logging planning in the forest, and the supply of logs for the log yard ceased" (Personal communication, Nov 2, 2020).

Jim Smith suggests that the only way for BC to realize the full value of its forest resources is to focus on value over volume. He believes a switch from volume-based forestry to small business operations requires a mindset change where people see logs as having more value than traditional commodity products (such as saw logs, pulp, veneer, or 2x4s). Smith says it will be neither costly nor cumbersome to implement these changes via open-access markets because the market will 'make itself', as demonstrated by the Vernon log sort yard (2020).

Local and regional log sort yards connect people to their own timber. The value of logs can be retained within the community. Residents of BC communities deserve to have this option available to them.

New Forest Legislation is Required for Better Outcomes

The challenge we face is to create a new vision for BC forests: a vision of ecological integrity and community empowerment. Out of that vision new forestry policy and legislation can emerge.

The negative outcomes of the present legislation are being imposed on people and ecosystems: the emphasis on professional reliance through Forest and Range Practices Act (FRPA), the entrenchment of tenures in the hands of multinational corporations, the prioritization of timber supply over ecological integrity, and a lack of public involvement in land decisions have all led to a troubled future for Boundary forests and humans.

For two reasons, there is no point in attempting to chip away at the problems created by FRPA and change one policy at a time:

1. As long as corporations have tenures that are protected by legislation, they are not motivated to shift from an industrial paradigm to an ecological paradigm.

2. The climate crisis leaves us with no choice but to shift to a new vision backed by legislation.

A New Forest Act Must Be Created

The new Forest Act must enshrine in law the new concept of sustainability that puts ecosystem integrity and resilience above all else. It must base forestry management on local administration, create open access to timber, provide undivided loyalty to the people of BC, and focus on local economic well-being.

It is time to legally remove large corporate industry from the woods and have it do what it does best, which is manufacturing, not forestry.

Essential elements required in a new vision and new forest legislation include:

1. A clear government mandate to create a forest management system based on the principles of ecological integrity
2. Democratize and decentralize forestry
3. Forests controlled by a publicly accountable agency that is transparent
4. Abolish professional reliance
5. Tenure reform
6. An independent, non-partisan Office of the Forester General to provide checks and balances and report regularly to the BC Legislature
7. Massively rebuild public sector involvement in forest management – create thousands of new Ministry jobs and open local Forest Service offices across the province
8. Create a revitalized Forest Research Branch – to not only conduct extensive research on forest ecosystems but also support the community-based management entities with data and analysis
9. Re-establish monitoring as a public sector function and create a mechanism for generating up-to-date forest data
10. A transition strategy and support for workers and communities as they adapt to changes resulting from a new forest management system
11. Creation of regional log markets
12. An immediate shift from logging primary and old growth forests to logging secondary forests
13. An immediate shift of logging practices from clearcutting to selection logging

Models already exist for making changes to provincial legislation. All it will take is the political will and brave leaders to make it happen.

Below is a graphic depiction adapted from one such model. The original model was created by Bob Williams and described in his report, “Restoring Forestry in BC: The story of industry’s decline and the case for regional management” (2018). In Williams’ model, an *independent* office of the forester general reports to the legislature and sets standards for regional forest practices, audits the activities of local forest trusts and regional log markets, oversees regional research, and provides the legislature with detailed annual forestry reports.

Figure 29 A model for regional empowerment.

Model is based on: Restoring Forestry in BC: The story of industry's decline and the case for regional management, Bob Williams, January 2018. Canadian Centre for Policy Alternatives.

The concept of regional decentralized forest management is being supported at the Union of BC Municipalities where a resolution was passed in 2019; and also by Rob Douglas, a councillor with the Municipality of North Cowichan on Vancouver Island. Douglas is pushing for the province to establish decentralized forest management for his region that would shift decision-making power from big corporations and senior bureaucrats to the community level, in partnership with First Nations. He is advocating a pilot project in his region to test the new management system (Barron, 2021).

BFWSS advocates for a pilot project to be undertaken in the Boundary along with a pilot project on Vancouver Island. Two regional pilots would function to identify and serve the differing challenges that are present in the BC interior and the coast. BFWSS recommends that local government in the Boundary work towards and advocate for this as well.

CONCLUSION

With climate change, the one thing for certain is that the future will NOT be like the past. We must prioritize managing the condition of the forest so it is more resistant and resilient to climate change.

Natural ecosystems provide the benefits we need for survival. It makes sense to facilitate, maintain, and enhance the ability of nature to continue to do this.

There already exists an abundance of research and treatise explaining how to apply Nature-Based Plans to the management of forests. The benefits to communities are abundantly clear. The reason this solution is not being implemented is political, rather than scientific or economic.

Catastrophes are already impacting the people of the Boundary, extensive damage has already been done to the watershed, and our futures are threatened by climate change. It is urgent that the BC government work with local people to initiate Nature-Based Planning on the landscape. This is planning that is consistent with our community's demand for a high standard of forest care.

We have made our case in this report for the need for positive change in the Boundary forests. This report is part of an ongoing search for insight, foresight, and wisdom, led by well-informed and committed citizens.

The members of BFWSS are citizens of BC telling the government in no uncertain terms what we want for our community's survival.

Respectfully, we ask our readers to do the same. What is at stake is too important to do otherwise.

What the Boundary forests needs is a real action plan, not more slogans and fluff that result in another false list of tasks.

GLOSSARY

AAC	Allowable Annual Cut
ECA	Equivalent Clearcut Area
FAIB	Forest Analysis and Inventory Branch (A branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development)
FPB	Forest Practices Board
FREP	Forest and Range Evaluation Program
FSP	Forest Stewardship Plan
KBHLP	Kootenay-Boundary Higher Level Plan Order
MFLNRORD	BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development
RDKB	Regional District of Kootenay Boundary
RPF	Registered Professional Forester
TSA	Timber Supply Area
TFL	Timber Farm License
TSR	Timber Supply Review
THLB	Timber Harvesting Land Base
VRI	Vegetation Resources Inventory

DEFINITIONS

Clear cutting – Clearcutting means that all of the trees in an area are cut, not just selected trees. (Natural Resources Canada. https://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/satellite-imagery-products/educational-resources/9513)

Equivalent Clearcut Area - "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. (British Columbia. Ministry of Forests. 1999. Watershed assessment BX Creek Community Watershed. Vernon Forest District.)

Selection logging vs. Selective logging (also see High Grading definition below) -

> Selection logging has an objective, usually to improve the growth rate of individual trees and recover tree mortality with intent to improve the overall vigour of the future forest. Selective logging is the unplanned partial logging of a forest to take the best trees, and leave the worst trees, with no thought for the productivity and values of the future forest. (personal communication, Ray Travers, March 2021)

High Grading – "High grading refers to the selective harvesting of goods to keep only the most valuable items. In forestry, high grading, also sometimes referred to as selective logging, is a selective type of timber harvesting that removes the highest grade of timber (i.e. the most merchantable stems) in an area of forest. It is sometimes described by the phrase "*cut the best and leave the rest*", and should not be confused with selection cutting. Over time, high grading gives rise to forest stands containing stems of lower timber quality. The reduced income from timber can make it harder to fund good silvicultural practices, thereby impacting the economy of non-timber forest products and other activities such as hunting, wildlife watching or hiking. The practice also has an ecological cost, with a direct impact in terms of biodiversity, genetic diversity and species mix. High grading can also be a form of fraud on the owner of the trees. Indeed, stumpage rates (the amount paid per a certain volume of wood) are based on the average quality of the wood. By taking only the best timber, the wood cutter obtains wood more valuable than average at the price of average wood."
(https://en.wikipedia.org/wiki/High_grading)

Cumulative Effects – "Cumulative effects are defined as the combined results from actions that are individually minor but collectively significant in the past, present, and foreseeable future". (Giles-Hansen, K.; Li, Q.; Wei, X. The Cumulative Effects of Forest Disturbance and Climate Variability on Streamflow in the Deadman River Watershed. *Forests* **2019**, *10*, 196.) **Cumulative** effects - "Cumulative effects are defined as changes to an ecosystem over time caused by a

combination of human activities, natural variability and climate change. Assessment of cumulative effects integrates the effects of past, present and foreseeable future events and processes. FLNR has a framework in place to guide assessment of the cumulative effects of resource management and climate change. Such a framework provides the context for informed decisions about which management actions are most likely to succeed." (Adapting natural resource management to climate change in the Kootenay Boundary Region: Considerations for practitioners and Government staff, - https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/kbren160222.pdf)

Value-added Definition - There is no one definition for value-added in forestry. The policy and operating challenge is to get the right log, in the right mill, at the right price (by a regional log market, like the former Vernon log yard).

There are two main definitions:
1. Forest economist's definition of value added:

Forest economists disagree with the business definition of value-added. They say the value is already there (like in a high quality log that is straight, round, has a low-taper rate, tight knots or no knots, is dense wood with high annual ring count/cm, and free from rot and other wood defects etc.)

