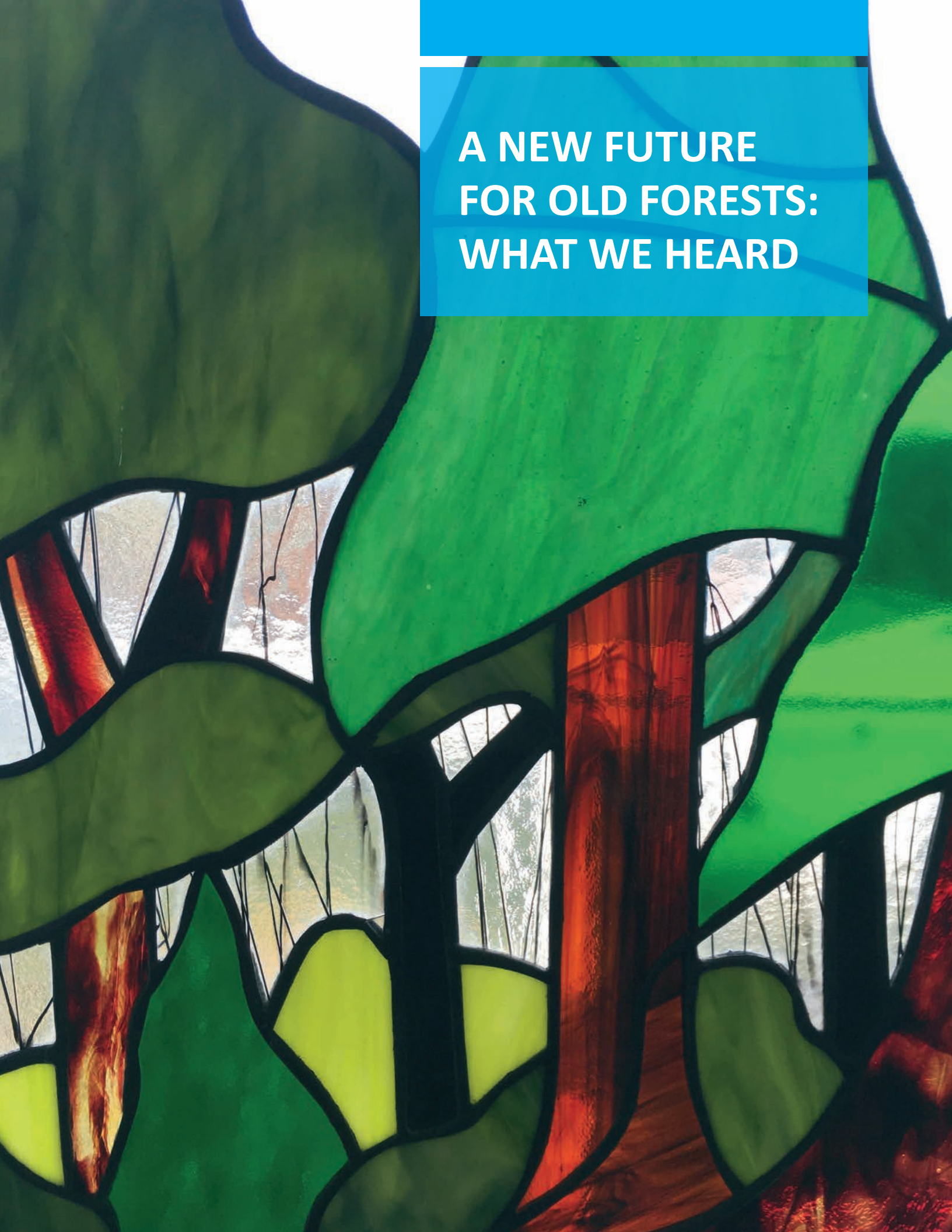
A NEW FUTURE FOR OLD FORESTS: WHAT WE HEARD



April 30, 2020

Honourable Doug Donaldson
Minister of Forests, Lands,
Natural Resource Operations
and Rural Development
Room 248 Parliament Buildings
Victoria, BC V8V 1X4

Dear Minister,

We are pleased to submit this report, which summarizes what we heard from British Columbians during the engagement phase of our independent strategic review of old growth forest management in British Columbia. We have been honoured to co-chair this work, and to have had the opportunity to engage with and hear from British Columbians directly about how they value old forests, and how they believe they should be managed.

In addition to scientific studies and data, people shared their personal observations, perspectives, and ideas about what needs to be done. In many cases, their information and ideas were about broader land use policies, or sometimes they focused on how to manage a specific plot of land. We particularly appreciated the constructive approach taken by nearly every participant in the dialogue, and the common sentiment that we need to find better ways to manage old forests for a broad spectrum of benefits and reasons.

The recommendations provided in our Strategic Review and Summary Report were 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. In the government's upcoming deliberations about how to implement our recommendations, we encourage you to engage with Indigenous leaders and organizations from the outset, and to involve local communities and stakeholders throughout the process.

We also encourage you to consider our recommendations as a whole. Had previous old forest strategies and recommendations been fully implemented, we would likely not be facing the challenges around old growth to the extent we are today, i.e., high risk to loss of biodiversity in many ecosystems, risk to potential economic benefits due to uncertainty and conflict, and widespread lack of confidence in the system of managing forests.

We would finally like to thank you and your government for putting your trust in us to carry out this review. We have done our best to capture the passion and many good suggestions that were provided in the hopes that the results of our deliberations will help you as your government determines the future of the management of old forests in British Columbia.

Al Gorley, RPF
Co-Chair

Garry Merkel, RPF
Co-Chair

FOREWORD

Nearly 30 years ago, more than one hundred people from various walks of life, including government, helped create An Old Growth Strategy for British Columbia (B.C. Ministry of Forests, May 1992), a comprehensive roadmap for the management of old forests, which observed:

"Members of the public, public interest groups, professional resource managers and representatives of industry have expressed increasing concern about management of old growth forests in British Columbia. Not only does the forest industry depend heavily on old growth for its current wood supply, but many new demands are being placed on the remaining old growth to satisfy a broad range of forest values. ***In parts of the province, meanwhile, opportunities to reserve representative samples of old growth are dwindling rapidly*** (Emphasis added)*. These pressures are leading to increased instances of conflict among supporters of competing land uses."*

Unfortunately, many critical aspects of the strategy laid out in that report were either discarded or only partly implemented. Had that strategy been fully implemented, we likely would not be facing the challenges around old growth to the extent we are today, such as: high risk of biodiversity loss in many ecosystems; risk to existing and potential economic benefits; and widespread lack of confidence in the system of managing forests.

During the engagement process of our Old Growth Strategic Review, we heard from thousands of British Columbians, many of whom shared scientific studies and data with us, along with their observations and perspectives about what needs to be done to safeguard the future of old forest in BC. The topics they addressed ranged from specific plots of land and local economic issues, to broader land use policies and the impacts of climate change. The sentiments expressed ranged from fear and skepticism, to hope and cautious optimism. The greatest consensus was in the belief that we need to find better ways to manage old forests for a broad spectrum of benefits and reasons.

We'd like to thank every individual and organization that took the time to share their knowledge and opinions with us. BC's old forests are so much more than old or big trees. They are products of ancient and unique ecosystems, and their characteristics vary greatly across the province. They can only be effectively managed in the context of broader public priorities, including the interests of current and future generations.

- Al Gorley, RPF and Garry Merkel, RPF

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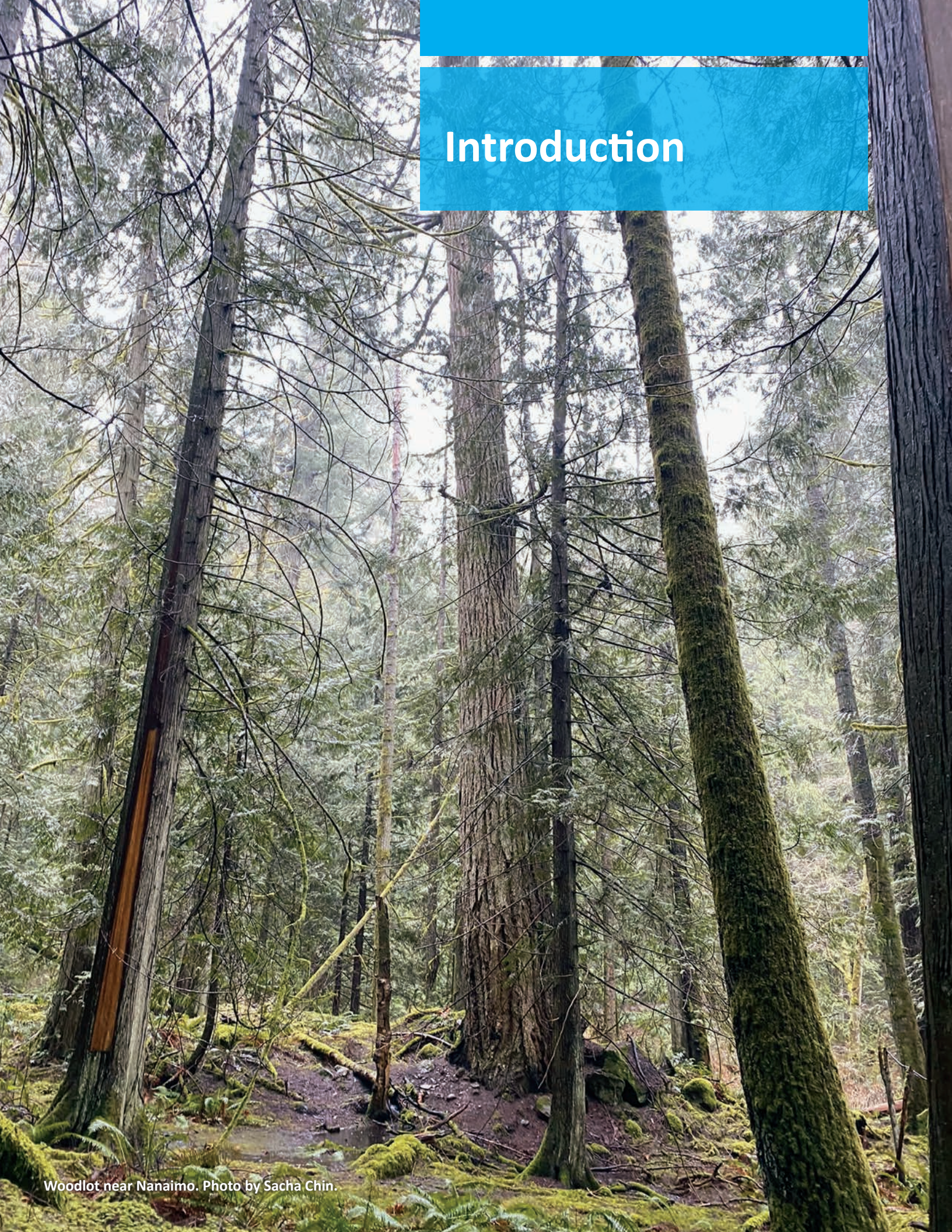


Woodlot near Nanaimo. Photo by Sacha Chin.

INTRODUCTION

On July 17, 2019, the Government of British Columbia announced an independent two-person panel (Al Gorley & Garry Merkel) to undertake a province-wide Old Growth Strategic Review and provide a report to the Minister of Forests, Lands, Natural Resource Operations and Rural Development by April 30, 2020. Its purpose was to inform the development of broad public policy regarding old growth forests.

We were asked to examine the subject from a variety of perspectives including employment, economic, social, cultural, environmental and climate change, and to consider the interplay between them. To ensure we were aware of these perspectives we undertook a four-month process of engagement, which was substantially complete on January 31, 2020.

Our aim was to learn as much as we could from a wide spectrum of people throughout the province so that we could make as fulsome of recommendations as we could, and we wanted to make sure every British Columbian had an opportunity to express their views. Without limiting who we heard from, our commitment was to ensure we connected with:

- Indigenous governments and communities
- Local governments and communities
- The forest industry
- The tourism and recreation industries
- Environmental non-government organizations
- Professional associations
- Professionals, academics, and other experts
- Forest and resource stewardship organizations
- Stakeholder groups
- Members of the public

There were several ways that people were able to provide feedback to the panel:

1. In-person, teleconference, and videoconference

We participated in over 200 meetings in 45 communities with close to 800 people. To ensure we got variety, we reached out directly to some groups and individuals, and through our website invited everyone interested to request a meeting. Due to the time available we were unable to accommodate all meeting requests. To help us write our Strategic Review report, we kept informal notes of these meetings, which will not be published.

2. Written submissions

We invited individuals and organizations to make formal written submissions. We received well over 300 plus more than 400 published articles, scientific papers, and reports. With a very few exceptions where confidentiality was requested, we have asked that these submissions be accessible on the government's website. A synopsis of the written submissions is available within this What We Heard report.

3. Survey responses and emails

We encouraged people to complete our on-line survey, which was open for just over three months. We also encouraged people to send us an email. We received 18,523 survey responses, and approximately 9,000 emails to our electronic mailbox. The results are summarized and available within this What We Heard report.

4. Technical and scientific briefings

We received an initial technical briefing from a group of over 30 government staff members to ensure we were informed about the status of current forest management processes and initiatives relevant to our task. Several follow-up briefings were also held to address specific information requirements. We also commissioned a report from the Department of Forest Resources Management at the University of British Columbia to tell us how other jurisdictions manage old forests and what we can learn from them.

This public engagement process concluded on Jan. 31, 2020, and a summary of the input we received is provided in this What We Heard report. Although most of the input we received was related to old growth forests, much of it focused more specifically on local or province-wide issues indirectly related to old growth forests. While some of that input may not find its way into our findings and conclusions directly, we have included it here as we consider it to be a valuable source of information for government.

It is important to note that our outreach was not a consultation process. Consultation will be government's responsibility after it receives our recommendations.

Meeting with community forest managers near Williams Lake. Photo by Sacha Chin.