When a wood manufacturing process does not capture the full value, this subtracts value from the potential. These economists talk about value subtracting. For example, this occurs when the butt log of a tree, which typically holds 60 percent of a tree's timber value, is used to make dimension lumber (2 x 4's etc), wood chips, and sawdust. This is like grinding up sirloin steak to make hamburger. Great hamburger, but really dumb economics. (personal communication, Ray Travers, March 2021)

2. Business definition of value-added (from Investopedia): *"The amount by which the value of an article is increased at each stage of its production, exclusive of initial costs*. ***Value-added*** *is the difference between the price of a product or service and the cost of producing it. The price is determined by what customers are willing to pay."* https://www.investopedia.com/terms/v/valueadded.asp

When we write about forest policy in this report, we are using the forest economist's definition, especially when writing about what the existing forest tenure system is costing BC taxpayers, i.e., when there is no log sort yard with competitive bidding (for well-sorted and graded logs) to capture the full value of BC timber. When we write about operational issues, like sawmill design, we use the business definition of value-added.

APPENDIX A: Red and Blue Listed Species in Kootenay-Boundary

2020 Red and Blue level threatened animal species in the Regional District Kootenay Boundary:

Red Animals:	Sandhill Skipper	Cutthroat Trout, lewisi subspecies	Pringhorn Clubtail
American Badger	Shortface Lanx	Cutthroat Trout, clarkii subspecies	Purple Martin
American White Pelican	Swainson's Hawk	Double-crested Cormorant	Pygmy Slug
Ashy Pebblesnail	Umatilla Dace	Dusky Fossaria	Red-necked Phalarope
Badlands Tiber Beetle	Upland Sandpiper	Eared Grebe	Red-tailed Chipmunk, simulans subspecies
Barn Owl	Viceroy	Eastern Tailed Blue	River Jewelwing
Behr's Hairstreak	Western Grebe	Emma's Dancer	Rough-legged Hawk
Black-crowned Night-heron	White Sturgeon (Upper Columbia River Population)	Flammulated Owl	Rusty Blackbird
Blotched Tiger Salamander	White-headed Woodpecker	Fringed Myotis	Sagebrush Tiger Beetle
Burrowing Owl	White-tailed Jackrabbit	Golden Fossaria	Sharp-tailed Grouse, columbianus subspecies
Caribou (Southern Mountain Population)	Yellow-billed Cuckoo	Gopher Snake, deserticola subspecies	Sheathed Slug
Clark's Grebe	Yellow-breasted Chat	Gray Flycatcher	Short-billed Dowitcher
Columbia Dune Moth	Blue animals:	Columbia Plateau Pocket Mouse	Short-eared Owl
Dark Saltflat Tiger Beetle	Abbreviate Pondsnail	Great Basin Spadefoot	Shorthead Sculpin
Desert Nightsnake	Alkali Bluet	Great Blue Heron, herodias subspecies	Silver-spotted Skipper
Forster's Tern	American Avocet	Green Heron	Silver-spotted Skipper, clarus subspecies
Grasshopper Sparrow	American Bittern	Grizzly Bear	Sinuous Snaketail
Greater Sage-Grouse	American Golden-Plover	Gyrfalcon	Smith's Longspur
Half-moon Hairstreak	Attenuate Fossaria	Hairy-necked Tiger Beetle	Sonora Skipper
Hoffman's Checkerspot	Banded Tigersnail	Herrington Fingernailclam	Speckled Dace
Hudsonian Godwit	Band-tailed Pigeon	Horned Lark, merrilli subspecies	Spotted Bat
Merriam's Shrew	Barn Swallow	Immaculate Green Hairstreak	Striated Fingernailclam
Monarch	Bighorn Sheep	Lance-tipped Darner	Subalpine Mountainsnail
Mormon Fritillary, erinna subspecies	Black Swift	Lark Sparrow	Surf Scoter
Mormon Metalmark	Bobolink	Lewis's Woodpecker	Townsend's Big-eared Bat
Northern Leopard Frog	Brant	Lilac-bordered Copper	Tundra Swan
Nuttall's Sheepmoth	Brewer's Sparrow, breweri subspecies	Long-billed Curlew	Twelve-spotted Skimmer
Okanagan Hammertail	Broad-winged Hawk	Magnum Mantleslug	Umbilicate Sprite
Olive Clubtail	Bull Trout	Mountain Goat	Variegated Fritillary
Pallid Bat	California Gull	Mountain Sucker	Vivid Dancer
Peregrine Falcon, anatum subspecies	California Hairstreak	Nevada Skipper	Wandering Tattler
Prairie Falcon	Canyon Wren	North American Racer	Western Bumblebee
Preble's Shrew	Caspian Tern	Northern Bog Lemming, artemisiae subspecies	Western Harvest Mouse
Pygmy Short-horned Lizard	Checkered Skipper	Northern Goshawk, atricapillus subspecies	Western Pondhawk
Rocky Mountain Ridged Mussel	Columbia Sculpin	Northern Tightcoil	Western Rattlesnake
Rotund Physa	Common Sootywing	Nuttall's Cottontail	Western River Cruiser
Sage Thrasher		Olive-sided Flycatcher	Western Screech Owl macfarlanei subspecies
		Painted Turtle - Intermountain - Rocky Mountain Population	Western Skink
		Pale Jumping-slug	Western Small-footed Myotis
			White-throated Swift
			Widelip Pondsnail
			Williamson's Sapsucker

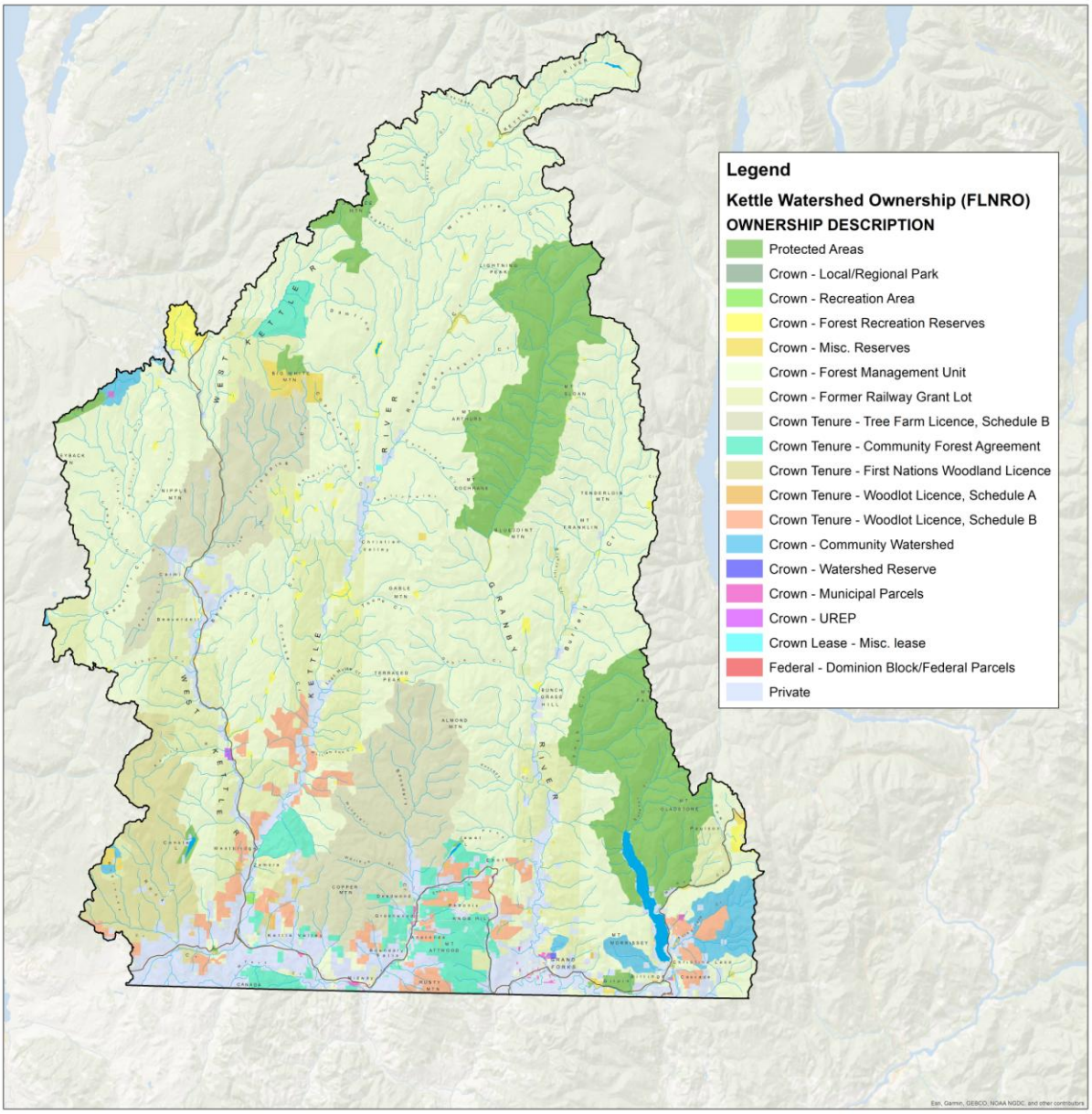
			Wolverine, luscus subspecies

2020 Red and Blue level threatened plant species in the Regional District Kootenay Boundary:

Red plants: alkali-marsh butterweed alpine sorrel Andean evening-primrose annual paintbrush bent spike-rush branched phacelia Columbia quillwort Dwarf hesperochiron edible valerian foxtail muhly Grand Coulee owl-clover hairy paintbrush Harkness' linanthus Hinds' willow Idaho blue-eyed grass Lemmon's holly fern Mountain holly fern Northern gooseberry Nugget moss	Oregon checkered-mallow Pale-evening primrose Parsnip-flowered buckwheat Rocky Mountain clubrush satinflower scarlet ammannia short-flowered evening-primrose short-rayed aster showy phlox shy gilia small-flowered lipocarpha Spalding's milk-vetch The Dalles milk-vetch toothcup Ute lady's tresses western centaury	Blue plants: alkaline wing-nerved moss beardless wildrye blackened sedge Cascade rockcress Close-flowered knotweed Columbian carpet moss Common clarkia Cushion daisy cut-leaved water-parsnip diverse-leaved cinquefoil Englemann's spike-rush hairgrass dropseed hairstem groundsmoke hairy water-clover heart-leaved springbeauty lance-leaved figwort leafless wintergreen least bladdery milk-vetch Lyall's mariposa lily mountain moonwort ochroleucous bladderwort Okanagan hawthorn Peach-leaf willow Peduncled sedge Purple meadowrue	Pursh's wallflower rabbitbrush goldenweed river bulrush rusty cord-moss slender arrow-grass slender gilia slender hawksbeard small-flowered skullcap smooth goldenrod Suksdorf's monkey-flower sulphur lupine sweet-marsh butterweed Thurber's needlegrass Tiny tassel Varied-leaf phacelia Washington fescue Watson's cryptantha western hawksbeard whitebark pine Whited's fissurewort wild licorice Wolf's trisetum Woolly blue violet yellowseed false pimpernel

Source: British Columbia Conservation Data Centre.
https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/species-and-ecosystems-explorer

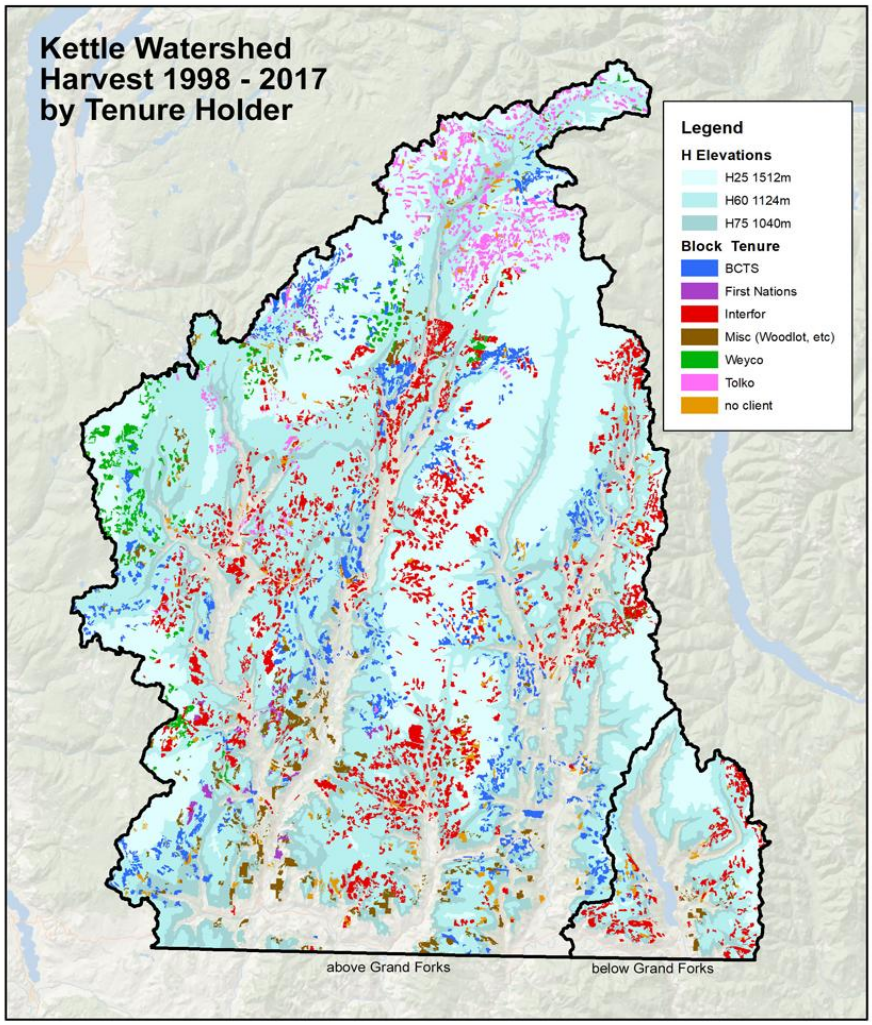
APPENDIX B: Land Ownership Boundary watershed



Source for data: British Columbia Ministry of Forests, Lands, Natural Resource Operations, and Rural Development

Map courtesy David Leversee

APPENDIX C: Kettle Watershed Harvest 1998-2017 by Tenure Holder

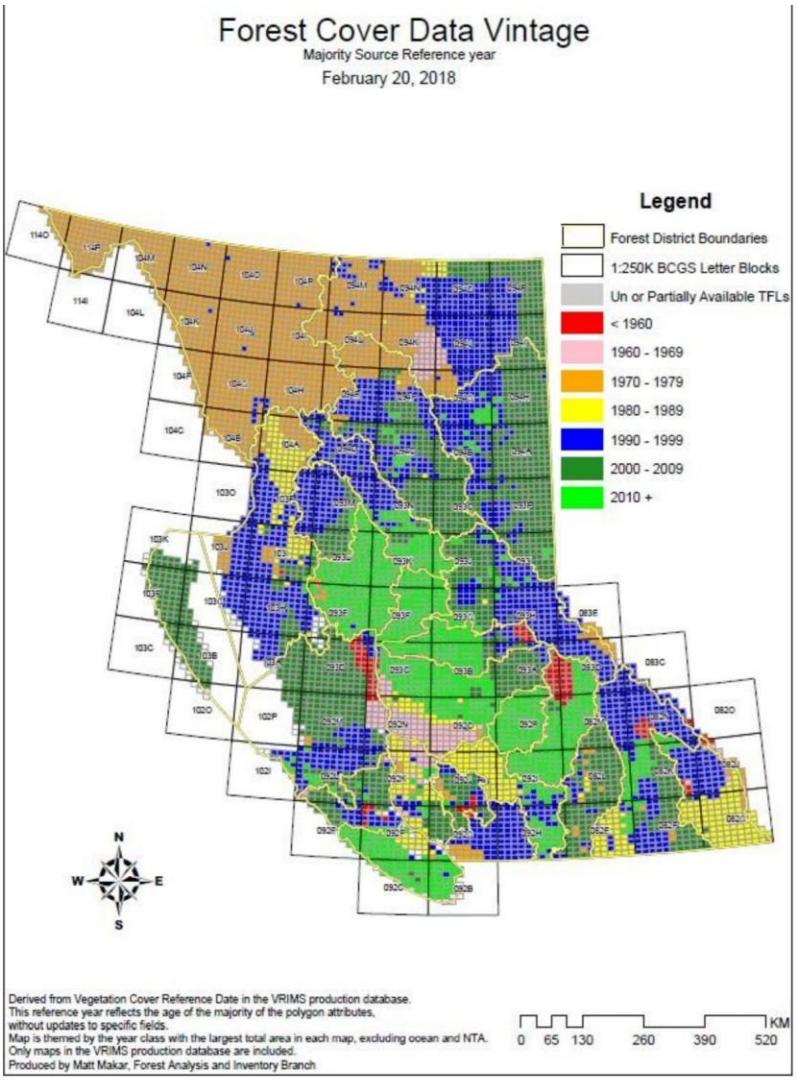


Data source: British Columbia Ministry of Forests, Lands, Natural Resource Operations, and Rural Development

Map by David Leversee.

APPENDIX D: Forest Cover Data Vintage

Map below shows that much of the forest inventory data for the Boundary (in yellow) is from 1980 to 1989. Any forest management calculations based on this data will be incorrect due to the massive changes to forest cover since then.