In-person, Teleconference and Videoconference Meetings

Photo courtesy BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development

IN-PERSON, TELECONFERENCE, AND VIDEOCONFERENCE MEETINGS

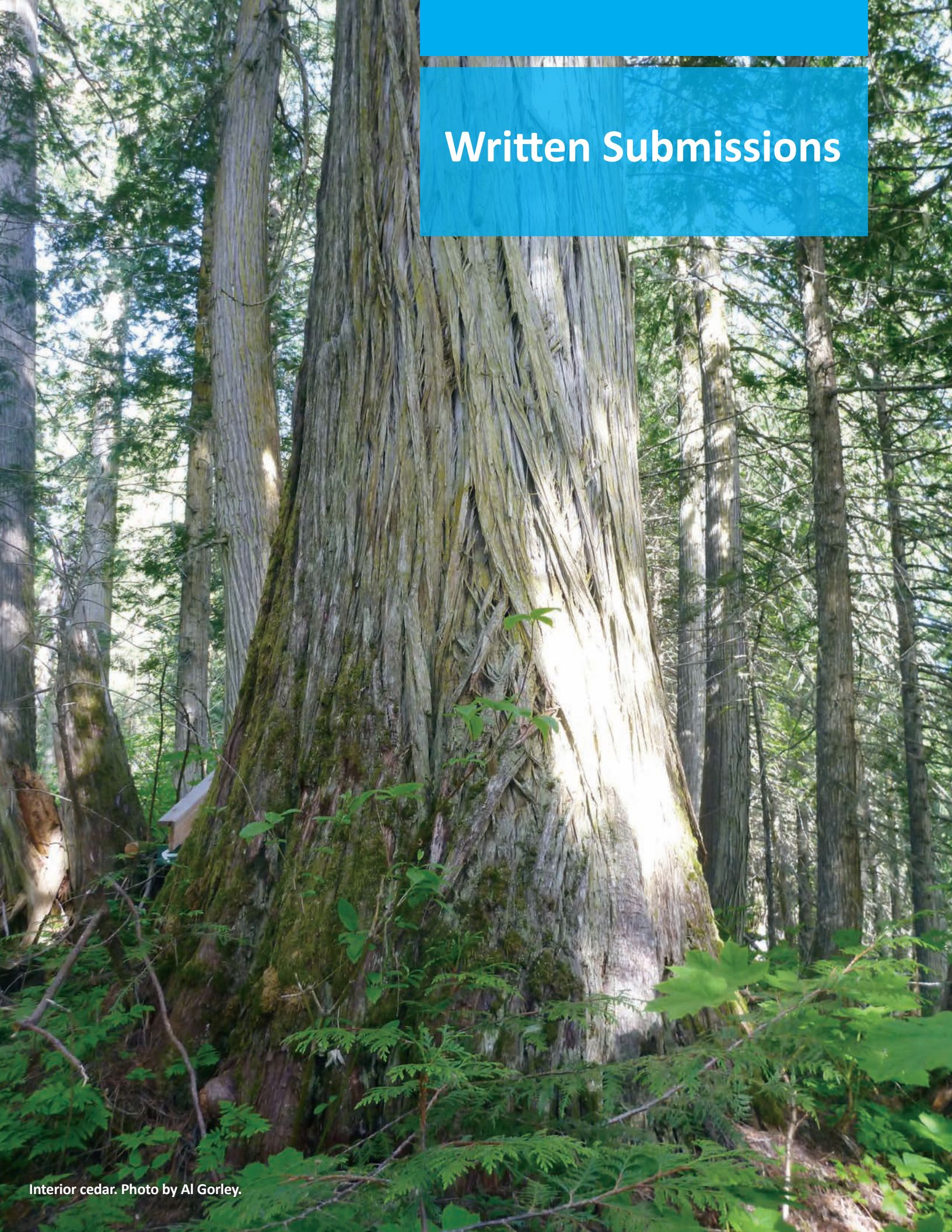
We participated in over 200 meetings in 45 communities with close to 800 people. To ensure we got variety, we reached out directly to some groups and individuals, and through our website invited everyone interested to request a meeting. In addition to in-person meetings, additional meetings were held by teleconference and video conference. Due to the time available we were unable to accommodate all meeting requests. To help us write this report, we kept informal notes of these meetings, which will not be published.

In our meetings, we heard from: environmental non-government organizations; forest industry organizations; forest licensees; forest and resource stewardship organizations; Indigenous governments and communities; local governments and communities; professional associations; professionals, academics and other experts; Provincial government staff; Provincial government elected officials; tourism and recreation industries; stakeholder groups; and members of the public.

The list below provides an overview of the communities we visited for in-person meetings:

- Burns Lake
- Campbell River
- Canoe
- Castlegar
- Charlie Lake
- Chemainus
- Cranbrook
- Creston
- Dawson Creek
- Fort St. John
- Fruitvale
- Kamloops
- Kelowna
- Ladysmith
- Langley
- Merritt
- Nanaimo
- Nelson
- Old Massett
- Parksville
- Peachland
- Penticton
- Port Alberni
- Port Clements
- Port Hardy
- Port McNeill
- Powell River
- Prince George
- Queen Charlotte
- Revelstoke
- Richmond
- Roberts Creek
- Salmon Arm
- Sechelt
- Skidegate
- Smithers
- Squamish
- Tappen
- Terrace
- Vancouver
- Vernon
- Victoria
- West Kelowna
- Westbank
- Williams Lake

Written Submissions



Interior cedar. Photo by Al Gorley.

WRITTEN SUBMISSIONS

As part of the province-wide Old Growth Strategic Review, organizations, professionals, and other interested parties were invited to email formal written submissions to the panel. Among the key guidelines for written submissions were that they:

- do not make unproven or unsupported accusations against individuals, groups or organizations;
- do not appear to be spam-like messages, repeat posting or template letter writing campaigns;
- do not contain information about, or images (e.g., photographs, videos or illustrations) of, any person other than the person submitting the content; and
- do not appear to, or do actually, infringe the copyright, trademark, right of privacy, right of publicity or any other intellectual property or other proprietary right of any third party.

Those providing submissions were asked to reference any organization that they were affiliated with and to indicate their place of residence in British Columbia. They were also informed that written submissions may be posted and could become part of the summary report for this engagement and were encouraged to keep their submissions as concise as possible.

Between July 2019 and January 2020, we received just over 300 submissions, along with more than 400 published articles, scientific papers, and reports that were included as attachments. As stated earlier in this report, our aim was to learn as much as we could from a wide spectrum of people throughout the province, and these written submissions played an valuable role in that process. Through the written submissions alone, we heard from each of groups below from whom we had committed to gathering input:

- Indigenous governments and communities
- Local governments and communities
- The forest industry
- The tourism and recreation industries
- Environmental non-government organizations
- Professional associations
- Professionals, academics, and other experts
- Forest and resource stewardship organizations
- Stakeholder groups
- Members of the public

In terms of format, those 300 submissions ranged from brief letters to 50-page documents, PowerPoint presentations and even drawings from elementary school children conveying what B.C.'s forests mean to them in their own unique way. Collectively, the written submissions provide an impressive example of the range of issues and the diversity of opinions, expertise and proposed solutions, related to forestry in our province. We extend our sincere appreciation to everyone who took the time to share their views and information with us.

Below is a synopsis of the written submissions we received. In addition to showing you what we heard and considered as part of our panel's work, we hope it will also help make people aware of the wide range of views, ideas, concerns, fears and hopes their fellow British Columbians have when it comes to forestry and old growth forest management.

A note on Format

Having received more than 1,000 pages of written submissions, our challenge was to present the key points made in a way that was easy to navigate for the reader and provides as accurate a presentation as possible of what we received. To that end:

- We have grouped content by subject areas and narrower sub-themes, while recognizing that points made within one subject area are relevant to other subject areas as well;
- We have tried to minimize editing or summarizing to ensure the original voice, tone and content of the submissions comes through;
- We have tried to minimize repetition;
- Within most comments, we have bolded words. (Please note that this was done ONLY to identify one focus of the comment to serve as a navigation tool for the reader; and
- For the most part, we have provided minimal editing, with the exception of some corrections in spelling and punctuation.

Please note that the following synopsis is our presentation of the written submissions as a whole. All written submissions were read individually in their entirety and considered as part of our research for this project.

The original unedited submissions are accessible on the Province's Old Growth Strategic Review website, with the exception of submissions where confidentiality was requested. We reserved the right to decide on whether submissions met the above criteria and were posted.

BIODIVERSITY / HABITAT/ ECOSYSTEMS

BIODIVERSITY

- Old Growth forests are extremely valuable for maintaining **high levels of plant and animal diversity**.
- Old forests are ecological **reservoirs of genetic variation** and a record of ecological history.
- Old growth forests are important to the Province of British Columbia as a **seed bank**.
- It is our belief there are many as of yet un-described **canopy-dwelling species** that are sure to be in these unique ecosystems.
- Considering all species and genetic traits, **biodiversity is considered to be highest in old growth** as compared to other seral stages.
- Old growth forests in British Columbia (BC) support a **complex array of plants and animals** with relationships and biochemical attributes that science is only starting to understand.
- There are approximately 376 different species of wildlife known to inhabit the inland temperate rainforest (ITR); this does not include the vast abundance of different types of vegetation and vegetation communities.
- Older forests may serve as important **gene pools** for the dispersal and maintenance of tree species across a landscape.
- The **UN Convention on Biological Diversity** in its draft protection target has also adopted a 30% by 2030 goal. Currently about 15% of BC is protected.
- Old growth is only one component of a comprehensive strategy to maintain biodiversity in forested ecosystems. Appropriate management of early seral stands, riparian areas, in-block retention and reserves, roads, and so forth must also be duly incorporated, as well as regeneration and restoration activities.

ECOSYSTEMS

- Old Growth forests **support plants and provide oxygen**.
- The **characteristics** of old growth forests such as a variety of age of their trees, open and varied canopies, diversity of understory growth, and quantity of standing or fallen dead trees result in an ecosystem that is diverse, self-sustaining and resilient to disease, parasite infestations, effects of climate change and wildfires.
- Old-Growth Forests provide **environmental services** that are essential to humans and all other life forms alike: clean water, clean air, protect soil from erosion, provide a stable climate and habitat.
- Intact watersheds and ecosystems have maximum **resilience against diseases and insect pests**.
- The roots of trees and understory plants stabilize soil and hillside reducing soil **erosion**.
- Old growth forests can be more fire resistant and can retard the speed of **fires**.
- Old growth systems provide such essential **life sustaining** services as water filtration, flood water storage, carbon sequestration, climate regulation and the production of oxygen.
- Humans need to see these old growth systems kept intact as they provide such **essential life sustaining services** as water filtration, flood water storage, carbon sequestration, climate regulation and the production of oxygen. Their value in terms of environmental services in many cases, far exceeds the economic benefits received from logging.

HABITAT

- Old growth forests provide **habitat** for thousands of terrestrial species, including mammals, birds, amphibians, mollusks, vascular plants, lichens, bryophytes and fungi.
- The largest **western red cedars** of the Inland Rainforest are characteristically hollow, a condition that results in a rare type of habitat for wildlife.
- Mature and old growth forests are **home** to lichens, plants, amphibians, birds, bats, and animals that would not otherwise exist.
- Habitat loss is the leading cause of loss of diversity worldwide, and thus old growth forests provide a **final refuge** for many plant and animal species.
- When an old growth forest is logged, the degraded forest becomes receptive and fertile to the introduction of exotic **invasive species** that are competition for the other plants and animals that need to live here.
- **Commercial plantation forests** cannot hold the same diversity of species and genetic variation as old growth forests.
- Old growth forests contribute to and help retain the earth's thin **soil layer** and help to prevent **erosion**.
- In BC, there are no distinct old growth bird, mammal, or amphibian/reptile **communities**, and very few vertebrate species known to be dependent on old growth (e.g., marbled murrelet).
- Old growth forests provide habitat for a rich **variety** of flora and fauna that cannot not thrive in the reduced diversity of second and third growth forest.

HABITAT (AREA CONNECTIVITY/CORRIDORS)

- Logging roads, trails and other infrastructure disrupt **habitat continuity** and render many species vulnerable to predators and hunters).
- For some species of wildlife (such as ungulates, including Caribou), the connectivity between old-growth areas is essential to enable seasonal **migrations** to occur.
- The historic and continuing **fragmentation** (by logging and roads) **of connectivity** does not allow for dispersal or reestablishment of species.

HEALTH

- Vancouver Island's native trees, Western Red Cedar, Coastal Douglas Fir and Coastal Western Hemlock are rich in **phytoncides** (wood essential oils), which are antimicrobial volatile organic compounds. This is important and relevant because of the large body of evidence showing profound human health benefits from these conifer forests.
- Old forests provide proven **health benefits from phytoncides** produced in conifer forests.
- Biodiversity reservoirs also provide a research basis for **future medicines** for human ailments.

MARINE LIFE

- Old Growth forests support **fish**.
- **Salmonids** are especially dependent on having high-quality freshwater in streams. Protect and enhance salmon habitat the economic benefits would be large.
- Old Growth forests help provide vital habitats (streams and rivers) that provide for the life-cycle of the **five Pacific salmon species** of the BC coast.
- Logging causes mud and debris to now roll into Robson Byte harming the area **Northern Resident Orcas** utilize.

- Old growth forests support **wild salmon**, which the provincial and federal governments agree require protection and support.
- Current forestry permit and tenure processes directly contradict and infringe on the **Wild Salmon Policy**.
- Mature forests also promote **streams** flowing during the dry season, an important factor for fish, and are important for maintaining our wetlands, including estuaries.
- If a **valley bottom** is logged, then the stream and its insect larvae (and consequently its fish populations) will not be as vigorous.

SPECIES PROTECTION/SURVIVAL

- Old growth forests are vital for the **survival of many different species**, including several listed as species-at-risk.
- Old growth forests are vital to sustaining wildlife, including **unique species** that can't live in the second-growth tree plantations that old growth forests are replaced with.
- Old growth logging is destroying vital habitat on Vancouver Island and within British Columbia that is essential to **bears** survival.

TRAPPING

- Many **trap lines** have NO stands of old growth/mature forests remaining to support wildlife populations.
- To trappers, the meaning of "old growth" are **contiguous areas** of mature forests that have the complex environment to support the survival of many species of terrestrial animals.

WATER

- Old Growth forests contribute to **water retention** in our watersheds.
- Old Growth forests are an essential component of the earth's **rainwater cycle system**.
- Logging of old growth forests negatively affects the quality of **coastal watersheds**, fish habitat and ecosystem goods and services provided by these watersheds.
- Logging of old growth forests has costly **impacts** to water quality such as sedimentation, pollution and changes in water levels.
- Mature forests are important **transient stores** of the water from the winter rains.
- Old growth forests shade and slow melting of **snowpack** and retain and store water from heavy rains and melting snow, thus reduce the risk of flooding while allowing water to be more available during warmer, drier seasons.
- Due to the amount of water they sequester and varied species and ages of their trees, old growth forests tend to be more **resistant to forest fires** than younger forests.
- Old growth forests **filter sediments and pollutants** and thus improve water quality.

RECOMMENDATIONS

- Maintain and increase roadless areas to improve **habitat connectivity** and protect sensitive ecosystems and critical wildlife habitat.
- Legislate safeguards for native and migratory birds, their young and nests during logging operations.
- Ban all logging in critical caribou habitat.
- Logging permits must be suspended as soon as a tree or affected wildlife species is listed under the federal Species at Risk Act.
- B.C. must legislate a provincial Species at Risk Act.

- The critical link between old growth and the health of remaining salmon populations must be recognized and protected in law.
- Old growth trees like cottonwood found in floodplains must be permanently protected.
- Require **resource extraction and development** to have net-positive impact on biodiversity, water quality and critical wildlife habitat.
- The Government must stop issuing BC Timber Sales permits in old growth/mature forests and in **caribou winter range**.
- **Legislation** that manages our public lands and waters, including old-growth forests, needs to meet the following requirements: Clear and enforceable road and trail densities with thresholds based on the best available science for the protection of critical habitat and sensitive fish and wildlife species.