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

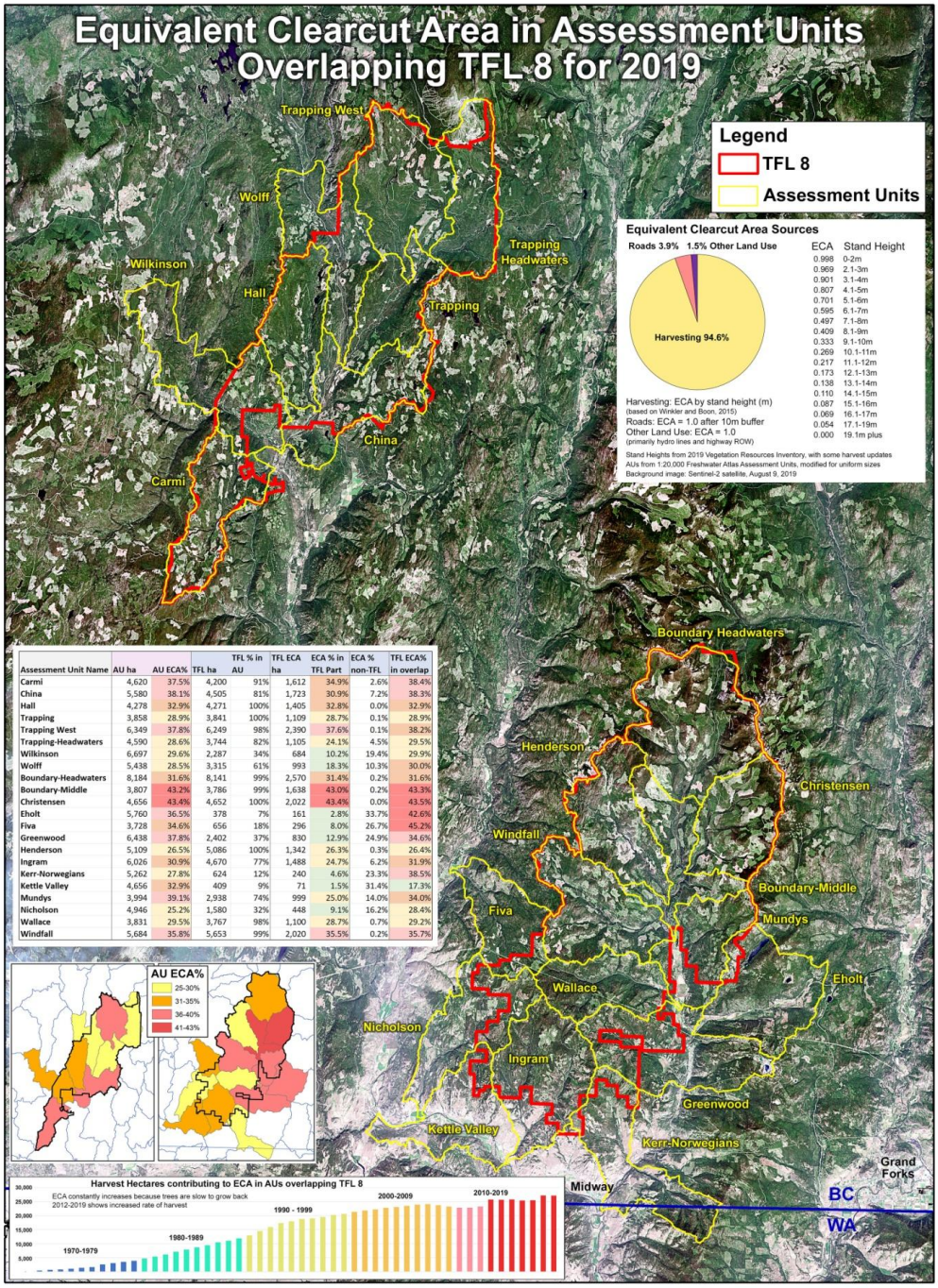
Source: British Columbia, Ministry of Forests, Forest Analysis and Inventory Branch. 2018.

APPENDIX E: Assessment Units TFL#8

The map below helps display BFWSS concerns regarding Equivalent Clearcut (ECA) determinations in TFL #8.

Explanation of map data:

- In an examination of the Assessment Units related to TFL#8, it appears they have an ECA greater than 25%. This is a problem because their cumulative affect downstream could create negative hydrology impacts. Almost two-thirds of the AUs have an ECA greater than 30% which is a serious concern because the range of 30-40% is the upper limit where impacts are likely to occur. 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% and 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 its 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%

Map and ECA calculations and map Courtesy David Leversee

APPENDIX F: Kettle Watershed ECA

The following quote is from: **Van Rensen C., Neumann N.N. and Young V.** 2019 *Analysis of the Kettle River Watershed: Streamflow and Sedimentation Hazards.* British Columbia Ministry of Forests, Lands and Natural Resource Operations and Rural Development, 2020. [Our highlight]

> "4.1.4 Equivalent Clearcut Area Forest cover disturbance can have a strong influence on snowmelt-driven peak flows in most of B.C. and is represented in the assessment by the Equivalent Clearcut Area (ECA) indicator. ECA is used to determine the area over which a reduction in forest cover has occurred, expressed relative to the hydrologic impact of a recent clearcut or where land has been cleared of vegetation cover.
>
> Although streamflow response to forest disturbance varies between watersheds, in general there are measurable changes in streamflow at ECA values greater that 20-25% (Winkler and Boon, 2017).
>
> Most of the AWs with very low ECA values in the east part of the Kettle River watershed were associated with larger parks and protected areas (i.e. Graystokes, Granby and Gladstone Provincial Parks), where anthropogenic disturbance is restricted but where natural disturbance may not be suppressed (e.g. wildfire, insect outbreaks) (Figures 12 and 13). Fire, insect outbreaks, and land development created the largest continuous disturbance areas." (p. 23)

The map below on the left is from p. 23 of the Van Rensen et al (2020) report. The map on the left displays ECA factor before roads are added to the ECA calculations (they should have been).

The map on the right displays ECA factor after roads have been added to the calculations. The map on the right demonstrates there is a big increase in both High and Very High ECA (and corresponding decrease in Low and Moderate ECA) when roads are included as they should be. The changes can be seen in the individual AWs (Assessment units) on the map. The chart below also demonstrates the increases in the High and Very High ECAs once the roads are included.

It is important to note in table below far right column that the number of Assessment Units in the High and Very High range ECA have increased by 20 with roads added to the calculations.

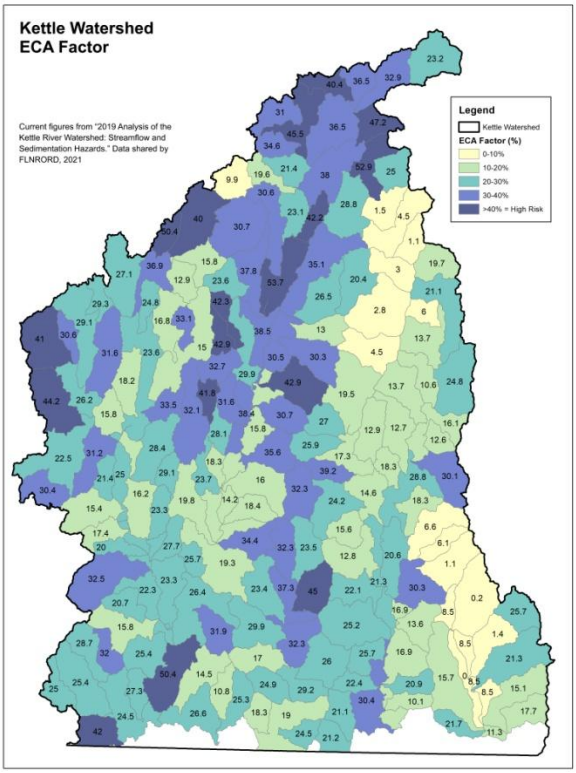
Based on the highlighted statement above, it is alarming that there are many AWs with an ECA value over 40% and some over 50%.

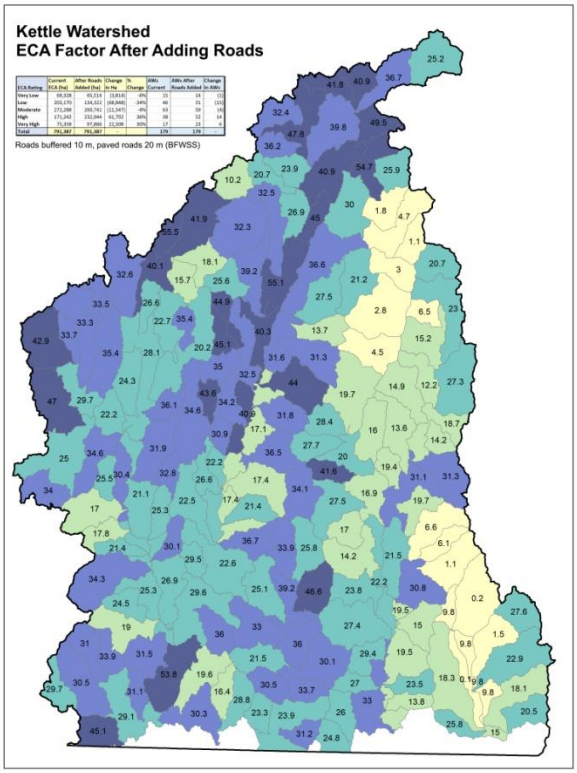
The role that harvest-related ECA plays in the frequency of significant flood events must be addressed by the BC government.

The table below is the same as on the map on the right below.

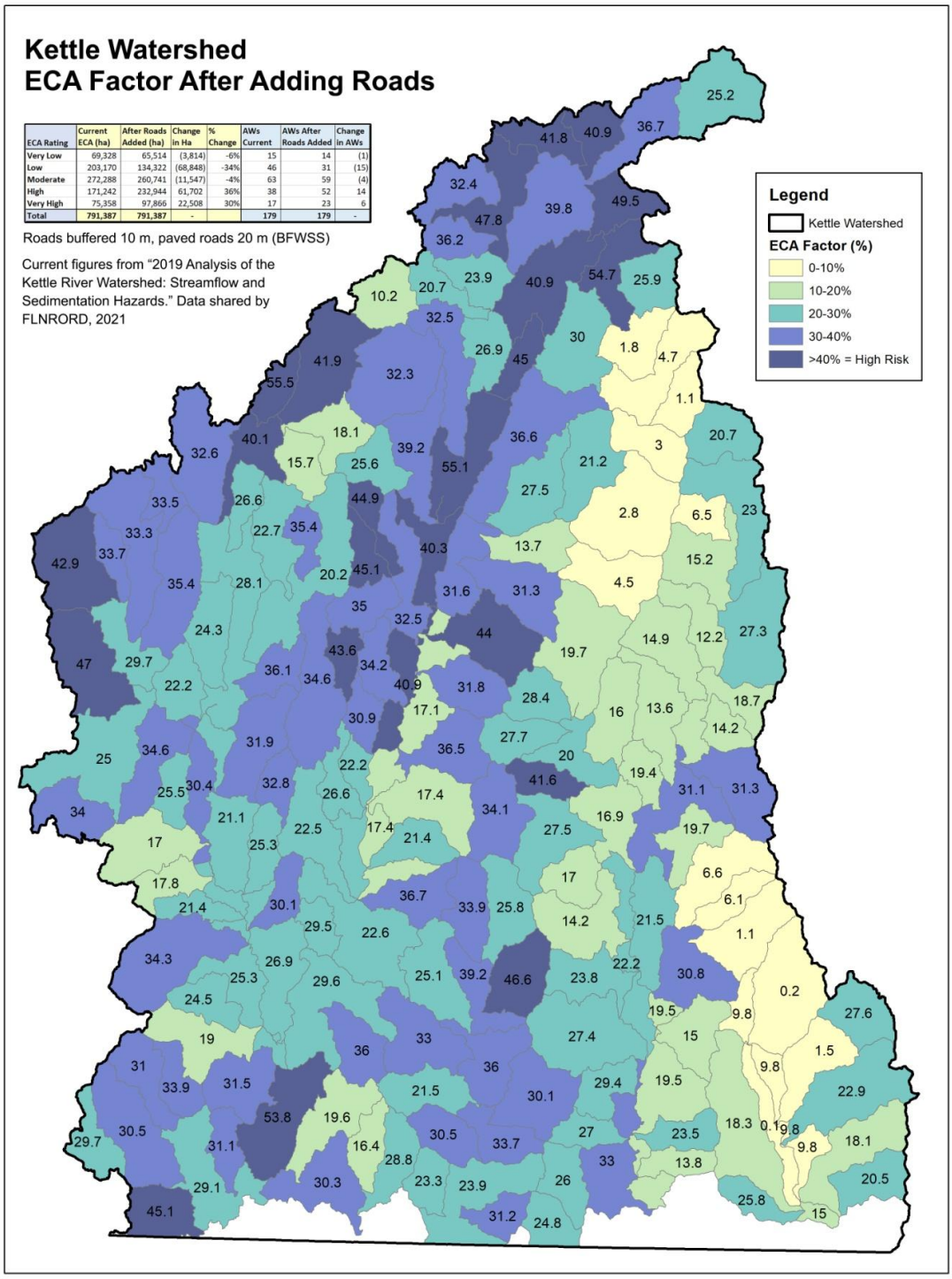
ECA Rating	Current ECA (ha)	After Roads Added (ha)	Change in Ha	% Change	AWs Current	AWs After Roads Added	Change in AWs
Very Low	69,328	65,514	(3,814)	-6%	15	14	(1)
Low	203,170	134,322	(68,848)	-34%	46	31	(15)
Moderate	272,288	260,741	(11,547)	-4%	63	59	(4)
High	171,242	232,944	61,702	36%	38	52	14
Very High	75,358	97,866	22,508	30%	17	23	6
Total	**791,387**	**791,387**	-		**179**	**179**	-

Roads buffered 10 m, paved roads 20 m (BFWSS)





The map below is a larger version of the map on the right above.



ECA Rating	Current ECA (ha)	After Roads Added (ha)	Change in Ha	% Change	AWs Current	AWs After Roads Added	Change in AWs
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Total	791,387	791,387	-		179	179	-

APPENDIX G: BFWSS 2019 Roads Report

In spring/early summer of 2019, members of BFWSS with previous forestry experience inspected 13 Forest Service Roads (FSR) in the Boundary TSA. They found that all were damaged by industrial use, inadequately maintained, and have suffered years of neglect.

Common problems included road lacking crown, grader berms, ditches fouled, culverts fouled, road surfaces washed and scoured, roads collecting water, and bridge problems. Only one, Burrell Creek FSR, had been recently graded.

These road problems have the potential to contribute to increased erosion, sediment being carried into streams and rivers, culvert and bridge blowouts, and problems for residents downstream. The accumulation of these problems (potentially on 16,000 km of Forest Service Roads in the Boundary) has the capacity for causing serious hydrological dysfunction in the watershed.

Forest Service Road	Problems	Significance/comments BFWSS request
Glover Creek	1. Routine maintenance neglected for years 2. Road lacks crown 3. Ditches are fouled 4. Grader berms on road edges 5. Damage from last year's logging not repaired 6. Extensive damage by recent logging 7. Residences affected by dust from logging traffic (complaints were ignored) 8. 10cm layer of fine loose dust 9. Environmental concern from current logging 2.2km to 2.9km – environmental inspection should be done	Current logging adjacent to road created much environmental concern – particularly bypass road 3.2 km to 2.9 km. Environmental inspection should be done.
Bunchgrass Wiseman	1. Inadequate maintenance 2. Road lacks crown 3. Lacks proper ditches 4. Lacks water control 5. Being further degraded by current logging operations	Immediately suspend all industrial use not directly related to road improvements or hydrological/environmental concerns and ensure that correctional works are carried out forthwith.
Sand Creek	1. Not properly maintained for many years	Reported to Enforcement and Compliance as

	2. Badly washed and scoured by uncontrolled water flow 3. Steep terrain and soil type mean there is potential for a major environmental disaster which could affect Sand Creek and downstream properties	immediate remedial action is required.
Granby	1. Best maintenance found. 2. Bridge over Burrell Creek at 0.0 km needs delineators, replace damaged planks. Silt & gravel accumulated at ends of beam shortens their lifespan. 3. Road lacks crown. 4. Debris trees and rocks along road edges make shaping and sloping difficult 5. Fines are gone and only subgrade exists. 6. Some sections need resurfacing. 7. Cattle guard at 8.5km needs to be removed, hole cleaned, guard reset.	
Granby-Bluejoint	1. Recently brushed and graded. 2. Much debris in ditches. 3. Culverts fouled. 4. Road lacks crown. 5. Approaches to bridge at 2.2 km need brushing. 6. New road leading to Granby Park Trail was built without crown.	We ask that all industrial use of this road system be suspended until adequate remedial work is done.
Miller Creek	1. Road abused and neglected in extreme. 2. Many steep grades create a high risk of failure. 3. Severe erosion and washing of the road surface. 4. Ditches are fouled. 5. Road lacks crown. 6. No construction of water bars or other means of water control or dispersement.	Failure could result in blockage of Miller Creek and threaten downstream properties. There was a sign posted as “Wilderness Forest Service Road – Not Maintained”. There should be no such thing as a ‘not maintained’ road in the forest industry. There are only two options for Forest Service Roads: 1. Maintain them (properly) 2. De-activate and reclaim them.
Cannon	1. Road is collecting rather than shedding water. 2. Water from above gate running half a km due to poor road shaping and grading. 3. Ditches and culverts look ok but have little sign of water use.	BCTS road – as a Crown company should be setting a good example rather than a poor example. Take immediate action to correct situation.

Burrell Creek (0-10 km)	Recent grading practices not acceptable. 1. Ditches not being re-established or cleared 2. Grader berms being left. 3. Grader blade cutting depth insufficient to address potholes, ruts, and washboard. 4. Road lacks sufficient crown to shed water 5. Burrell Creek bridge – delineators partially obscured; tree under bridge	We ask that all industrial use of this road system be suspended until adequate remedial work is done.
Pass Creek-Rock Candy	1. Needs extensive maintenance works. 2. Deep potholes. 3. Considerable erosion of the surface materials 4. Ditches are obstructed 5. Grader berms exist 6. Road lacks sufficient crown.	Much of road traverses steep terrain with side slopes near 100%. Steep slopes have potential for an environmental disaster. We ask that all industrial use of this road system be suspended until adequate remedial work is done.
Deadeye Creek	1. Suffers from years of neglect. 2. Ditches are restricted by debris and vegetation. 3. Road surface is washed by water runoff. 4. Road lacks crown.	We ask that all industrial use of this road system be suspended until adequate remedial work is done.
Lynch Creek	1. Road is damaged from industrial use. 2. Drainage system not repaired. 3. Ditches are destroyed. 4. Cattle guard bypass needs repair 5. Bridge over Lynch Creek lacks delineators 6. Culvert near bridge inadequate to handle water flow. 7. Road lacks crown	Major reconstruction is required. We ask that all maintenance and re-construction works be carried out post-haste and that all industrial use be curtailed immediately until such works are completed.
Volcanic Creek	1. Ditches need to be cleared. 2. Ditches need reshaping. 3. Water is collecting and washing the road surface. 4. Road needs shaping and grading. 5. Road lacks proper crown.	Ensure that full maintenance is completed before any industrial use is allowed.
Almond Creek	1. Deep potholes. 2. Rutting. 3. Culverts fouled. 4. Ditches fouled. 5. Scouring of road surface. 6. Lack of crown. 7. Grader berms.	Blowdown noted at 7km - assumed that logging will soon occur. We ask that all industrial use of this road system be suspended until adequate remedial work is done.