ADDITIONAL COMMENTS

- At this point in the **climate crisis**, old growth trees need to be left intact to provide habitat to at risk species and endemic species, enhance salmon watersheds and mitigate climate change.
- Listing species with threatened or endangered status does nothing if we are unwilling to protect their **habitats**.
- Having worked in the forest industry as a logger for a number of years, I have seen and contributed to the brutal **effects** of clear-cut old growth logging on the landscape. In fact, destruction of the soil, loss of the ancient fungi and mycelium networks, damage to hydrologic systems, wildlife habitat loss, wide spread loss of superior carbon capturing capabilities, diminishing biodiversity, drastic decline in anadromous aquatic species, the use of destructive glyphosate, infiltration of roads, loss of wildfire resiliency, all a result of the way we conduct business now.
- Our entire **tum xula7xw** is an area of high wilderness values and has a key role to play in the survival of many species in the upcoming years. Already, our activities have extirpated the two southern caribou herds, in spite of government committees, panels and processes. We say no to any more ecological losses.
- We wipe out **wolves** and kill **cougars** to protect dying caribou herds, but we still log the old growth their very lives depend on.
- When I went out in the bush 10 years ago, I used to see **game**. Now I don't.
- **Biodiversity** is greatest in old-growth forests, which are far, far more diverse than "monoculture tree farms".
- If there is a serious commitment to **protecting wildlife**, make more edge habitat, and remove all stream obstructions. Then wait 30 years to see if it's been effective.
- Old growth forests give us **clean air**. They take carbon dioxide from the environment and make oxygen. They give us the air we breath.
- The **ecological value** of old growth - carbon retention, critical wildlife habitat, water purification and retention, etc. - must be recognized as its 'highest and best use' - that its 'value' as a living (and some researchers say as a sentient) ecosystem – is worth more than its value as lumber.

CLIMATE CHANGE / CARBON STORAGE

CLIMATE CHANGE

- The global climate crisis is affecting B.C.'s forest ecosystems, contributing to record-breaking wildfires, pest outbreaks, and changing **climatic conditions** that are putting increased stress on BC's forests and the biodiversity they support.
- With hotter, drier **summers** and shorter, warmer **winters**, we can expect bigger wildfires, longer droughts and more frequent floods. We can expect more pest outbreaks like the pine and spruce beetles. And we can expect the loss of entire species that may not survive into the future.
- Numerous **watersheds** are in serious replenishment deficits.
- With **changing climate patterns**, we have seen disturbance types that would normally have had stand maintaining disturbances now having expansive, stand destroying disturbances.
- Major **die-offs** due to climate change are being seen in old growth yellow cedar in coastal Alaska and BC. Indirect die-offs due to increased drought and bark beetles have and are being seen in pine and spruce in interior BC.
- A major contributor to forests being carbon sources is from wildfires and other **natural disturbances**.
- Western Canada is experiencing more **extreme fire weather** with longer fire seasons and increased fire intensity. Potential fire intensity increases with the build-up of fuels.
- **Newly planted forests** take between 13 and 30 years to counterbalance the continuing emissions from decomposing organic matter and exposed soils on clearcuts.
- **High-elevation logging** generally requires much carbon-intensive road building and the production of extra greenhouse gas emissions from transporting the logs to the mills.
- **When a tree gets cut down**, 40% to 60% of the carbon stays in the forest. This results in carbon being sequestered which translates to approximately 2.9 million tonnes of carbon/ year.
- **Harvesting** old growth forests releases large quantities of carbon into the atmosphere in the form of CO_2.
- Burning old-growth forestry slash also emits vast quantities of smoke into the bottom levels of regional **airsheds**. The smoke badly pollutes the air northern residents breathe, harming the health of tens of thousands of people.
- New research shows that logging old-growth results in thirteen year **"carbon dead zones"** as replanted forests take more than a decade to offset the carbon released as a result of logging.

CARBON OLD GROWTH

- **Old-growth forests** sequester CO2 at a much more optimum rate than the planting of new trees.
- When old-growth forests are cut, that **storage capacity** is lost for hundreds of years.
- Preserved old-growth forests store carbon, but whether they are a net sink or net source of greenhouse gasses is **variable**.
- Old growth forests have been proven to be some of the most valuable **carbon sinks** that exist on the planet, therefore they will become increasingly important to help reduce the concentration of greenhouse gasses in the atmosphere.
- Old growth forests remove carbon dioxide from the atmosphere lock it into **biomass**.
- Old growth and mature forests are a vital part of the earth's **climate system**; keeping temperatures cool in the summers, sheltering and protecting wildlife and soil from harsh winter weather.

- Old Forests emit more CO2 into the atmosphere from **decay, stand decomposition**, and possibly wildfire as compared to managed second growth forests.
- Old growth forests have a moderating effect on **local temperature extremes**.
- Trees are solar powered to consume the **de-stabilizing carbon** out of the air and grow it into materials and energy that humans need. Trees during their later older growth period slow their carbon capturing traits but tend to support more bio-diversity.
- Living trees can accumulate nearly half their **lifetime carbon** in the last quarter of their lives.
- **Old forests** do a better job regulating temperatures and water flows, and leaving these ecosystems intact is the best way to mitigate climate change.
- When a forest reaches its **climax seral community**, it reaches a stage where the decay/growth ratio falls into a neutral (or sometimes even negative) volume/carbon sequestration ratio. At this advanced age-stage, a stand is considered to be 'decadent' due to the large amount of rot and mechanical defect that has accrued.
- Old growth forests store significant amounts of carbon both above and below ground but are not always carbon sinks. The mortality caused by the mountain pine beetle epidemic was estimated to convert the **pine forest** from a small net carbon sink to a large net carbon source during and immediately after the outbreak.

CARBON: SECOND GROWTH

- **Young healthy trees** sequester up to 25% more carbon than old dying trees.
- The forests that absorb the most CO2 are the fast-growing **2nd growth stands** that are putting on the most volume. Old Growth forests do not increase their volume. They have peaked and in many cases their volume (of merchantable wood) declines slightly with blow-down and disease.
- Our new and healthy forests of today consume carbon dioxide at a much **faster rate** than the decadent "Old Growth" in a comparable land base.
- By limiting OG harvesting, you limit the amount of **carbon sequestration** that can occur through stand conversion to a younger forest that will begin the carbon sequestration process all over again, and at a much higher rate.
- Healthy forests result in healthy **streams and wetlands** and such wetlands sequester even more carbon dioxide per unit area than mature forests.
- The climate-based **seed transfer policy**, combined with the results of the tree improvement investments, leads to incremental carbon sequestration (mitigation) where the seed is deployed.

WOOD PRODUCTS

- Logging and using old-growth trees to produce **fuel pellets** is harmful to the environment when you consider the greenhouse gases emitted in producing, transporting and burning the pellets abroad and the loss of carbon storage in the original standing trees.
- There are significant carbon emission savings when using wood as a **building material** compared to steel and concrete.
- Harvesting wood stores carbon when used in **long-term products**.

RECOMMENDATIONS

- Implement **sustainable forestry practices** that protect the environment, as a central feature of the B.C. Government's Climate Change Policy.
- Old-growth forests must be are **protected** as quickly as possible.
- Future climate and biodiversity policies should prioritize the **protection** of intact and old growth forests.

- The **UN IPCC 1.5 Report** in Oct 2018 warns that meeting a 1.5 degree C global warming target will require deep emissions reductions in order to avoid extreme weather, rising sea levels and loss of many ecosystems among other impacts. This "climate emergency" will require major changes to "business as usual" in the next 10 years.
- To meet the **Paris Accord** goal of holding global warming to less than 2 degrees C., targets and associated GHG reduction projects must be substantially increased.
- We desperately need to **stop clearcutting** entirely, so that the forests of this province – which provide a life-support system for the entire planet – can grow older, healthier, stronger, and more biologically diverse.
- In consideration of climate change, each old growth area can be **evaluated** to measure if it's a carbon sink or carbon source.
- Set up a **market-based carbon trading** scheme such as "Cap and Trade", where industries that reduce or store carbon receive carbon credits (typically forestry and agriculture) and industries that produce increased carbon emissions are required to pay a pollution fee or purchase carbon credits from low emissions enterprises to continue operations (typically oil and gas industries, manufacturing, transportation, etc.).

ADDITIONAL COMMENTS

- The **carbon sequestration "services"** provided by old growth forests far outweighs their value in lumber.
- In this era of climate change, it is unconscionable for ANY Old Growth to be logged. It is the removal of forests, especially Old Growth, that are contributing to **climate catastrophe**.
- The volume of carbon released by clear cutting old growth is a **climate crime**.
- There is no silver bullet to solving the climate change threat. It will take a massive **multi- pronged approach**. Forest carbon stewardship is one of those prongs and conservation of 'old growth' is a key part of forest carbon stewardship.
- **Conifers planted today** will only sequester minimal amounts for the first fifty years. In 50 years, it will be too late. The rate of carbon sequestration is directly linked to the amount of green surface photosynthesizing on trees.
- By continuing to log old-growth, BC is laying down both our sharpest sword and our strongest shield in **the fight against climate change**.
- Simply put, we cannot safeguard a stable climate without **protecting and restoring** intact forests, and we cannot sustain forests without stabilizing the climate.
- **Cutting old-growth forest** is essentially the same as burning coal, oil, or natural gas. Carbon locked in living (or dead) trees 100-, 200-, or 300-years old is mostly liberated into the atmosphere by logging and no significant portion of it is subsequently sequestered by plantation trees or natural regrowth, under historical conditions, for over 35 years.
- Old forests are also more **resilient** to wildfire and pest outbreaks. So, it is imperative that we conserve old growth to fortify our communities against the climate crisis, which is now upon us.
- For improving **water quality** and **air quality** there is nothing better than an old-growth forest.
- If we wish to prevent Holocaust-scale climate destabilization, it seems that **protecting existing older forests and allowing younger forests to grow** old should be the only forestry policy on the table.
- If we simply look at maximizing the amount of carbon retention within our forests, then a **transition strategy** from Old Forests to managed second growth forests is critical.
- Old-growth forests are a **critical defense against climate change**, both for mitigation and adaptation. They not only store carbon, but are more fire-resistant, regulate water supplies, and provide food in a number of forms – plants, wildlife, and healthy fisheries.

- Make **protection and enhancement** of forest carbon reservoirs and sinks a “value” under the Forest and Range Practice Act that must be addressed in all aspects of forest management.
- A **separate report** needs to be initiated to quantify carbon emissions from BC forests, and these numbers need to be **integrated into provincial strategies** such as CleanBC and the Coast Revitalization Initiative.

DATA / SCIENCE / INVENTORY / RESEARCH

INVENTORY

- Wildlife tree patches are **double-counted**. Some wildlife tree patches, intended to contribute to stand- level retention, are currently counted as old forest despite being too small to function at the landscape scale.
- **FREP monitoring** has focused on harvested areas, not on what forest is remaining.
- **The government's numbers** refer to all old growth, not just the "big tree areas". This includes high-altitude scrub as well as bogs, none of which have the sizeable trees that are so tremendously valuable as habitat.
- Some 42 per cent of the province's forest has **not been inventoried** since 1990. An astonishing 30 per cent hasn't been inventoried in more than three decades since 1980.
- The current amount and **location of old growth in BC** needs to be determined, rated, mapped and made publicly available. Utilization of **LiDAR** would help enormously in this regard and for the current multi-year acquisition effort to expand LiDAR coverage to the entire province needs to be rapidly accelerated.
- The location of every tree and the use of every log in the forestry cycle should be known using **modern tracking technologies** if real efficiencies are to be realized and true sustainability is to be achieved.
- A comprehensive review requires information on the current status of old growth supply and the degree of protection. **Inventory** of existing old growth forest by Forest District is required, summarized by Biogeoclimatic (BEC) subzone/variants.
- Very little old-growth coastal temperate **rainforest karst** is left in BC. What does remain should be inventoried and protected as soon as possible. British Columbia has a rare opportunity to save what remains.
- A **meaningful assessment** of old-growth on the coast should be reported by ecologically-meaningful strata such as the BEC site series.
- However, the government has repeatedly presented **old-growth statistics** by the entire coast region or by BEC Zone, thus obscuring the loss of old- growth.
- Require improved province-wide forest inventory consistent with the recommendations of the **British Columbia Forest Inventory Review Panel**.
- A strategic review should include an **accurate inventory** of the amount, quality, and distribution of old growth, available timber and biodiversity in the Province.

MAPPING

- Only accurate, detailed, publicly available **high-resolution-zoomable online mapping**, showing the habitat quality, can show where the truly unique habitat (i.e. low-elevation, high-productivity rainforests) is located.
- BC Government GIS staff need to produce **detailed maps** that clearly show where the high-productivity ("big-tree-friendly") forests were (originally, i.e. starting a century ago) and what is remaining today. The highest priority must be the rainforest-containing areas. This includes all of Vancouver Island, all of the BC Coast and all of the Interior Wet Belt areas (which are numerous and have yet to be fully mapped).

- The general public needs to see **detailed mapping** that shows all the high-productivity forest areas—both those that have been logged to date and those that have not been. Year-by-year, the logging of high-productivity rainforest habitat needs to be made easily visible in such a way that the average citizen can understand the rate of loss.
- The Ministry's detailed mapping and dataset resources are not necessarily standardized, fully consolidated, up-to-date, **reliable and readily accessible** to all interested persons.
- **Landscape Unit Boundaries** that have been informally in use throughout the province in recent years must be formally established.
- **Publicly available reports** should include maps that show planned harvest, cumulative effects, OGMAs, critical wildlife habitat, and road/trail networks and density.
- A province-wide BC Government investment in **LiDAR** will allow for better decision making when selecting areas for old growth management.

RESEARCH

- Government should increase their **investment in research**, in order to ensure forest management in BC represents the best available science, and to help build public confidence in the industry.
- Other research is being conducted on the retention of **glyphosate** in plants that survive the original spraying. This results in malformation of the plants and reduction in the pollen and therefore reproduction of the plant, again reducing food supplies.
- **Government capacity** for monitoring, research and restoration is needed.
- Research is required into the impacts to biodiversity of **representing ecosystems at the variant scale**.

MISC.

- The **Biodiversity Guidebook** was watered down prior to publication. The guidebook moved from presenting science to presenting practices designed to "reduce the impacts of forest management on biodiversity, within targeted social and economic constraints".

RECOMMENDATIONS

- **Survey** the amount of old-growth remaining in all forest types down to the Biogeoclimatic Ecosystem Classification (BEC) variant or site series level of classification, factoring in forest productivity.
- When OG trees are cut, there should be a requirement to preserve **tree cookies or wedges** to help preserve the historical data. Each area has had a different history behind the regeneration and growth pattern over the OG tree's life, and tree "cookies" offer the best information for analysis. ~
- We need mapping all across the province...not just Vancouver Island, not just the Great Bear Rainforest. **High-resolution satellite overviews** should also be included.
- Explore the actions and strategies of **other countries** who manage Old Growth forests.
- Improve (restore) the **Government's ability and resources** to create and keep up-to-date maps of forest cover and ecosystems.
- The provincial government must require all **municipalities** and cities to map old growth and large trees in their jurisdiction including private lands and protect them wherever possible in conservation areas and sensitive development zones. **Development permits** must require rigorous sensitive area habitat protection for old growth and old urban trees.

- Use the new emerging international concept of **"intact forest landscapes**" – and the analytical tools developed by Global Forest Watch and the Forest Stewardship Council among others - as a starting point for identifying the key areas of old-growth in the interior of the province and put moratoria on these while analyses such as ecosystem representation, and scarcity are completed.
- **BC Forests needs to increase its staffing** of ecosystems-and-habitat biologists (or ecologists).
- **Recommendations must be based on science** including exploring the actions and strategies taken by other countries who manage Old Growth forests. Similarly, decision makers must use relevant science to assist with Old Growth management decisions, helping to **reduce political influence**.
- The Report should include a description of the ecosystems found in the OGF within the territory of B.C., as well as an up-to-date and **comprehensive survey** or inventory of the plant and animal species present in the OGF, their diverse characteristics and currently estimated quantities, including the plant and animal species that are endemic to the OGF, those species whose presence and survival in the foreseeable future depend on the preservation of the OGF ecosystems, and those species that are actually listed as part of the species at risk list.
- Properly **account for climate change** in timber supply analyses.