Appendix H: Logging Rates and Slow Re-growth of Forests

In reference to the report about hydrological modelling for the Kettle Watershed in 2020: *The hydrological effect of forest disturbance on the Kettle River Watershed* (Chernos et al) called the *MacHydro report* in the tables below), we offer the following tables to explain how slow-growing the forests of the Kettle River watershed really are (tables courtesy David Leversee).

The referenced 2020 hydrological model designed for the Kettle River watershed found that "increasingly large forest disturbance can have substantial impacts on both average peak flows and large destructive floods" (p. 1. Chernos, et al, 2020).

The report concluded, "Under increased forest disturbance, median and extreme peak flows increased. Scenarios that disturbed higher elevations had approximately double the flood response relative to disturbance at lower elevations. Finally, 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 disturbance increase average peak flows and the probability of large, destructive floods. In addition, the location and elevation of the disturbance is an important consideration in determining in the hydrologic response experienced, where the hydrologic effects are greater at higher elevations." (Chernos, et al, 2020, p. 28)

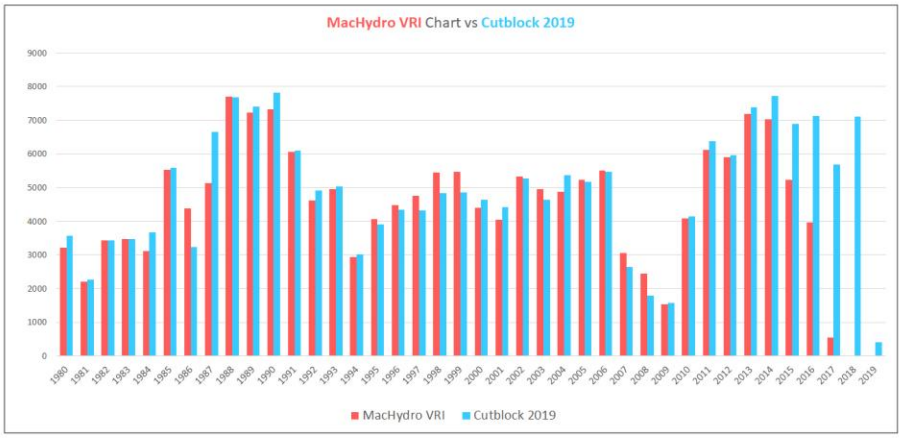
The authors of the above report also stated, "Assuming that harvested areas regrow and regain relatively similar hydrologic properties to pre-disturbed conditions within 20 years, the proportion of the watershed that was effectively disturbed peaked in approximately 2004 and has been relatively steady since then."(Chernos, et al, 2020,p. 3, our highlight).

We respectfully disagree with this statement because forests cannot return to "pre-disturbed condition" in 20 years (trees just don't grow that fast). They are also incorrect when they state that disturbance has been relatively steady since 2004. Their own graph shows that logging increased by a lot starting in 2010, but because their graph shows that they used 2017 data and most of 2015-2016 data had not been updated by that point, their results make it looks like a downward trend in disturbance. But in reality, the rate of logging since 2011 has been either the same or much higher than it was in 2004.

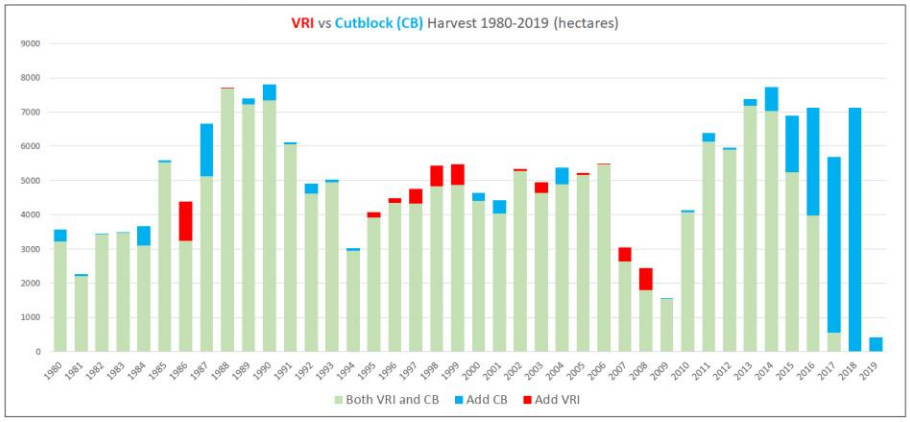
If the modelling data had been complete and up-to-date would the study have found even higher probabilities of large destructive floods?

The third chart shows that the logging from 1980 to 2018 has only hydrologically recovered by 23% and the last 20 years by only 2%. This chart uses the average height of harvested stands for each year and links it to the same ECA, but in 2-metre intervals to explain how slow-growing the forests are.

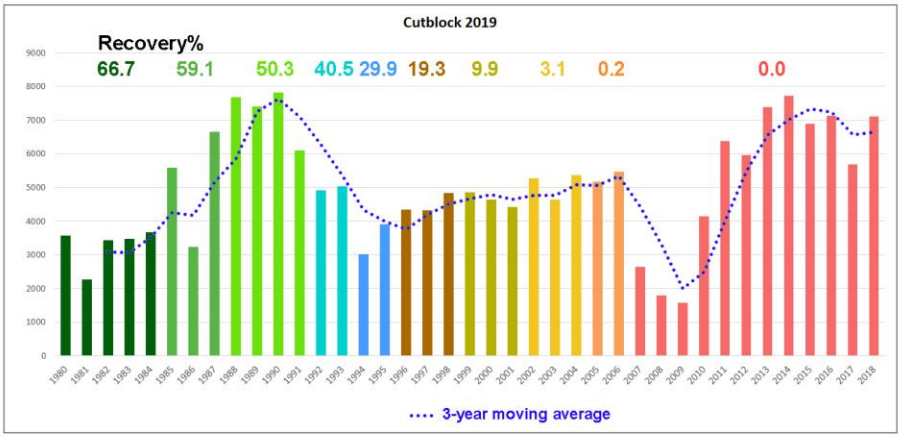
This compares the graph that MacHydro has in their report (with BEC colours) using VRI data with the newer Cutblock 2019 data that BFWSS received from FLNRO. Even though MacHydro had access to the Cutblock 2019 data, they used the older data which gives a misleading impression that the 2014-2017 harvest was declining or leveling off.



This shows where the yearly totals overlap and where they are different. It does not show where one is more accurate than the other. Some of the VRI-only blocks are logged, but missing in the Cutblock data, and some are errors (not logged). There are some errors in the Cutblock data as well, so neither one is perfect, but a quick check looks like Cutblock data are more accurate overall.



This shows the 3-year average trend for Cutblock 2019 data (excluding 2019). Rather than showing "a minimal change" over the 2006-2017 period, the harvest rate has never been as high for as long as it has since 2010. Every block harvested since 2006 is 0% hydrologically recovered, while the oldest blocks are 66.7% recovered*. The recovery percent for 1980-2018 is 23% and for 1999-2018 (20 years) it is just 2%.



* Using average VRI 2019 Tree Height for harvested blocks.
Recovery percent is based on IPA Cummulative Effects Framework ECA curve.

APPENDIX I: Tool for Determining Properly Functioning Condition in Riparian Areas

The concept and process for determining the base case in setting the AAC would be significantly improved if there was a classification of watersheds into (1) functioning properly, (2) at risk, and (3) impaired. A tool for doing this already exists in the form of PFC assessments.

The USDA Natural Resources Conservation Service (NRCS), in the USA, has developed a method for using PFC assessments to evaluate the condition of riparian wetland areas. The following are excerpts directly quoted from: *USDA, USDI, Bureau of Land Management, Natural Resources Conservation Service, 2003, A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas, Prichard, D.*

- "The BLM [Bureau of Land Management] and the FS [Forest Service], working with the NRCS, have initiated an effort to restore and manage riparian-wetland areas in 11 Western States. To be effective, these agencies have established common terms and definitions, as well as a method for evaluating the condition of these areas, which has been extensively reviewed and tested. This method is the proper functioning condition assessment (see TR 1737-9, TR 1737-11, and TR 1737-15).
- The PFC method is straightforward: *review existing documents, analyze the PFC definition, and assess functionality using the checklist.*
- Riparian-wetland areas are rated in four categories: proper functioning condition, functional—at risk, non-functional, and unknown.
- At-risk areas with a downward trend are often the highest management priority because a decline in resource values is apparent. Yet these areas often retain much of the resiliency associated with a functioning area. There is usually an opportunity to reverse this trend through changes in management. At-risk areas with an upward trend are often a priority for monitoring efforts. These areas should be monitored to ensure that they continue to improve.
- When a riparian-wetland area's physical aspects are in working order, then characteristics are maintained that sustain the area's ability to produce resource values. *Function comes first, and then values (desired condition).*
- *Managing riparian-wetland areas does not cease once PFC is achieved—it has just started.* Existing and potential resource values and the plant communities necessary to support these values have to be identified. Once these values have been identified, specific objectives can be derived to ascertain desired condition. Management actions to achieve desired condition can then be designed and implemented. " *Accessed here:* https://sagebrusheco.nv.gov/uploadedFiles/sagebrusheconvgov/content/CCS/4.1%20Field%20CCS%20Forms%20-%20Lentic%20PFC%20User%20Guide%20(Credit%20Projects).pdf

APPENDIX J: Communication Timeline from Government on Kettle-Granby Grizzlies

The following section is summarized on page 83. The details are included below as a demonstration of how government has been putting corporate considerations over ecosystem values and the public good (which requires the presence of bears in the ecosystem) and stalling any effective action that would protect grizzlies.