ADDITIONAL COMMENTS

- Ensuring that BC's forest management is informed **based on science** as opposed to pressure from environmental groups is key to ensuring that the coastal forest industry is sustainable for years to come.
- Any strategy developed must be **based on science** and not on the populist values at a certain time in history.
- The key to **sustainable forest management** is continuing to adapt science-based approaches which implement the best available science to inform decision making, rather than policy change as a result of non-science-based pressures.
- The best available science agrees that consideration of ecosystem type, productivity and risk are crucial factors to include in **representation planning**.
- The **Landscape Unit Guidebook** made a mockery of biodiversity targets.
- Changing policy due to **non-science-based pressures** is contrary to years of professional forest management decisions.

FORESTRY INDUSTRY PRACTICES

EMISSIONS

- The timber industry is our biggest source of **carbon emissions**.
- **Slash burning** releases huge amounts of carbon dioxide as does blasting and clearing for road building.
- B.C.'s forest carbon emissions are **not counted** as part of the official greenhouse gas emissions of the province. Instead these emissions are reported as a 'memo' item and tend to be ignored, despite their alarming growth.
- The **burning** of old-growth forestry slash in general releases colossal and disproportionate quantities of greenhouse gases into the atmosphere. Burning high-elevation old-growth forestry slash is even worse.
- **Harvesting** in Canada releases less carbon dioxide than wildfires and other natural disturbances.
- Clearcutting converts forests from major sequesters of carbon dioxide to **net producers of carbon dioxide.** Today clearcutting of forests in BC results in the release of 42 million tonnes of carbon dioxide annually.

HARVESTING

- **Clearcutting** effects include rises in summer stream water temperature (4° C) and rises in ambient summer air temperature (3.2° C).
- When Old Growth forests are clearcut, **soils** that are crucial to supporting healthy forests are degraded.
- Sloped areas are most vulnerable to **erosion**. Logging changes the hydrologic regime in such a way that downstream flooding becomes more likely. Although loggers leave woody debris on the slopes in a sort of mulch, such mulching does not guarantee long-term protection against erosion.
- Even if clear cuts are relatively small in size, the surrounding forest seems to suffer a significant amount as **trees blow down** along the edge of the clear cut.
- For every four trees logged and taken to market at least one tree was **left behind to rot** in the forest from which it was logged.
- The **under-recording of CMTs** has implications related to Indigenous land title cases where there are remaining old growth stands, and future protections for old growth in the province.
- Old growth harvesting can increase the risk of **landslides**, which can affect people's home as well as salmon producing rivers and streams.
- Old-growth logging can directly impact **archaeological sites**, such as culturally modified trees (CMTs), rock shelters and caves, burial sites, trails, shell midden habitation and camp sites. Impacts associated with incomplete survey, direct logging, exposure caused windfall and road building activities can contribute to the loss of archaeological sites.
- Logging old growth forests can increase the severity of **floods**.
- Logging causes a decrease in the **water table** and an increase in **water temperature**. Both conditions negatively affect juvenile wild Pacific salmon, the food chain and ecosystem function.
- Logging increases the volume of **fine fuels** and opens up forest canopies to air, drying the fuel. Access created by logging may increase the chance of anthropogenic sparks to ignite fine fuels left by logging.

- The **industrial road systems** alone, a make-work project for the road building companies, have removed large tracts of mature forest, that will never even be replanted. Since the latest harvests, there have large amounts of post logging blowdown, erosion and irreparable damage to our island's watershed.
- Various **harvesting trials** around the province (i.e, Invermere TSA, Skeena TSA) demonstrate that old growth associated species such as cavity nesters can be maintained with selective/partial harvesting.

SILVICULTURE

- **Free to grow criteria** need to be changed to allow the use of chemical herbicides to be stopped.The cumulative effects of these toxic chemicals are still being evaluated.
- Today, three trees are **planted** for every tree harvested.

WATER

- For small **watersheds**, two months of work for a handful of people can effectively decimate the value of small watersheds for drinking water supply for generations to come.
- Building roads and harvesting timber can significantly change the **pattern of water flow** and cause **pollution of the water** that will affect people and ecosystems downstream.

MISC.

- Major investments in operations totaling $17 billion since 2006 have shaped a modern and **technologically advanced** industry. The sector has found ways to use fibre from every part of a log, creating new products and new processing techniques. Most pulp mills in BC today generate the power they need by using material that was once considered waste.
- Forestry is one of the few industries that is **renewable**, reduces carbon emissions, and is a sustainable green resource, like wind, solar, or geothermal heat.
- People don't bat an eye at the **removal of forested lands** for agriculture, industrial and residential developments, but if a forestry company wants to harvest trees, and then reforest that area with three trees for every one logged, they are met with protests. Farms, golf courses, and vineyards take up thousands of hectares of deforested land and are highly water dependent but are met with the justification that they are required to grow the economy.
- As an industry we know a big tree is not necessarily an old growth tree and a small tree is not necessarily a young tree. It is important to truly **define what constitutes an old growth forest** or an old growth tree.

RECOMMENDATIONS

- **Phase out logging** of coastal old-growth as rapidly and completely as possible.
- Destructive logging techniques must be changed. **Ban clearcutting**.
- **Logging roads** should be replanted and returned to forest, not simply "deactivated" with earth piles.
- We must do **landscape level assessments** to minimize the risk of drought, flooding and siltation caused by industrial logging. This will also serve to retain and restore our depleted salmon spawning grounds.
- Revitalize the forest sector with greater investment in **silviculture and value-added processing**.
- Clear-cutting in community drinking watersheds should come to an end and we must begin to

consider the **cumulative impacts** of our logging practices on water quality and timing of flow.
- Watersheds reserved for **drinking water supply** should be legislatively protected to prevent logging so the valuable ecological services of providing a clean reliable water supply to communities is not thrown away for a relatively small number of temporary jobs.
- **Current approaches** of logging practice and policy need to be modified and enforced to ensure coherent functional forests remain when a logging company leaves a site.

ADDITIONAL COMMENTS

- All industrial scale clear cutting is a dirty industry that is based on dirty fossil fuel extraction and creates **ecological deficit**.
- **Clearcutting** is a cost-effective and silviculturally-effective way to regrow trees.
- **Timber companies** get to block forest access, threaten the public with persecution for trespassing, take the best and burn the rest, export the spoils, spray with toxic glyphosate, and monocrop farm. Our climate is getting drier and forest fires more intense because our great climate regulating system is fragmented and, for the most part, decimated.
- For over 60 years, the **Association of British Columbia Forest Professionals**, have protected the public's interest by balancing forest policy against socio-economic values, through intensive forest management and stewardship. Over time as these values have changed, so to have management practices to ensure the resources continue to be managed in an environmentally responsible and sustainable way.
- **Communities** that enjoyed clean low-cost water for the last hundred years end up with muddy water that has to be filtered and treated at great expense in order to be used for the next hundred years. It makes no financial sense to maintain logging for those jobs in these circumstances.
- Just as a farmer plants grains to be harvested no other group has a greater motivation to plant and manage our forest than does the **forest industry**.
- The current logging of Original Growth puts timber supply and short-term **financial profit** above social well being of our communities.
- I am **proud** to be in the forest industry. I am confident that the company I work for is doing more than they can to improve our forest practices by working with ministry, environmental groups, first nations etc., to ensure longevity in this industry. What we need to do is spread these practices globally, ensuring our partners across the globe have as much care and concern as we do here in Canada.
- Fix the logging truck-size "ecosystem-based" **loopholes** which are permitting the destructive building of logging roads right through the middle of, and the cutting of, those old-growth forests with the best large western redcedars in the "protected" Southern Great Bear Rainforest.
- The industry continues to explore and increase the use of the **latest technologies** to minimize impacts on the landscape and wildlife, while increasing the yield and economic value of the working forest.
- Over the years, we have been called many things by **environmentalists**, but in fact we are just farmers creating new crops and ridding the environment of trees that have lived their life cycle and that are creating carbon dioxide into the atmosphere, as well as diseased trees that spread their disease in to new stands of vibrant and young forests. Can any normal human being say that these trees are ancient or that this province has not reforested itself many times over since the conception of time?
- **The real costs** of old growth "harvesting" – ever-increasing volume and intensity of forest fires, floods, landslides, loss of salmon runs and wildlife, diminished biodiversity, polluted air and water - are just starting to add up.

- All of us working in the forests of BC have a huge **respect for the land** and are “boots in the bush” everyday loving every second of it, you would not like it so much, just let us be.
- Forestry, as practiced in BC, is operating at **a net loss** to the economy, the environment and social values.
- Our **foresters and engineers** have code of ethics that they unlike the environmentalists must live by, I have watched the professionalism over the span of my life time and time has changed the new younger generation has been taught that everything that we do leaves a fingerprint on the environment and have adjusted their plans to always put the ecosystems and bio adversities first, these are not just jobs to all of us.

FOREST MANAGEMENT - CURRENT PRACTICES

ALLOWABLE ANNUAL CUT / TIMBER HARVEST LEVELS

- Annual Allowable Cuts must get rid of **minimum timber harvest levels** and find a way to give credit for logging which is selective, in which the benefit comes from growing and preserving forests and forest ecosystems.
- Annual Allowable Cut calculations and assumptions made by industry and reviewed/approved by government have never considered the curtailment of Old Growth harvest. The harvest levels across the province are designed to provide **long-term economic stability** while providing for long term ecosystem management.
- Since 1990 the forest industry on the coast has had the Annual Allowable Cut **decline by 30%.**
- OG blocks are usually synonymous with **higher volume per hectare** (VPH). As a result, to achieve the same AAC target, you have to log approximately twice as many second growth stands than you do old growth, which puts a higher harvesting footprint on the land base.
- Currently, there is **no differentiation** in the annual allowable cut (AAC) that discerns old growth from anything else. What if the AAC were adjusted into two parts?: Part 1 that allowed a certain percentage of old growth (years old to be decided), and Part 2 that allowed a remaining percentage of 2nd growth. As the old growth percentage would diminish, that volume could be adjusted and added onto the 2nd growth side of the AAC.
- Provincial processes such as the **Timber Supply Review** and associated Annual Allowable Cut determinations are dynamic and adapt to an ever-changing environment. Much of the coastal crown land harvest is managed by companies who hold long-term tenures and as such it is in their best interest to ensure harvest is done in a sustainable manner.

APPURTENANCY

- The lack of forest licensee **appurtenancy** requirements encourages raw log exports, hampers the development of value-added lumber and wood industries and contributes to employment instability in small communities.

BCTS

- BCTS is **understaffed and underequipped**.
- The British Columbia Timber Sales program operates without **oversight** and in routine violation of the Province's own weak regulations around old-growth forest management.
- BCTS is responsible for the terrible, widespread, **indiscriminate destruction** of the non-renewable old growth forest ecosystems of the Nahmint Valley, Tahsish River, Port Renfrew area, Schmidt Creek and many others, none of which will ever recover their incredible, former natural wealth. In some cases, licenses are awarded without consideration for local community's needs.
- The mature and biologically diverse second growth, potential park lands on Mount Elphinstone are being logged with BCTS approval over the objections of the local governments of Sechelt, Gibsons, the local Regional District and local residents. Rather than being put to a higher and better long-term use, the targeted lands are being used for one time **cut and run logging**, doing a great disservice to the long-range plans of the local community.
- BCTS needs to serve communities and the people of BC better with a more **holistic model** that considers the forest's full range of intrinsic values as the primary guiding principle.

- The B.C. Government has **accelerated logging** of some of the last stands of coastal old-growth forests through its own BC Timber Sales program.

ECOSYSTEMS / NON-TIMBER VALUES

- Many of the **non-timber ecosystem services** provided by forests are tangible, measurable features of the forest yet they are not currently included in forest management planning in any quantifiable and verifiable way.
- The absence of reporting and forecasting on the state of non-timber values and absence of any forecasts except for timber is another **institutionalized timber bias** inherent in the current Timber Supply Review process.
- The very detailed and prescriptive **ecosystem-based management** (EBM) approach being implemented to manage old growth forests and other values in the Great Bear Rainforest is not appropriate and was not intended for areas such as Vancouver Island and most other areas of BC which are vastly different and already highly developed.
- Ecosystems should never be managed for **single objectives**, otherwise disastrous results occur; we have several examples of this in our history (Wolves, Spotted Owl, etc.).
- Management has ignored **ecology and heterogeneity** for the past 50 years.
- On the coast a wide range of tools are used to manage forests of all age classes. Old Growth Management Areas, Wildlife Habitat, Visual Quality, Cultural Reserves and Terrain Management are just a few examples of stewardship objectives and policies that make up our forest management system. Areas reserved from harvesting under these objectives add to our overall **forest stewardship system**. Within the timber harvesting land base, other stand level practices such as variable retention, big tree retention and others add up to a mosaic of forest conditions that contribute to ecosystem health.

EVALUATION AND REPORTING

- There is a **lack of clarity** about how to measure performance and how to interpret the measurements.
- Government's **Cumulative Effects Framework** identifies old growth forest as a value, but very little work has been published on the evaluation results and whether targets for old and mature forest are being met.
- FREP monitoring has focused on harvested areas, not on what forest is remaining. There is **no FREP protocol** for landscape level biodiversity. There is also no information available regarding government monitoring of the effectiveness of the existing tools for protection of old growth (OGMA, UWR, WHA).
- The province's new old-growth strategy should preserve old-growth forests in instances where they are worth more left standing, however, **no effective system** of evaluating and answering this question is currently in place.

FIRE

- **High biomass** and **fuel loading** do not necessarily lead to increased fire severity.
- Ignition requires fuels—particularly fine fuels. Clearcutting followed by prescribed fire that removes all fine materials will reduce ignition risk. However, prescribed fire is unlikely to be socially acceptable in such close proximity to human habituation.

- Foresters understand that fire origin stands are not uniformly spaced, and that "clumpy and gappy" patterns play an important functional role. Scientifically, there is a broad consensus that to increase **resilience**, treatments should have a range of patterns with intact disturbance regimes, and strict basal area and spacing based prescriptions do not achieve this goal.
- **Fire Management planning** for the BC Wildfire Service supports fuel management that engages First Nations and local forest contractors to reduce wildfire fuels adjacent to communities and at a landscape level.
- Forest planning operations to mitigate the risks of wildfire and the benefits to other resources are virtually non-existent, particularly in the northeastern part of the province. **Wildfire prevention**, and mitigation should be a provincial function that is strategically planned provincially and implemented tactically, not just in areas already developed with roads and layout, and proximity to residential areas.
- Logging can only **mitigate wildfire risk** in limited conditions: clearcut logging followed by prescribed burning will reduce wildfire risk; fuel thinning can reduce risk in years without extreme fire weather. As the climate continues to change, drier, hotter weather will increase extreme fire weather and overwhelm the effectiveness of fuel management.

OLD GROWTH MANAGEMENT AREAS (OGMAs)

- "Old growth management area" is an **oxymoron**, like "sanitary landfill" and "borrow pit". It is a soothing term to convince taxpayers, old growth timber has a measure of protection, and there for industrial logging is safe.
- Simply preserving old growth stands in a **static management approach** such as the establishment of old growth management areas (OGMAs), will not ensure forest resilience or persistence.
- Most of the old forest left is actually outside of OGMAs, but even if all remaining old forest was conserved in OGMAs, we still could not meet legal targets in the **Higher Level Plan Order**.
- **When OGMAs were first established**, the impacts of climate change, forest health, and decades of fire suppression on the resilience of forest ecosystems were not considered.
- The provincial Old Growth Management Area policy is a requirement when preparing a **Forest Stewardship Plan** and is a key tool in protecting priority areas, but for our community, it fell short of protecting the old growth forests that serve our tourism economy.
- In many **community forests**, the location of existing OGMAs does not make sense on the ground. CFA Managers are finding areas where existing old forests are not in OGMAs and where the majority of forests contained in OGMAs are not old. In many cases, the designated areas are not serving the desired objectives.
- OGMAs were first established about 20 years ago through a mapping exercise based on **Vegetation Resources Inventory** (VRI) and in many cases outdated aerial photography. Inventory data was inadequate and inaccurate. In most areas of the province no ground-truthing was conducted. In addition, many of the OGMAs were located at a higher-level plan perspective across a given TSA, a process that did not consider the dynamic of smaller area-based tenures that are now a reality.
- Many Old Growth Management Areas were established based on a Biogeoclimatic Ecosystem Classification data base that is **outdated**. Improved inventories and ground truthing has confirmed ecosystem boundaries are not consistent with the designations. Likewise, other newer information around management factors such as terrain stability, environmentally sensitivity and operability, which were originally considered in land use designations, have not been adopted into the current management regime.
- Government needs to ensure the process of incursions into, and **replacement** of, OGMAs has sufficient rigour. Government does not currently know whether licensees have appropriately replaced harvested areas with other areas having equal or better old growth attributes.

- Old Growth Management Areas include younger forest, but their entire area is counted as old. Where legal OGMAs have been designated, aspatial targets no longer apply; hence the amount of old forest decreases and nobody notices. Rather than following good conservation design procedures, OGMAs are **planned on an ad-hoc basis** to capture already-constrained forest.
- Too often, designated old growth management areas have succumbed to forest health issues such as bark beetles, or developed into areas of significant wildfire threat. While management measures have been enabled by legislation, there is no financial incentive for the forest industry to manage these areas. These static reserves on the landscape have often turned into dead old growth management areas, affectionately referred to as **DOGMAs**, which while are part of a natural system, do not perpetuate the old growth values for which they were established.
- People that live close to OGMAs are at risk because of un-managed biomass that accumulates every year. Grossly overstocked stands should be reduced to a desired stocking level. OGMAs should be managed to set targets based on Old Growth metrics, especially tree diameter and maximum **"time since fire" thresholds**.
- OGMAs with an abundance of dead standing overmature trees and blowdown are an extreme **fire hazard** that often have poor access for rapid fire suppression. Veteran trees act as lightning rods and are often struck by lightning since they are the tallest trees on the landscape.
- Under FRPA, industry is allowed to adjust **OGMA boundaries** on their own to accommodate their logging plans. Additionally, industry holds 'rights' over their **data** and does not share that data with the Ministry.
- Our investigations, later confirmed by Ministry analysis, have shown that Old Growth Management Areas (OGMAs) established to conserve old growth often don't even contain old growth. We have also found that **industry foresters** are illegally moving OGMAs to younger stands – or in one case a cleared powerline right-of-way – so their companies can harvest the old growth in the OGMAs.
- The policy for OGMAs seems to be "Let Nature take its course and if the trees die and burn in a wildfire there will still be some ecological value in dead, burnt overmature trees."
- Some OGMAs have been established within park boundaries and other lands already off limits to logging, a process considered legal and encouraged as provincial legislation directs land managers and industry to look for ways to **overlap conservation goals** on the same piece of land.
- **Policy** to locate retention preferentially in areas with a low priority for harvest means that representation favours lower productivity ecosystems so that forest harvesting can target productive forest.
- To be successful in maintaining OGMA values you need dedicated individuals who will carry out **ongoing management** on specific OGMAs on a long-term contractual basis. The Forest Service doesn't seem to be able to get out of the office to orchestrate the work that needs to be done on an annual or periodic basis.
- OGMAs may be established spatially (i.e., a mapped polygon) or non-spatially (i.e., not static locations). This increases the risk to old growth protection primarily because monitoring of **non-spatial old forest retention targets** relies on forest inventory datasets, which likely contain inaccuracies.
- Old-growth is very **poorly managed**. Logging companies, including government agencies such as BCTS, are only required to maintain a specified percentage of a Timber Supply Area in old-growth management areas (OGMAs) when preparing forest stewardship plans for Crown Land tenures. The boundaries around what is and isn't protected can be modified easily to accommodate timber harvesting as long as "new" old-growth areas are added.
- OGMAs are mainly in **high elevation zones** rather than low elevations. Low elevations are where a large component of biodiversity and dependent wildlife are found.

OVERSIGHT / LEGISLATION / MONITORING

- Not long ago, forest companies were required to consult and inform the public about all their development plans. Now what we have is **no legal requirement** or ability to know about or provide input toward logging on [private or] public-crown forest lands, and no policy statement or ability to stop any logging plan once it is in the planning stage.
- Many of the designations which aim to protect old-growth outside of the protected area system have **inadequate regulatory protections**. These areas lack regulatory protections and may permit incursions, boundary adjustments, salvage logging, and road building within them. In addition, management decisions are often left to the forestry tenure holder, with little government oversight.
- A reform movement has to start with a **Royal Commission** accompanied by public hearings emphasizing citizen and social driven regulatory controls on the logging behavior of BC Timber Sales and MFLNRO.
- **Legislation** to protect old growth in BC is limited and does not apply equally to all industrial sectors. For example, Old Growth Management Areas (OGMAs) established under the *Land Act* apply only to the forest sector operating on Crown lands. There is no legal requirement for other industrial operations to adhere to the protection of established OGMAs therefore limiting their effectiveness. A single "Old Growth Protection Act" that applies to all sectors would more effectively protect old growth in the province.
- The **Forest and Range Practices Act** contains loopholes that allow much of Earth's grandest forests and biggest trees to be logged, such as moveable Old Growth Management Areas and a lack of forest productivity distinctions (which skews representation of protection towards marginal stands with small trees and less biodiversity).
- There is no **FREP protocol** for landscape level biodiversity. There is also no information available regarding government monitoring of the effectiveness of the existing tools for protection of old growth (OGMA, UWR, WHA).

PRIVATE LANDS

- There are **no protections** for old-growth forests on Private Managed Forest Land.
- **Riparian trees** are being logged on Private Managed Forest Lands, which do not require buffers on streams. This leaves streams that are vital to water supply vulnerable to drying up and it will take centuries for the riparian zones to regrow, due to the short growing season at certain altitudes.
- The present system that regulates and monitors **private logging** in B.C. doesn't hold companies and landowners to a high enough standard.
- Forbid the **rezoning of forest lands for residential use**. Encourage instead the donation or sale of land for parks or conservation areas.
- In 2004, a forest corporation was permitted to log in an area identified by Ministry of Environment biologists as critical winter habitat for Deer and Roosevelt Elk because the government took the land out of the Tree Farm Licence and put it under a **private land management** regime that allows the company to decide what's best for wildlife.

PROFESSIONAL RELIANCE

- The Professional Reliance model in practice since FRPA has **failed to protect** our Old Growth. Steps must be taken to ensure that only truly qualified professionals with knowledge of Old Growth ecosystems and the values other than the economics of timber, are the ones making decisions about Old Growth.

- In BC, we have the **Association of British Columbia Forest Professionals** (ABCFP) to help in our management of the forests. This group has been protecting forests and the interest of the public for over 70 years. They have risen to the challenges presented from our ever-changing management of this resource and continue to live up to a stringent Code of Ethics.

PUBLIC AWARENESS

- There is **no universal definition** for old growth , so how can we give the government our submissions, suggestions, expectations if what we are calling old growth differs from what they call old growth and that again differs from what industry calls old growth. Everyone is at odds for their own gain.
- Most of the **general public** could not even identify an old growth stand.
- There is a lot of **conflicting information** out on websites and in social media. I believe strongly that there needs to be a public information partnership between Government, Industry and Associations The messaging needs to be consistent, factual, reliable, and timely.
- Before any headway can be made, a **clear definition** of what constitutes “old growth” needs to be made.

REGIONAL UNIQUENESS

- While the complex system of biodiversity, wildlife and cultural regulations has been agreed to in the Central Coast, it is not a solution that would work for the rest of the coast.
- Our forests are so **diverse** that there is no solution that makes sense for all regions of the Province.
- The **Great Bear Rainforest Order** provides extensive, prescriptive measures for old forest management. This approach was not intended for areas such as Vancouver Island and most other areas of BC, which are vastly different and highly developed already.

REPLANTING / SILVICULTURE

- All **new planting** should be mixed forest and suitable to the soil in which the species are planted. I have seen areas of pine that just die after 20-30 years, because planted in the wrong soil and climate locations.
- Although **harvested areas** are replanted, plantations have little of the structure, function and processes of old growth forests, and are scheduled to be re-harvested on a very short timeframe compared to the recovery time of an old growth forest.
- For every tree that is harvested there are 3 or more trees being planted back. Tree **nurseries** are continuously working on producing a better tree through **genetic improvements**. The future forests are becoming genetically superior with trees having high growth gains, better wood attributes and with more disease and pest resistance.
- **Fertilizers** should be kept well away from any water body (streams, swamps, rivers and ponds). Fertilizers alter the fertility of the soil by increasing the acid levels in it. Plants which are given fertilizers do not live for too long compared to the plants which grow naturally. Fertilizers entering water bodies can lead to the excessive growth of algae and decreased oxygen leads to the death of fish and other aquatic fauna and flora. Eventually the ground water and our water supply are contaminated. Treating the soil with too much nitrogen also leads to loss of certain plant species especially those with less nitrogen needs.
- The single-age stands that are planted in the wake of industrial clearcuts are not forests. They are **tree plantations**. Not only are they exceptionally poor and degraded habitat; they are also incredibly vulnerable to pests and to fire.

SECOND GROWTH

- A disturbed, replanted, **monocultural tree farm** is NOT a forest - with its deep diversity and undisturbed living soil, streams, and extraordinarily varied living organisms of all types.
- By allowing harvest of old growth trees, you allow for a longer rotation regime of **SG stands**. This allows second growth timber to go from the juvenile stage to the mature stage, all the while providing functional mid to late-seral stage habitat for a number of species.

TALK AND LOG

- **Stop logging while talking**. Even as consultation on old growth is proceeding, logging continues and BC Timber Sales actively markets remaining old growth stands. The "talk and log" routine has characterized British Columbia's public engagement for decades. Through this unethical practice, government launches studies, meetings, conferences, consultation, and reports that distract those who would protect forests, all the while maintaining the industrial status quo.
- It is time to end the '**Talk and Log approach'** of avoiding the old-growth question and to now deliver meaningful, science-based management of our old-growth forests and the multiple values they provide.

TERMS

- The **lack of commonality** of reference points in referring to forest stands can easily generate confusion. Saying 50% of the old growth has been protected versus 50% of the remaining old growth is not a mere matter of semantics, because as the "loggable" amount is progressively consumed, eventually the formally protected area ends up being all that is left even though during that logging alone, the actual amount of old growth has been halved.
- The **definition of old-growth** is too weak. As sections of FRPA have been repealed, it's unclear what the status of OGMAs are under FRPA. Definitions of old-growth should consider the ecosystem functions present within intact first growth systems and not only the age of the trees.

VARIABLE SPACING / VARIABLE DENSITY

- Nutritional value of food in 10-20 year-old stands of timber (after clear cutting) are depleted because of more tannin rendering nitrogen unavailable. Monoculture, (primarily pine) and trees planted too close together is the worst-case scenario for food production. Variable spacing and variable density is mandatory. **Nutrition for all terrestrial species** is a major consideration in re-establishing old growth characteristics in the future.

WATERSHEDS

- The B.C. Forest Practices Board investigates public complaints and audits foresters across the province. Since 2013, about 22% of its investigations have included concerns surrounding harvesting watersheds. According to a 2019 FPB report, "there is no legal requirement for licensees to consider downstream private property or road infrastructure. **Protection** of watersheds should be at the very forefront!

WILDLIFE

- An industry trend province-wide toward preferential selection of smaller trees for inclusion as **wildlife tree patches** and other reserves within cut-blocks compromises the biological effectiveness of the reserves.

TIMBER CRUISING

- A lot of timber cruising is done by **private consultants** for logging firms, and this type of "privatization" generates potential **conflict-of-interest** concerns.
- BCTS's in-forest role is specifically timber cruising. The fundamental problem is two-fold: firstly, because timber-cruising is based on examining a sample, it is easy for **variations** in tree composition to be missed. Secondly, BCTS staff are trained to focus on forestry from the industrial perspective (i.e. trees as timber with a dollar value), and do not have the background to make **ecosystem-related decisions** in old growth areas.

MISC.

- **Variable retention** is a forest harvest practice not an old growth conservation and landscape retention plan and does not achieve what is needed for fully functioning old growth and dependent species.
- The detailed guidance for management of old growth provided in the **Forest Practices Guidebook for Biodiversity** and other associated guidebooks has not been effectively applied.
- **FSPs** can lower standards. Some are written to be inconsistent with legal objectives. Licensees then argue (wrongly) that once in the FSP, results and measures are the legal benchmark (e.g., Nahmint FSP only includes old growth objectives under rare ecosystems, whereas HLPO targets apply to all ecosystems).
- Many land use plans are **outdated** and have not been revisited since the MPB epidemic, extensive forest fires, and now spruce and fir, beetle. Government's "Modernized Land use Planning" is a positive step, but targets only some areas and will take time.
- Old growth is **sustainably managed** now because it considers environmental, social, cultural and economic interests together. Significant portions of old growth are protected from logging forever.
- **Management practices** such as Old Growth Management Areas, Riparian Reserves Zones, Ungulate Winter Range, Goshawk Reserves, Marble Murrelet habitat areas, Eagle nests, Bear dens, Big Trees and Retention Patches are used to ensure the old growth forest values are protected while working forest is being utilized.
- I feel there is an **unwarranted sense of urgency** whether by government or social media to create new policies or enact new legislation to protect old growth when in fact this process has been going on for decades. Public interest and values have and will continue to change over time and the forest policies and practices will evolve as well.
- **Key drivers in forest land management** have changed since the Forest and Range Practices Act was introduced, which necessitates a rethinking of policy goals and objectives to better serve BC now and into the future. Emerging drivers such as wildfire fuel management, climate change, First Nations reconciliation, and a better understanding of the interconnectedness of ecosystem communities generates the need to reorient forest management to not only protect forests but improve overall community well-being, resilience to climate change, the economy, public health and First Nations relations in BC.