The following summarizes a sequence of events:

1. 2017 FPB report makes four recommendations. Full report is here: https://www.bcfpb.ca/wp-content/uploads/2017/08/IRC210-Kettle-Granby.pdf

2. 2018 the BC government wrote a response to those recommendations (available here: https://www.bcfpb.ca/wp-content/uploads/2018/04/IRC210-Response-to-Recommendations.pdf)

3. 2020 BFWSS sent an email to FLNRORD asking which FPB recommendations have been implemented. Selkirk District Manager of FLNRORD responded November 2020 via email to BFWSS.

The information is organized as such:

a) 2017 Forest Practices Board Recommendation
b) 2018 BC government response to FPB recommendations [paraphrased and/or condensed]
c) 2020 FLNRORD email to BFWSS [paraphrased and/or condensed]
d) BFWSS commentary on the above

Forest Practices Board Recommendation #1

a) *"Government should confirm its population recovery objective and develop a strategy that includes a population target for the Kettle-Granby grizzly bear population unit that can be used to guide habitat management and industrial planning decisions." (p. i)*

b) Government response 2018: it is committed to **"…**development of a provincial grizzly bear management plan, which will help inform the development of area-specific objectives for populations…"

c) Government email November 2020: the provincial team is working on a grizzly bear management plan for the province.

d) BFWSS COMMENTARY ON GOVERNMENT ACTION AROUND #1:

The BC government has failed to indicate any timeline for its 'commitments'. It has been 3 years since the BC government announced it was going to "develop a provincial grizzly bear management plan with clear objectives, roles, responsibilities and accountabilities." (FLNRORD 2017a). To date there is still no plan.

By announcing commitments that have no timelines, the BC government gives itself the ability to stall, delay, postpone, and remain inactive on critical environmental issues. Meanwhile, the government has not stalled, postponed, or delayed either the building of new roads or the clear cutting that is endangering the grizzly bears in the Boundary.

Forest Practices Board Recommendation #2

a) "Government should consider revising GAR Order 8-373, in light of the recent grizzly bear research in the Kettle-Granby area and the failure to meet the road density targets through voluntary guidance. This reconsideration should weigh the benefits of road density and secure core area measures to government's recovery objectives for the Kettle-Granby grizzly bear population unit against an informed assessment of any material adverse effects on delivered wood costs."(p.ii)

b) Government response 2018: "…The government accepts that recommended road densities and secure core area targets within GAR Order 3-873 have not been met by forest licensees and ministry staff. However, placing legal requirements on licensees to achieve these road density targets requires solutions to reduce economic risks, such as delivered wood costs..." Government also suggested they would consider funding or other cost-recovery mechanisms for licensees.

d) BFWSS COMMENTARY ON GOVERNMENT ACTION AROUND #2:

The licensees are making enormous profits from publicly owned timber for which they pay a nominal rent. The costs of meeting ecologically responsible road density targets should be borne by the licensees who make the profits, not by the public in the form of subsidy funding from government. In addition, the costs of industrial clearcut logging and industrial road development should <u>not</u> be borne by the ecosystem (including wildlife).

As long as targets set for road rehabilitation are not legally binding, there is zero incentive for profit-oriented corporations to meet targets. In order to protect the greater public interest, government is responsible for setting legally binding road density targets.

Forest Practices Board Recommendation #3

a) "Government should provide leadership to reduce the current risks to bears in the Kettle-Granby area. Government should lead local licensees and BCTS in an operational planning

process for roads and timber harvesting in the Kettle-Granby specified area that protects high value bear habitat and addresses access management, such as road deactivation and regulatory road closures, while integrating with timber objectives. The Board's previous reports on access management may be helpful to this exercise."(p. ii)

b) Government response 2018: "…The government supports: Appointing a regional lead to work directly with industry…".

c) Government email Nov 2020: government informed BFWSS that instead of appointing a regional lead, it has, "…convened a road deactivation pilot group to look at how to engage with the public, stakeholders and First Nations and determine where roads can be deactivated to most benefit hydrologic and habitat concerns without undue impact to road users."

d) BFWSS COMMENTARY ON GOVERNMENT ACTION AROUND #3:

There is no reason to convene a pilot group to figure out how to engage with the public. The BC government has been doing consultation and engagements for decades and there are structures and frameworks for engagement already established.

There is a conflict between the values of 'hydrologic and habitat concerns' and 'undue impact to road users'. Until the government chooses to put the former values above the latter regarding forest road decisions, the Boundary ecosystem will continue to degrade and this will impart a negative ecological and economic result for the residents of the Boundary.

The BC government must implement a system whereby licensees are required to pay road rehabilitation costs up-front. For example, rents can be raised (the cost of tenures) and the costs of stumpage can be raised.

Whatever specific measures are implemented, the government is responsible for ensuring, through legislation, that those who are taking the profits from public resources must also bear the burden of repairing the ecological and economic damage caused by those profit-taking activities.

Forest Practices Board Recommendation #4

a) "Government should monitor the amount of open road density, secure core area, and grizzly population size and distribution over time and make further adjustments to management and legal requirements if and as needed." (p. ii)

b) Government response 2018: "…the provincial team is working on a grizzly bear management plan for the province…".

c) Government email November 2020: "Population monitoring is typically done once every 10 years, unless there is a significant risk to the population in question. An inventory of the Kettle Granby population unit is scheduled to be completed in about 2025."

d) BFWSS COMMENTARY ON GOVERNMENT ACTION AROUND #4:

In their 2017 report, the FPB reported, "Grizzly bears are blue-listed in BC and ranked as a 'high priority' for conservation in the provincial conservation framework…. the population unit in the Kettle-Granby area has been a management concern for the BC government since the 1990s because of its low population numbers and the poor population connectivity with surrounding bear populations." (p. 3).

The BC government has rated Granby grizzly bears as at risk and a high priority. In other words it has determined that there is significant risk to the population. This warrants the immediate initiation of monitoring the grizzlies. There is no excuse for not doing this.

APPENDIX K: LIST OF ALL RECOMMENDED ACTIONS

RECOMMENDED ACTIONS AROUND AAC, ECA, CLEARCUTTING

It is too late to undo the ecological and economic damage done by the clearcutting and overcutting that has already occurred in the watershed. The outdated and incorrect AAC determination is incongruous with the 2018 catastrophic flooding event, overall increased flooding of the past few years, forests losses due to fire, insects and disease, the massive amount of logging over the past 20 years, and is conceivably dangerous to the local community in an era of climate volatility. Given all these uncertainties and potential inaccuracies, immediate action must be taken.

In the words of Anthony Britneff, "…a truthful and honest assessment of what our forests contain is fundamental to making Allowable Annual Cut (AAC) determinations" (Britneff and Watt, 2018).

AAC determinations carry a risk of serious or irreversible harm to local economies and to ecosystems and therefore require use of the best available knowledge.

For the Boundary TSA, it is essential that inventory is reviewed for accuracy, the Timber Supply Review methodology used in support of AAC, and the AAC determination be reviewed immediately. (The last AAC calculation was done prior to the 2018 flood and is not required again until 2024.)

4. The Boundary TSA AAC must be immediately reduced by at least 30% to bring it to the what the province considers to be a 'sustainable' level.
5. Immediately undertake a study to determine how much to further reduce the AAC to bring the ecosystem back to a functioning state.
6. Mandate the use of the most recent technology (such as LiDAR) and up-to-date information to calculate inventory.

5. Mandate baseline hydrological assessments in all watersheds before any new logging can take place. Assessments must determine if logging has contributed to increases in the frequency, duration and magnitude of peak flows, increased sediment transport, and how it may contribute to further severe flooding events. If so, pause or decrease logging accordingly.

6. Hydrological assessments must be based on standardized science and performed by independent scientists not in the employ of licensees.

7. The Province must mandate methods that licensees use for ECA calculations that are appropriate to the local watershed conditions.

8. Pause logging in areas with ECA higher than 25% until the ECA is at 15%.Government must mandate that any increase in cutblock size more than 25% above 40 ha must be adjudicated by an independent professional not in the employ of the forest industry.
9. Mandate that further logging is not permitted in watersheds/sub-watersheds that have been clearcut until that watershed/sub-watershed has resumed its ecological function.