- Existing mechanisms such as Old Growth Management Areas (OGMAs), Wildlife Habitat Areas and Visual Quality Objective areas do not prohibit **logging or road-building** and are thus not a robust form of protection for old growth forests.
- Forest harvesting for the **maximization of economic return** in BC has, in many cases, resulted in profits for international corporations, a boom and bust economy for local communities, and, a steady degradation of social, cultural and ecological values. The province and indeed the world can no longer sustain a model that maximizes economic return at the expense of other values.
- The system is broken – legislation, regulations, and policy all have a **narrow mandate** and do not monitor effectiveness of OG retention and cannot address big picture problems.
- The Forest Service often places MCH in the woods after the **Douglas-fir bark beetle** flight has already started. In order to be most effective MCH must be placed in the woods before the bark beetle flight starts.

ADDITIONAL COMMENTS

- **BCTS** should be wound up as it has violated the public trust and for the conflict of interest that exists by this government agency operating within the same ministry responsible for compliance with forestry law and regulations.
- As for **BCTS** auctioning old growth abutting the Juan de Fuca trail? Just the latest outrage of a rogue agency with no oversight and accountability. Shut it down!
- It is imperative that any **legislation** banning or prohibiting logging of old growth forests in BC must have TEETH. It is not enough just to declare such logging prohibited. There must also be enforcement provisions in any such act that make actions contravening the prohibition not just criminal, but COSTLY. We have seen over and over again individuals and corporations all too gladly choose to contravene inconvenient laws in exchange for a slap-on-the-wrist or a small fine when the costs of breaking the law are so much less than the profits to be gained by doing so.
- Old growth is appropriately managed for multiple uses and managed well. Given over 50 million hectares of BC Forests have received numerous **third-party certifications** indicate (CSA, FSC, SFI) the world views this also.
- I believe that our **old growth is managed well** under the Forest and Range Practices Act and regulations which manages our crown forests for different resource values that include recreation, soils, sustainable timber supply, wildlife, water, fish, biodiversity, visual landscapes and cultural resources. This makes it one of the most sustainably managed forest regions in the world.
- **BCTS** is simply not equipped to assess ecosystems.
- The forest industry has faced many **challenges** during my career but none more daunting than the erosion of tenures, external pressures from special interest groups and poor land use decisions.
- Just like everything in life, managing the timber resource and specifically Old Growth is all about **"balance"**. I think we've done a pretty good job in balancing the need to have large areas of Old Growth timber preserved in areas such as Parks, Wildlife Habitat Areas, Ungulate Winter Ranges, Riparian Reserve Zones, visually sensitive areas etc.
- I participated in the **Old Growth Strategy for BC** in 1992. Everything that needed to be learned and acted upon was captured in that report. Nothing has happened in nearly 30 years and in the meantime, we have lost virtually all the last great stands. Why are you continuing to talk and log?
- My view as a forest professional is that the forests on the coast are **well managed**. While there are always things that can be improved, I believe we lead the world in managing for multiple values on the land.

- Despite what politicians may say, one fact has endured through successive governments: old-growth **timber value has been prioritized** over all else. Unfortunately, the "all else" that has been sacrificed in the name of short-term returns includes species, Indigenous rights, vital freshwater systems, and sustainable rural economies. The results have been dire: destroyed ecosystems, endangered and extinct species, massive carbon outputs, and devastated communities.
- The only way to legally **stop a logging development plan** is through parliamentary intervention, including financial compensation for expenses incurred and unrealized potential profits. Achieving parliamentary intervention is close to impossible which seems to leave & actually encourage two other options that can work: **Civil disobedience** (blockades/ picketing etc.) & **social pressure and license**.
- Political parties will come and go but **forests are forever**.

FOREST MANAGEMENT – RECOMMENDATIONS

APPROACH - LANSDSCAPE LEVEL

- The government needs to make more of an effort to establish forest management objectives that support the sustainability and resilience for important old-growth forest values at the **landscape level**, particularly aquatic and terrestrial habitats and fish and wildlife populations.
- We need to restore **'old' forest structural values** to the broad landscape as opposed to the current approach to have 'set asides' with no management. Historically, these forests had complex structures at the fine scale.
- Forests are complex ecological structures and require trained professionals to design and implement the proper forest management **plan for each hectare** of forest. Forest policy must be designed to give professionals the flexibility to make proper decisions for the full range of forest values and to allow different management strategies to be employed in different parts of the province.
- The province should promote **landscape level conservation** planning including objectives for biodiversity conservation, old growth forests, connectivity and climate change adaptation and mitigation across all landowners and managers.
- To be retained, old growth forests must be selected as part of long-term, landscape-level plans that provide **functional Land Use Plans** throughout all watersheds and upslope to alpine tundra.
- Objectives and targets for old growth conservation and recruitment should use planning units based on watersheds or landscape units-spatial scales that more closely align with Nanwakolas member First Nation governance and management systems.

APPROACH – THINK LONG-TERM

- At best, most industrial users plan for 5 years ahead. Some LUP, plan for 20 years ahead. The forest is a living organism that has survived tens of thousands of years already and will continue to do so when we are long gone. As a result, it is short sightedness to not plan on at least a 200 to 500-year management horizon; which should be the bare minimum. This could be achieved in a manner of ways, however one such example would be rotational park/conservancy areas with **long-term rotation cycles** of 200+ years.
- The entire forestry system has to **shift to long-term** investment in our environment, culture, and green jobs.
- It is time the Provincial Government developed legislation which does not subject forest management decisions to **four-year political cycles**.
- The Annual Allowable Cut should be based on a **250+ year rotation** not an 80-year rotation.
- Land Use Plans must be long-term (150+ years) and landscape level, include **planning for <u>all</u> land** within the landscape, not just industrial forest land, and be focussed on long-term sustainability for future generations.

APPROACH – LOOK AT THE BIG PICTURE

- If one removes the maximization of economic return as the highest priority and management for social, cultural and ecological values becomes an equal or overriding priority, the goal is no longer forest harvest, the goal then becomes **true forest management** for the full spectrum of values.

- The strategic review should analyze **a whole system** of management objectives rather than simply its individual components. Policies should be all-inclusive within the whole forest management framework. In this way they can consider multiple benefits of overlapping objectives; be considerate of community and landscape wildfire risk and vulnerability; and make sure they do not interfere with ability to manage resilient landscapes amid climate change.
- A **paradigm shift** that places the long-term ecological integrity and resilience of BC's forests ahead of timber supply is urgently needed to ensure species and ecosystems can thrive while adapting to our rapidly changing climate and British Columbians can continue to reap the benefits that fully functioning forest ecosystems provide for generations to come.
- Many of the values identified as needing old growth are actually dependent on **forest attributes** which can be achieved in younger stands through forest management. So, rather than a narrow focus on age, or size, adopt an approach that manages for attributes to facilitate desired forest values and objectives across managed forests.
- **Biodiversity** is key to manage all aspects from micro-organisms, plants, fish, animals and even communities, schools, hospitals and families. All of these must be considered and managed not just one alone. A large component of the working forest is comprised of old growth timber that is constrained or being protected for other values i.e.: Riparian reserves, Old Growth Management Areas (OGMA), Wildlife habitat areas, Big trees and many more.
- Land Use Plans must focus as first priority on what land and **ecological resources** need to be protected and sustained before there is any planning for industrial, recreational, agricultural, or other disturbances or activities.
- More emphasis is needed on understanding the forest **attributes** that contribute to values, then – via well-designed sustainable forest management policies – promoting the activities that will allow these values to manifest.
- A **new model for forest management** is required that recognizes management for social, cultural and ecological values as an equal or overriding priority to the generation of profit. Many models of forest management exist that are economically viable, engage First Nations and local communities, create local employment and still fully accommodate social, cultural and ecological values.
- BC's **priorities** moving forward should centralize on the proper management of soil sustainability, biodiversity, ecology, wildlife, fish, spiritual values, water, riparian features, and NTFP's within these intensive forestry zones, not merely on whether a stand has or has not been harvested yet.
- Government should work with qualified professionals to design and implement **science-based** plans for forest management.

BCTS

- The BC government should use its control over BCTS to quickly phase out issuance of old-growth forest cutblocks and to begin supporting the implementation of **conservation** measures on forested lands under BCTS' authority.
- B.C. Timber Sales Agency must be **abolished or completely re-organized** with independent, meaningful public input and oversight and a new mandate for truly sustainable management that removes the requirement to log 20% of the annual allowable provincial cut.
- **Investigate** more fully the extent to which BC Timber Sales is in violation of the Pprovince's policies and Vancouver Island's Land Use Plan.
- Change the BC Timber Sales model. The **stumpage rates** are entirely inadequate when all natural services provided by old growth forests are taken into account.
- Commission a **Review/Investigation** of BC Timber Sales (Mission, Core Values, Policy & Procedures; Practice, Performance & Behaviour with respect to Old Growth), perhaps by the Forest Practices Board, although it isn't sufficiently arms-length.

- Focus BCTS on maturing 2nd growth, increasing its pivotal role in reforestation, decommissioning roads, allowing candidate areas for parks additions. One of the stated goals of BCTS is **sustainable forest management**. Make changes to the BCTS goal of reliance solely on the market pricing system for the auctioning of harvested timber.

COLLABORATION

- Fixing will require sound science from **landscape and wildlife ecologists**.
- Consult with bear viewing operators and other users on the land-base to ensure that all **tourism operators** in an area of old growth are considered be/ore logging takes place.
- Consideration should be given **to private forest landowners** with second growth stands that could be used to recruit future old-growth stands.
- Create an old-growth **science panel**, tasked with establishing a much more comprehensive, science-based approach for determining old-growth retention/restoration targets and timelines.
- Include the **upstream oil and gas industry** in consultation as early as possible to align and integrate surface and sub-surface planning.
- Increase support of **local governments and planners** to implement development bylaws that promote the maintenance and recruitment of old growth forests.
- Create **working coalitions** between the forestry industry and **local conservationists**. Having an established forestry corporation that employs community members and fundamentally acts in the best interests of the region will allow us to develop new and innovative logging strategies without outside pressure.
- Old growth management must be **collaborative and coordinated** with other legislative, policy and land use planning frameworks in British Columbia to reduce conflict and redundancy.
- Consider **community-based worker co-ops** for forestry.
- Enlist an expert **scientific panel**, including western academic and **Indigenous knowledge**.
- Other than the **provincial government** and **First Nations**, the following should be actively involved with decision making about the future of old growth forests in B.C.: **Local communities** and **governments**; **recreational users**; **naturalists or conservation groups**; **tourism industry**, particularly **eco-tourism businesses**; **commercial or domestic water users**; **youth**; and **ecologists** and **biologists**.

COMMUNITY FORESTS

- BC needs to significantly **shift forest management toward community forests** that more fully reflect community values and provide multi-dimensional benefits such as local job creation and retention, recreation and tourism development opportunities and strengthening regional and First Nations' partnerships. It would also be advantageous for community forests to be able to set old forest reserve levels that differ from provincial requirements in alignment with their individual management approach.
- Community forests are a highly **successful model** of forest management, where profits from forest management are directly returned to local community and First Nations, while creating local employment and managing for all values.
- Provide more latitude in provincial policy so community forests aligning their **Forest Stewardship Plan** with Old Growth Management Area policy can more fully deliver community values onto the timber harvesting land base.

ECOLOGICAL RESERVES

- Augment the ER system with exemplary examples of the variety of old growth forests that exist in B.C. Set a goal that 1% of the 57 million ha of Crown forest be designated as ERs. This is an 800% increase in the forested areas now in ERs. An **expanded ER system** is a provincial insurance policy limiting irreparable biological losses and fostering the knowledge acquisition and adaptation needed due to accelerated climate change effects on all forests.
- Seek input to the development of the decision process on **candidate ERs** from non-government conservation biologists and First Nations knowledge keepers as well as government staff and ensure the participants conduct themselves professionally and report in an open and transparent manner.

ECOSYSTEMS / NON-TIMBER VALUES

- Use **ecosystem-based management principles** to re-write Land Use Plans and Forest Stewardship Plans (FSP).
- I recommend that British Columbia needs to shift entirely to a forest management policy focused on the support of forest **ecosystem health first**, and timber and fibre production second.
- Impacts and risks from **climatic-induced events** such as drought, insects, disease and severe wildfire must be factored into an adaptive management framework or model. Active forest management must be embraced to manage dynamic ecosystems faced with changing climate conditions.
- Retention of old growth forests should, as a priority, **focus on valley bottom**, low elevation ecosystems, as they are the richest growing sites, present the lowest operating costs, provide the best timber stands, and are therefore currently at the greatest risk to ecosystem function from industrial development.
- Determine how much old-growth must be retained and/or restored in every ecosystem type relative to its **range of natural variation** (RONV) in order to ensure the long-term ecological integrity of those systems, based on a wide variety of factors that are employed in modern conservation biology assessments.
- We recommend static Old Growth Management **spatial constraints** on the forest landscape be eliminated in favour of a dynamic approach that includes recognition of climate change and the declining health of our forests.
- The province should promote and endorse land use planning that considers efforts to identify and evaluate **natural capital values**, as demonstrated by the Municipal Natural Asset Initiative of the Federation of Canadian Municipalities and the federal government.

EVALUATION AND REPORTING

- Provide **regular reporting** on status of old growth protection in BC.
- Commit to **transparent reporting** on conservation initiatives, clearly communicating challenges and celebrations with the public.
- Local governments, academics and NGOs are working together to better define and evaluate various forms of Natural Capital assessment. We need to **improve how we quantify and evaluate** environmental values.
- The province should **develop better tools** to improve the analysis of social, environmental and economic benefits and costs, to inform management decisions and policies around old growth forests including the inevitable trade-offs that will occur.

FIRE

- **Human safety** must be paramount in the location and management of old growth management areas. In the unprecedented wildfire years of 2017 and 2018, it is very likely that unhealthy or dead old growth management areas with significant portions of bark beetle killed trees or build ups of significant forest fuels in close proximity to homes, neighbourhoods, rural subdivisions or ranches contributed to the extreme conditions and subsequent wildfires. While old growth forests and their attributes are important, the safety of people and their homes should be paramount.
- Fire there are too many **ladder fuels** within OG patches today. There should be different management practices in different areas (Parks & etc.) but a substantial portion OG areas needs to be analysis for wildfire protection.
- Add incentives to encourage treatment of old growth stands with **high fuel loads** or **over-stocking**, to reduce the risk of mortality due to fire or drought.
- Old growth management must be aligned with a new **integrated approach** of FireSmart, WUI management and landscape level management for greater ecosystem resilience.

OLD GROWTH MANAGEMENT AREAS (OGMAs)

- **Allow CFA Managers to make changes** to the locations and boundaries of OGMAs to improve their ecological value and to reduce impacts to the Timber Harvesting Land Base (THLB) by co-locating them with other land designations where appropriate.
- Consider an **alternative approach** to the location and design of OGMAs. A-spatial management of OGMAs is one potential solution. OGMAs could be temporary (10 yrs?) and revisited when required.
- Consider that a 1000-year-old tree is 250 times as old as the length of a standard four-year political term of office, or 50 times the length of a forester's 20-year career in the role as timber-supply manager. These transcendental time scales again make it clear that OGMAs **should not be moved** around by foresters.
- Implement the recommendations of the Forest Practices Board 2012 report and develop an **OGMA inventory and tracking system** and enter all current OGMAs into this system and their condition. Maintain the OGMA registry and provide periodic summaries for Landscape Units.
- There should be a **written rational for all management actions** – even the action to do nothing to an OG patch, OG tree, OGMA, or Park. Currently no management (leave it natural) is the default action for most OGMAs, Provincial Parks, and other preservation/conservation areas. This no management decision produces its own enhanced Risk to an area from wildfire, often without the managers realizing it for many ecosystems.
- Greater clarity is required regarding how it is determined that a **replacement area** is of equal or better biological attributes.
- Old growth management areas must enable and **incentivize management** to maintain their old growth attributes.
- A **small-scale harvesting** contract that is competitively awarded to a select group of very skilled operators who are dedicated to carefully extracting dead and beetle infested trees in conjunction with fire risk reduction and bark beetle management treatments might be a way to maintain old growth values in OGMA's. Major licensees in our area don't seem to be interested in aggressive bark beetle management on a small-scale basis or burning of winter harvesting debris that becomes infested with bark beetles, before the beetles emerge the next spring.
- Whenever an OGMA is proposed, **ecosystem biologists** should be consulted first. BC Timber Sales is not equipped to make OGMA decisions on its own.

- **OGMAs need to be large enough** to take into account the increase in wildfire activity that climate change is already bringing. Updates to designation criteria are clearly needed. If a devastating mega-wildfire hits a certain OGMA area that is the "bare minimum" in terms of size, then there is no "spare area" to maintain OGMA functioning in the long term.
- Currently OGMA Orders in BC are defined as either Spatial, A-spatial, or a combination of the two. Given that OGMAs will change over time, it is beneficial to have some **flexibility** built into these legal Orders. One possible approach is to put in place an A-spatial Old Forest Order where OGMAs can be spatialized in short 10-year terms and managed by Area Based Licensees and BC Government with input from nearby communities. The parameters of each OGMA Order would need to be clearly spelled out and used as the foundation for OGMA location and design within Landscape Units or BEC zones. This will allow for community input into the location of OGMAs as well as provide some flexibility and certainty to the working forest concept.
- **Stop re-allocating** OGMAs.
- **Require that government report** which regions and areas have not completed government orders to establish spatial OGMAs. Seek a commitment from government that there will be completion province-wide of all spatial OGMAs within the 2020/2021 fiscal year and that these be made known on the government website.
- OGMA must be replaced when lost by **disturbance** (fire) on the landscape; and OGMAs cannot be doubled as **Wildlife Tree Patches**, these reserve requirements must be separate.

OVERSIGHT / LEGISLATION / MONITORING

- Consider the implementation of an **Old Growth Forest Act** as recommended by the ELC.
- Draft and table an **Old Growth Protection Act**, along the lines of the proposal by the Environmental Law Centre Clinic.
- Recommend revisions to the **Local Government Act** and **Islands Trust Act** to grant the Islands Trust greater jurisdiction to implement conservation-focused legislative tools.
- Hire **more provincial forest scientists** to monitor logging companies rather than expect them to monitor themselves. The current approach has been a dismal failure.
- **Environmental Impact Assessments** that the public has a chance to participate in must definitely be part of the process, along with strict compliance and enforcement regulations, and adequate government oversight to administer.
- The **Forest Practices Board**, which does good investigations, must have power to enforce its recommendations.
- A science-based **Old-Growth Forest Protection Act** or amendments to existing legislation is needed that: inventories how much old-growth forests remain in each ecosystem type; undertakes scientific assessments on what are the minimum necessary protection levels in each ecosystem in order to sustain its biodiversity and ecological integrity; and most importantly, mandates the legal protection and the restoration of old-growth and native forests to reach those minimum viable protection levels.
- Develop legislation to protect old growth that is **applicable to all industrial sectors**.
- **Significant fines** need to be imposed for violations.
- Change the **Forestry and Range Practices Act** and bring back the **government forestry department** to oversee practices. Companies should not be self regulating and audits should be done externally.
- Amend the *Forest and Range Practices Act* or create new legislation to establish higher, legally-binding **old-growth protection targets**, based on the latest science, to sustain the long-term ecological integrity of old-growth forest ecosystems and to prioritize the management of biodiversity over timber supply across landscapes.
- Include provisions for **protection of old-growth at all spatial scales** (e.g. at the big tree, grove, ecosystem, watershed/landscape levels).

- Bring better management oversight and control to the Forests Ministry through the latest **technology** and adequate **staffing** levels.
- There must be more effort put into apprehending **timber poachers**, with significant penalties for the poachers and the mills and private customers who buy the illegally harvested old growth.
- The province should invest significant resources in **monitoring and auditing**, with boots-on-the-ground, the activities of both Crown and Private Managed Forest licensees/owners, including compliance with first and old-growth protections (current and recommended).
- Importantly, the management of old-growth forests must be governed by **clear, enforceable regulations** that are resilient to economic pressures, incentivize conservation leadership, and penalize infractions.
- Ensure that managed forests are **monitored** not only for timber production, but also for effective ecosystem processes and services inherent to them, and for biodiversity maintenance and enhancement.
- Replace the approach of **professional forester reliance** linked to decisions on changes in OGMAs and old forest retention during harvest planning and layout with a more effective system involving provincial government and/or independent third-party oversight.
- Resurrect the **Forest Practices Code** with landscape level planning and establish a meaningful monitoring and enforcement program.
- It is time for a **review of the actual cut blocks** in the manner that was done in the 1990's, when randomized blocks were selected for examination by fisheries, wildlife and soils scientists to determine the actual result compared to the plan.
- Amend the **Government Action Regulation** by removing section 2 Limitation on Actions that places priority on timber at the expense of conservation of nine other old growth forest dependent values.
- Remove the **1990s 6% AAC limit** applied to the implementation of the *Forest Practices Code* and inform implementation of old growth retention using criteria that test the current condition of older forests and the vulnerability and sustainability of non-timber values within the context of landscape unit plans.
- We have to properly regulate how **spruce beetle** is harvested, so they don't just use the excuse of spread of beetle to log remaining spruce old growth without having to verify actual beetle %.

PRIVATE LANDS

- Require **old growth protection** on private managed forest lands.
- Private land logging on a large scale must be subject to strict **rules and regulations** in line with those on Crown land including requirements for sustainable harvest, the protection of old growth, protection of wildlife habitat, water protection, protection of viewscapes, and community input.
- Legislate **improved oversight** and protection on private lands.
- To reduce ecologically destructive practices on privately managed forest lands, regulations outlined by the **Private Managed Forest Land Act** need to be updated (e.g. forest management should prioritise development of old growth characteristics; total allowable cut must be lowered; and clearcutting should be replaced with selective practices that maintain canopy).
- The **Islands Trust** should be granted greater jurisdiction to implement environmental regulations to fulfill the "preserve and protect" object charged to them via the Islands Trust Act to reduce highly unregulated cutting on private property.
- Promote and facilitate **contributions from private lands**, including private managed forest land, to maintain and recruit old growth forests.
- The province should support the development of **incentives to private landowners** to retain or recruit old growth and mature/late successional forests.

- Old growth planning should apply to very large areas of **private land within the Nanwakolas member First Nations' territories** that are governed under the Private Managed Forest Land Act.

PUBLIC AWARENESS

- The methods and science of forestry activities do not seem to be well publicized by the government or by industry, leading people to believe that forests are being managed poorly and without regulation.
- **Increasing public knowledge** of the current and future initiatives in BC's forest management is critical in helping to build public confidence in the management of BC's old growth.
- Commit to **transparent reporting** on conservation initiatives, clearly communicating challenges and celebrations with the public.

REGIONAL UNIQUENESS

- Avoid a **'one size fits all'** approach to old growth management in the interior, recognizing the diversity and imperatives presented by the range of natural variation in parts of the interior. Move toward management practices that recognize the differing natural disturbance patterns present in the interior.
- Because forests of BC vary by region, and because of the lack of consensus around clear definitions of "Old Growth Forests", management strategies, policies and legislation for managing "Old Growth Forests" should also vary across the province, and be flexible to allow professionals to make proper decisions on how to best manage the forests at **local levels**.
- BC's approach to old growth management can't be "One Size Fits All". It must be **tailored to the ecosystem** (i.e. BEC zones) and must consider the impacts of climate change.

SECOND GROWTH (TRANSITION TO)

- Shift away from harvesting old growth by focusing more on managing second growth forests to reduce the risk of **wildfire**.
- I encourage the logging industry to become a **sustainable 2nd growth industry** which does not resort to removing old growth trees and habitat.
- The industry must shift to rely entirely on sustainable fiber yield from second growth forests, with an aim to **add value** to every board foot of timber and gram of fibre produced.
- **Innovative measures** are necessary to support perpetual, economically viable second-growth harvesting in rural areas of the coast. We are confident that, over time, innovation will prevail through decreased delivered log/lumber costs, thereby increasing the economic viability of second growth harvesting in expensive, rural locations.

SILVICULTURE

- The industry must convert to **"engineered lumber"** and move itself into a growth system similar to an agriculture mode.
- Additionally, the industry must cease spraying reforested plantings with **chemicals** that cull out "unwanted" varieties as well the planting of non-indigenous varieties must cease.

TAXATION

- A key proposal is the creation of a **Conservation Tax Incentive Program** for conservation of forest values on private land. This is via the creation of enabling legislation allowing local governments to conduct tax shifting activities within their local jurisdictions. This involves both Ministry of Municipal Affairs and Ministry of Finance. However, tax shifting analysis indicates that the actual cost implications to most taxpayers is miniscule. An existing program for residents in the Islands Trust area can serve as a model.

TARGETS

- Create **wild forest targets** in addition to old forest targets.
- Forest objectives must be established to **ensure the quantity and quality** of old forest and mature plus old forest is maintained within the natural range of variability.
- **Historic levels of old growth** should inform management actions, but not form hard targets, given rapidly changing disturbance regimes we are experiencing now, and the extensive changes that have occurred to many landscapes.
- **Old forest objectives** must be formally established at the Natural Disturbance Type, Biogeoclimatic Zone, Subzone, and Variant level within each Landscape Unit.
- **Revise** the current old growth retention targets, which were developed in 1995 when establishing OGMAs. Over the past 25 years, new knowledge has been gained and new pressures in the landscape have become apparent. Updating the targets ensures best practices are in place for protecting old forest values.
- Establish **clear and measurable** sustainability targets.

TIMBER CRUISING / PRICING

- Eliminate or publicly review and correct the flaws in **'cruise-based' pricing** (no oversight, etc.)
- During **forest assessments** (timber cruising), BCTS staff should be accompanied by biologists-ecologists from the Resource Management side of FLNRORD. Addressing this staffing shortage should be the first priority. (It may be feasible to hire summer students with biology and environmental-science backgrounds to help out here.)
- Stop using cruise-based pricing. **Sample plots are not an accurate measure** of timber volume and quality.
- Consider a **market value stumpage fee structure** similar to that used in AB and SK as our current stumpage fee calculation leads to the boom-bust cycle that we are currently experiencing.

WATERSHEDS

- All community watersheds must be mapped, particularly the old growth and endangered species habitat, and removed from timber permits. **Communities** should own their own watersheds, and the provincial government should help them buy out private land and Crown logging rights in their watershed.

WILDLIFE

- Government needs to coordinate its action, internally and with the Federal Government with respect to **species at risk** and resulting forest management policy decisions. MaMu habitat areas, Big Tree Protection, GossHawk...

- Provide more resources to implement the work of the **Species and Ecosystems at Risk - Local Government Working Group** (SEAR-LGWG), sponsored by the Ministry of Environment and Climate Change.

ADDITIONAL RECOMMENDATIONS

- **Reduce political influence** in Old Growth management decisions.
- Dismantle the **tenure system** that continues to allow corporations to log uncontrollably for profit, on land that rightfully belongs to the public of BC.
- Expand the **community forest program** to increase the size of existing community forests, create new community forests, and give local communities full control of the multitude of values provided by our forests, including Old Growth management.
- Change the law around **fee simple**, which means one can do whatever one wishes with one's property subject to a few restrictions that may be imposed by local, provincial or federal governments. Land use that affects the ecological health of any region needs careful scrutiny before being approved.
- Consider **tenure options** with a stumpage assessment that recognizes development costs and provides rebates for higher management standards.
- The province should consider ways to preserve old growth in favour of **incentives** (i.e. policy and stumpage) to better utilize existing waste wood and second-growth forests. These would encourage and support the **Coastal Forest Sector Revitalization Program**, support existing pulp and secondary manufacturing and support new industries to use waste fibre (i.e. wood not suitable for chips, salted hog fuel, other species, etc.).
- Complete in the 2020/2021 fiscal year, a **decision tree**, a formal process with a set timeline for decisions on conservation values and a legal protection for forest stands that have high conservation values. This will benefit regional government staff, ENGOs, First Nations and industry so that it is known where and under what conditions conservation values will be given precedence over forest harvesting. Communicate the process to interested stakeholders and First Nations and clearly outline the steps in the process on government websites.
- Modify **stocking requirements** to reflect variability in stocking under historic disturbance regimes and allow for a greater range of variable retention at harvest (i.e., drop the basal area requirements for fully stocked stands).
- Build an **adaptation** framework into systems, policy, and approach.
- Ensure new plantations are mixed (suitable to the soil conditions) with **variable spacing** and **variable density**.
- Evaluate the potential of selling **carbon offsets** from the Municipal Forest Reserve, which could assist in buffering communities from any reductions in old-growth harvesting.
- BC should adopt an approach for balancing multiple ecosystem services such as those that have been implemented in the **US Forest Service**.
- Old growth conservation, and biodiversity conservation more broadly, should be based on a **foundation of the science** related to: the range of natural variation, which differs from region to region; managing toward natural disturbance patterns; achieving seral stage distributions; and a system of 'rotating reserves' greater than 100 hectares.

ADDITIONAL COMMENTS

- Decisive action, in terms of **halts on all old-growth**, has to be a prelude to planning. Otherwise it is just the same old "talk and log" and the same old perspectives on land-use. We do not have time for that.

- BC needs a much **smaller, sustainable forest industry** that protects old growth and biodiversity, cuts second ant third growth trees and adds maximum value to the wood before it leaves the province.
- Its concerning when the vast-majority of **BC's population** lives in cities such as Vancouver and Victoria where they are so far removed from forests and old growth but due to their population have such a strong say in what we decide as a province is the best course of action. Meanwhile, citizens in towns such as Port McNeil, Woss, Zeballos, Gold River, Campbell River, and Port Alberni where almost every family has one or more forestry workers, will struggle to have their voices are heard. These will be the people wearing the brunt of harsh cutbacks of old growth logging because as said before there is misinformation being given to uneducated people.
- We should sustainably log our second and old growth Canadian working forests and set the **global standard** of good stewardship. It is time we wake up, think bigger picture, and support an incredible industry that is unfairly under attack. I would rather fill my home with locally made wooden furniture over cheaply made and questionably acquired wooden IKEA furniture.
- Our forests are **dynamic** and our Old Growth Management needs to be as well.
- Certainly, the industry is a balancing act of environmental, social and economic needs. I believe that generally things are in **balance** at the moment but are dangerously close to being pulled out of balance by placing too much weight on the social aspect through an inaccurate portrayal of reality.
- Given these huge knowledge gaps and given how habitats are shifting due to climate change, the **Precautionary Principle** should be invoked, which means that a great many more areas need to be protected automatically.
- The forest industry at this time is under extreme pressure of all sorts including strikes, economic tariffs, governmental strategies, and biological attacks. There will continue to be contraction in the coastal industrial base regardless of any old growth retention decisions made. Anything that you can do to support the existing industry at this time would allow for a **gradual change** to achieve the right balance of sustainable forestry and its economic benefits.
- Old forests are important ecologically, spiritually and culturally – but the amount of old forest is not the only definition of a healthy forest ecosystem. Forests are dynamic and a healthy forest is one with a **range of age classes**.
- **Forest Professionals** should be trusted to continue doing sound forest management, as we are trained and responsible for balancing social, economic and environmental values when making decisions.
- **Professional foresters** are employees of the logging corporations, not public employees, and thus should not be part of the planning process. Forest companies should not have input to weaken land conservation and wildlife protection policies.
- The **mismanagement of old growth forests** in the Province of BC is a travesty. A priceless resource has been squandered, resulting in loss of irreplaceable habitat value with devastating consequences for species like mountain caribou.
- Decisions need to be made based on **facts, not bias**.