10. Forests in the Boundary must no longer be logged faster than they grow back.

11. Immediately undertake a pilot project in the Boundary that utilizes selection logging instead of clearcutting.

12. Mandate that licencees must manage forest resources in a way that prioritizes the public interest over private interests (typically profit).

RECOMMENDED ACTIONS REGARDING FLOODS AND HYDROLOGY

1. Government must conduct in depth hydrological assessments using actual field data (not modeling) for watersheds/subwatersheds currently scheduled and targeted for logging in the near future before any further logging is done. The assessments must determine if logging has contributed to increases in the frequency, duration and magnitude of peak flows, sedimentation and sediment transport, and how it may contribute to further severe flooding events.

2. The Chief Forester use a Properly Functioning Assessment tool to provide an ecological base case for further analysis, planning, and setting the AAC (see example in Appendix I).

RECOMMENDED ACTIONS REGARDING CLIMATE CHANGE

8. Since the BC government 2016 report on climate change in the Kootenay-Boundary is entitled "*Adapting natural resource management to climate change in the Kootenay Boundary Region: Considerations for practitioners and Government staff*" the Province must mandate that forestry practices are enacted according to the sombre statements made within that document.

9. It is a public sector function to ensure that climate change is factored into the management of public forests. It must not be an optional practice that is merely recommended to professionals. Practices reflective of climate change impacts must be legally mandated by forestry legislation and policy.

10. Lack of full scientific certainty about the potential effects of climate change on Boundary forests require the immediate application of the precautionary principle in every aspect of forestry, including determination of the AAC.

11. Regarding CO2 emissions, the safest overall policy option is to require logging emissions to not exceed what managed forests absorb. This strategy would mean putting an end to the logging of old growth and primary forests in the Boundary. There must be a shift to the logging of second growth only (where selection logging is used across the majority of the areas rather than clearcutting.)

12. Immediately cease the practice of clearcut salvage logging in pine-mixture stands with other tree species. Selection logging to remove the dead pine would be acceptable where machine use would not initiate erosion or compaction. The intent should be to leave as much of the forest structure intact as possible and to permit the live trees that remain to expand into the growing space of the trees removed and to recover their former vigor.

13. Stop logging within 100m of riparian zones (due to the risk of drought and the importance of water).

14. Slash piles – cease the practice of burning slash piles. Instead of creating slash piles, leave the logging debris distributed across logging sites.

RECOMMENDED ACTIONS FOR ROADS

Many roads are in poor shape and in need of repair or maintenance. This is a condition that has been building over the last decade with no end in sight under the current government and forest industry operating policies and procedures. The Boundary region is in trouble without some changes in how forest management is carried out.

In regards to the 13 roads inspected by BFWSS in 2019 (see Appendix G), we ask that:

1. those who have used these roads for timber harvesting repair them, or close and deactivate them, and

2. all industrial use of these road systems be suspended until adequate remedial work is done

Operational

3. Build or re-build roads to the proper specifications before any hauling commences

4. Maintain ditches and culverts, deactivate roads, and restore natural drainage patterns as soon as possible after logging has ceased

5. Minimize sediment introductions from roads and ditches during construction, maintenance, logging, and deactivation

6. Ensure culverts are placed and spaced so that natural drainage is maintained

Overall Recommendations

7. Government implement and enforce all of the FPB recommendations from its 2017 report regarding roads and grizzlies in the Kettle-Granby (see page Appendix J)

8. Adjust road density guidelines so they are legally binding requirements (rather than recommendations) and place grizzly and other wildlife needs as the top priority for determining road density requirements.

9. Close non-legacy/secondary roads to public access once logging has ceased and planting is finished. (Legacy roads are the main roads through the drainage.)

10. Fully deactivate roads in sensitive wildlife habitat areas once logging has ceased and planting is finished.

11. Water in the ditches should be returned to the natural drainage patterns. This will permit the base flows of natural drainage and storage to return to the pre-logging condition (instead of ditch water directly flowing into creeks).

12. Adopt a no-net-new roads policy and strictly enforce it.

13. Create an approval mechanism for road permits.

14. Mandate a process by which citizens can view and give input on road permits prior to construction; and, mandate that licensees provide road location and construction specifications to the public on request.

15. Legislate a system for government authority regarding enforcement and non-compliance around road building, road maintenance, road deactivation, and road rehabilitation.

16. Immediately undertake studies to discover the ecological, economic, and social consequences of the extensive road system in drainages with ECAs over 30%, ensure that methodology, results, and data are freely available to the public.

17. Create an active road management plan and road ledger to provide information about the roads over their lifetime.

18. Fund adequate staff in the Boundary watershed to monitor and address road maintenance at the operational level (boots-on-the-ground).

19. Government must dedicate funding to ensure that all of the above is addressed.

RECOMMENDED ACTIONS FOR SPECIES-AT-RISK AND GRIZZLIES

Government must:

1. Immediately implement the grizzly bear management plan in the Boundary watershed.

2. Take immediate action to reduce the road density to a limit of 0.4 km/km2 in the area of concern for grizzlies (as indicated on the map above). Make this a legally binding requirement.

3. Build no new roads in the area of concern (as indicated on map above).

4. Road construction, deactivation, and access controls must be guided by the science on grizzly bears in the area of concern, including finding ways to reduce road use in the entire Boundary watershed.

6. Use every opportunity to protect bear habitat. Legislation protecting bear habitat from logging must be written that overrides the 'unduly' clause in FRPA that enables licensees to prioritize the timber supply over grizzly survival.

7. Immediately appoint a regional lead (with a science background) to work directly with industry.

8. Due to the significant risk to the Kettle-Granby grizzly population, monitor the grizzly situation immediately and adjust legal requirements for protecting them (including road targets, habitat targets, connectivity targets).

9. Direct the Chief Forester to set the AAC at a level necessary to conserve biodiversity, sustain ecosystem function, and support viable grizzly bear populations. By supporting grizzly populations (a species for which there is data), other species in the watershed will also benefit and rebound.

10. Due to the detrimental effect of clearcut logging on habitat, productivity, biodiversity and connectivity, logging practices must immediately shift from clearcutting to selection logging in the area of concern. Logging practices must prioritize high levels of tree retention, habitat, and connectivity corridors to enable species survival.

11. Immediately create a Species-at-Risk Act for British Columbia.

RECOMMENDED ACTIONS FOR OLD GROWTH

With the climate crisis, risks to wildlife and biodiversity, degree of recent flooding, and risks of future flooding, old growth protection must be a priority in the Boundary. Also, mature and primary forests must be retained to use for recruitment of future old forests.

Our top two recommendations:

1. Legally implement 100% protection of all old growth in the Boundary watershed. Retain all trees and pockets of trees greater than 140 years old.

There must be an *immediate* response to ecosystems at very high risk of irreversible biodiversity loss.

It is imperative to the public interest that this be applied without delay to the specific areas in our region listed below. There are others that are not listed. However, any areas that meet the criteria of 'very high and near-term risk of irreversible biodiversity loss' must be included. This includes any cutblocks that have already been laid out.

- July Creek cutblocks (Mid Boundary Community Forest cutblocks)
- Wildlife Corridors between Granby and Gladstone Parks
- East Patarageous – the entire ridge at the top where Whitebark Pine is growing. It is naturally regenerating and it does not successfully regrow in plantations (The cutting permit identifier there is: CP480 Blk16 RD16.1 RP#1 POC STN1 Smfz WP/Js 7.7.20)
- Slopes of Grano Canyon, Cochrane, Hellroarer, Goatskin
- Burrell Creek watershed
- McRae Creek watershed by Christina Lake

2. Do not allow logging in Old Growth Management Areas (OGMAs).

Price et al (2020) made some specific recommendations on old growth. We support them all. Below some are paraphrased and condensed:

Recommendations for OGMAs:

3. Recruit the oldest available mature forest where no old forest remains for OGMAS.

4. Ensure that forest retained in OGMAs represents the best old forest available for each zone.

5. Ensure OGMAs are functional.

6. Immediately remove the low Biodiversity Emphasis Option target "drawdown" that reduces targets in low biodiversity emphasis option areas by two-thirds in all zones.

7. Fix arithmetic errors - Stop double counting protected areas in old forest targets.

BFWSS supports Gorley and Merkel's recommendations from *A New Future for Old Forests: Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems (2020)*. We have blended some of those recommendations with our own below.

We advocate for these recommendations to be applied to the management of *all* forests in the Boundary, not just old growth.

8. Prioritize Ecosystem Health and Resilience. Declare the conservation and management of ecosystem health and biodiversity of forests as an overarching priority. Enact legislation that legally establishes this priority.

9. Monitoring and Evaluation. Establish and fund a more robust monitoring and evaluation system for updating management of old forests.

10. Update biodiversity targets, so that biodiversity is prioritized, and targets for retention and management of old and ancient forest.

11. Create a silviculture program aimed at developing logging alternatives to clearcutting that maintain old forest values.

Switch from: Predominately clearcutting with a focus on minimizing cost to the industry

To: Use silviculture systems that manage for multiple values

Gorley and Merkel stated in their report, "Our recommendations are shaped by a recognition that society is undergoing a paradigm shift in its relationship with the environment, and the way we manage our old forests needs to adapt accordingly."

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Cedar-Hemlock old growth forest in the Boundary. July 2020.

Photo courtesy Jennifer Houghton