INDIGENOUS ISSUES

CULTURE

- Old Growth forests support Indigenous peoples' **culture and arts**.
- Focusing down to old-growth, it is unreasonable to expect that **reconciliation** will be possible if Indigenous peoples do not have access to adequate amounts of intact original forests. As Indigenous leaders like Tla-o-qui-aht master carver Joe Martin argue, old-growth is vital to First Nations' cultures and should be protected for that reason.
- **Cedar** is a well-known symbol of the Pacific Northwest Coast and for thousands of years important in many aspects of coastal First Nations lives. Not only is cedar a key natural resource in the production of material goods, the tree also plays an integral role in the spiritual beliefs and ceremonial life of coastal First Nations.
- **Cultural cedars** are logged to profit very few at the expense of entire indigenous nations.
- First Nations have strong aboriginal rights to harvest **cedar trees** for economic benefits as well as the ceremonial aspects of their culture.
- The continued destruction of **archaeological sites and cultural landscapes** during the harvesting of old-growth forests without consent and co-management of First Nations is inconsistent with the recently adopted articles of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) in British Columbia.
- The destruction of these **culturally modified trees** reduces the potential for future economies in local and First Nations run tourism.
- First Nations connect with and depend upon **old-growth forests** in specific and unique ways, which only these peoples can fully and properly articulate.

GOVERNMENT

- The Province should seek and **support First Nations leadership** within these processes, unless a Nation or Nations elects to defer to Provincial agency leadership for the process within their territory(ies).
- In all cases, the Province should assure First Nations have sufficient **funding** to support their elected role.
- We must now develop a **government-to-government** relationship whereby the Province of BC supports First Nations in getting access to more tenure assets that they can manage on a sustainable basis that meets our social, cultural, economic needs.

HISTORICAL

- Indigenous peoples have taken good care of the OGF for centuries. They provide a resident human presence in the OGF year-round and have a **vested interest** in ensuring its protection and management on the ground.
- British Columbia's forestry policies and practices are founded on a **colonial worldview** that assumes there will always be more trees to cut and more profits to be made.
- Impacts associated with incomplete survey, direct logging, exposure caused windfall and road building activities can contribute to the **loss of archaeological sites**. Beyond specific loss of archaeological sites, the cultural landscape immediately surrounding identified sites are often irreparably impacted or destroyed. These spaces contain knowledge and history beyond the scientific record of the archaeological site. For example, they may host ancient resource gathering areas, trail routes, seasonally visited camping and hunting locations and named oral history sites.

KNOWLEDGE

- Indigenous peoples collectively constitute **a wealth of information** regarding the past history of these old-growth forests, and given that valley bottoms are most likely to have been used by Indigenous peoples for a variety of uses (including hunting, seasonal settlements, cultural ceremonies, burial grounds, cultural trees, and so on) over millennia, the gathering of traditional-knowledge insights regarding these old-growth tracts must be made a priority.
- First Nations across BC have depended on and cared for these old growth forests since time immemorial. Their laws and values enabled flourishing healthy societies who were able to meet their needs without compromising the needs of those to come. **We have much to learn from them**.

ROLE

- Indigenous peoples should play a central and front-line role in the **protection and management** of the remaining patches of the OGF going forward.
- Old-Growth forests in BC cannot be protected without major support for **First Nations Indigenous Protected Areas and land use plans** that protect old-growth forests.
- Many rural & First Nations communities lack a range of **alternative economic development opportunities** that would support a transition away from old-growth logging, should they wish to.

RIGHTS AND TITLE

- **Nuu-chah-nulth jurisdiction** supersedes the colonial laws of British Columbia and Canada. Tla-o-qui-aht First Nation members have not been properly consulted and have not given consent for the current logging plans in Tla-o-qui-aht territory.
- We continue to work on our mapping project to broaden core protected areas in the Sinixt tum xula7xw into a Climate Change Conservation Network. Until this ecologically based and responsible planning is complete, we will not allow, as per our UN affirmed Indigenous rights, any resource development in our tum xula7xw and certainly not without our **prior, free and informed consent**.
- Not having **access to appropriate cultural wood** is an infringement of our Aboriginal Rights under Section 35 of the Constitution Act. As part of our healing journey we must get access to large cultural cedar trees.
- **A veto** would be a significant management simplifier, would result in more protection, and would reduce conflict. It would also reduce litigation over this issue, including the incredible expense of that to both the province and First Nations.

RECOMMENDATIONS

- The provincial government should fund **conservation financing solutions** to support First Nations sustainable economic development as an alternative to old-growth logging, similar to the $120 million provided to nations in the Great Bear Rainforest.
- In fulfilling the commitments of the **B.C. Declaration on the Rights of Indigenous Peoples**, recognize the cultural connection and rights of First Nations to old growth preservation.
- FLNRORD needs to collaborate with the Ministry of Social Development & Poverty Reduction and the Ministry of Indigenous Relations and Reconciliation to build **long-term solutions** to achieve the stated objectives of resilient communities and workforce, reconciliation with Indigenous communities, and sustainable forest management.

- Future regulatory or policy changes must be addressed through **government-togovernment engagement** as outlined in the shared decision-making process of the Nanwakolas Reconciliation Protocol Agreement.
- Old growth policies should align with Nanwakolas member First Nations' **protocols for cultural forest resources** such as Large Cultural Cedar.
- First Nations should have **a veto** over any logging of old growth in their traditional territories.
- Unanimous approval from all First Nations groups within a certain radius (e.g. 400 kilometres), plus also approval from ecosystem biologists (on staff with FLNRORD Resource Management) should first be required before a pristine virgin rainforest old-growth area can be considered for harvesting. Such **consultation should be large-area-wide**, not just with the nearest First Nations band.
- Support **Indigenous forest management**, that is millenniums old, by ensuring Indigenous forest companies and communities are not being coerced into logging and destroying their territories to pay for a TFL in their territory or the "rights to log" and defend/guard against a non-Indigenous company attempting to acquire the TFL in their territory.
- Obey the guidelines of the **United Nations' Declaration on the Rights of Indigenous Peoples**, including the free, prior, and informed consent of Hereditary Indigenous Chiefs and Leadership.
- The Province should collaborate with First Nations leaders to develop an **old-growth conservation strategy** that applies to provincial Crown land forests areas within Natural Disturbance Type 1 and 2, with climate- change mitigation as a primary goal and rationale.
- Recognize **Indigenous authority, governance and stewardship** in forest management.
- Old-growth management should include **dialogue with First Nations** on how Old-Growth Protection can be integrated into Indigenous-led Land Use Planning, new governance models, and sustainable economic diversification.
- Commit funding to conservation financing solutions for First Nations' **sustainable economic development and diversification** in lieu of old-growth logging, tied to modernized, Indigenous-led land-use plans, improved community wellbeing, and support for and legal recognition of new and existing Indigenous Protected and Conserved Areas.
- Provide annual funding for the creation of **Indigenous Protected and Conserved Areas** aimed at protecting sensitive ecosystems, expanding species protection, and helping Indigenous groups play a role in conservation efforts.
- Highly detailed, rigorous **archaeological assessments** should be conducted before timber-harvesting can be considered in such areas.
- **Transfer harvesting rights** for most coastal cedar-leading stands to First Nations.
- Declare a **moratorium on logging** of coastal old-growth western red cedar.
- Remove stands that contain large old cedar trees from the regular operating areas of coastal tenures and from the **Timber Harvesting Land Base** used in AAC determinations.
- Develop forest management strategies to ensure a **long-term ongoing supply of cedar** needed for First Nations cultural purposes.
- The Province should **seek and support First Nations leadership** within these processes, unless a Nation or Nations elects to defer to Provincial agency leadership for the process within their territory(ies).

ADDITIONAL COMMENTS

- I consider the taking of any resources from Indigenous unceded territories without the consent of Indigenous peoples to be illegal and to be considered **theft**.
- Consent given to resource projects by an elected **Band Council** using the power imposed by the Indian Act – with its colonial racist nature and purpose of divide and conquer, is clearly different than circumstance where elected Band Councils made/make decisions about resource management after properly informing and consulting with **Hereditary Chiefs** and band membership in a form that is appropriate to the Nation in question.
- There cannot be progress on addressing the old-growth issues without the **direct participation** of the First Nations.
- The Province of BC and Canada has **without compensation de facto expropriated** the 164,000 hectares of Pacheedaht's Traditional Territory and subsequently carved it up and distributed it to TFL licenses, BCTS, Federal and provincial parks with only 134 ha remaining under Pacheedaht ownership. Pacheedaht, once resource rich, has become a pauper in their own land. Pacheedaht has started down the long road of addressing this inequity. It is apparent to us that treaty will fail to address this disparity of resources. To survive/prosper and remain an intact entity we will require other sources of income. The resources of our land are from the forest and oceans surrounding us.
- It is essential for the Province to be respectful of any specific First Nation priorities affecting the balance of old-growth retention and harvesting within their territory. For example, a First Nation may see its own economic development imperatives as requiring more old-growth harvesting in their territory than is suggested by the Province's overall target. Or a Nation may lean towards greater levels of retention in their territory to meet their own needs. The Province should respond openly and flexibly to any of these unique **First Nations priorities**.
- Tenure holders that have operated in unceded territory **have not managed the forests the way we would have**.
- We need government to recognize that **for time immemorial** First Nations managed the forests in a sustainable way and, given the opportunity, we would continue to do that.
- To say that old-growth forests were not managed, is to erase the vast **history of Indigenous use** of these forests from the historical record. From cedar bark harvesting, to the collection of plant medicines, to the carving of canoes, Indigenous peoples relied on the bounty of the woods for countless generations. They took only what they needed and, after millennia of harvesting, left behind vast, healthy forests.
- According to Articles 26 and 32, [of the UN Declaration on the Rights of Indigenous People] not only do we have the right to the resources in our tum xula7xw (traditional territory), anyone operating in our territory must obtain our **free and informed consent** for any development activities on our lands. Our Sinixt Indigenous rights and responsibilities encompass the water, land and the forests, including all Old Growth in our tum xula7xw.
- We have seen the BC Government run programs and services for years that were funded by forestry yet, in our own Territory, we do not have access to the same volume to be able to run equivalent **programs and services for our community**.

PROTECTION – MORE NEEDED

EXISTING PROTECTION / INVENTORY

- Very little old-growth coastal temperate **rainforest karst** is left in BC. What does remain should be inventoried and protected as soon as possible. British Columbia has a rare opportunity to save what remains.
- On Vancouver Island alone, the equivalent of 34 soccer fields of the last remaining old-growth rainforests are **logged every day**.
- **Old growth logging** continues at a rate of 140,000 hectares a year, about one Stanley Park or 500 soccer fields a day!
- **Less than 5%** of the remaining low-elevation old-growth forests remain on Vancouver Island and they too are being systematically liquidated and replaced with biologically barren tree plantations.
- Aside from some major successes for old-growth forest protection, such as the Carmanah and the Great Bear Rainforest, the majority of recent set asides have protected rock and ice, **unproductive high-elevation forests**, or achieved conservation only for small token groves (e.g., Avatar Grove, Port Renfrew, BC) and isolated individual trees (e.g., the 54 trees from the Big Tree Registry).
- Logging **old-growth karst sites** has proceeded and even been encouraged without the benefit of baseline data, adequate oversight, effective enforcement, up-to-date inventories, and comprehensive monitoring. In short, the integrity of BC's sensitive karst resources and their associated values for future generations have not been protected by the Forest and Range Practices Act (FRPA).
- The University of British Columbia's **Big Tree Registry** on which the province's big tree initiative is based, identifies nearly 350 stems, meaning only 15% are now under temporary protection. Accounting for the 0.01km² grove protected around each of the 54 trees, this results in less than 1km² of old growth protection province wide.
- There is only 8% of the original old-growth forests of the South Coast protected in parks, and out of this there is only 2.6% that is highly productive valley-bottom old-growth. These **statistics** paint a different than the BC government's website which are tenfold these amounts.
- Though the province reports that 23% (132,000km²) of forested lands in BC remain in old growth, the Environmental Law Centre (ELC) at the University of Victoria in collaboration with Sierra Club BC, recently found this proportion to be closer to 5% (32,000 km²). The province also claims that 55% of old growth in BC's coastal regions is protected; however, this figure is based on the ***existing*** **extent, rather than the *historic* extent** of old growth. Since 2005, almost two million hectares of old growth forests have been logged.

MISC.

- An independent Research Co. poll showed 92 per cent of British Columbians support taking action to defend **endangered old-growth forests**.
- The rules and regulations MUST become stricter and a complete **moratorium** must be instituted on existing remaining old growth forested areas in BC, especially areas that are now difficult to log requiring complex high-risk helicopter logging in steep terrain where likely the entire hillside will come down and devastate the area.
- In the face of the **climate emergency**, protecting the resilience of intact natural forest ecosystems is particularly important.
- **All remaining old- growth forest** should be considered endangered habitat and should receive full protection from all forms of destruction.

- The existing protected areas of Old Growth Forests are disproportionate and inadequate to support the requirement for the **overall natural ecological stability** of British Columbia.
- The rate of regenerated Old Growth Forest is negligible compared to the **rate of cutting** and elimination of Forests with Old Growth Attributes; that provide biological health and diversity for indigenous plants, trees, bird, aquatic, mammal, and other wild life, plus the quantity and quality of drinking water essential for the health and well being of all British Columbia's inhabitants.
- Conserving old growth and mature forests on the **private land base** will maintain resiliency of BC's forests by providing connectivity across and along valleys, thereby bridging the gaps between the older forests located on Crown land.

RECOMMENDATIONS

- Place an **immediate halt on logging in old-growth 'hotspots'** while the BC government develops its Old Growth Strategy.
- Place a **moratorium** on logging old growth ecosystems, especially on Vancouver Island, in southwestern British Columbia, and in the Interior wet belt, until an inventory has been made of the remaining old growth forest, and new regulations devised.
- Immediate action should be taken to protect the little remaining old, and second-growth forests of the **Coastal Douglas-fir (CDF) region**.
- Suspend harvesting and development in **Coastal Doulas-fir old growth ecosystems** and develop a strategy for old forest recruitment.
- The government must put into place an immediate **moratorium** on old growth logging in the province.
- Create a provincial **Natural Lands Acquisition Fund** for the purchase and protection of endangered old-growth forests on private lands. Establishing new protected areas on private land requires the outright purchase of lands from willing sellers.
- Financially support and legally recognize **First Nations Indigenous Protected Areas** and land use plans that protect old-growth forests.
- Use the **ecosystem-based management approach** of the Great Bear Rainforest (where 85% of the forests are reserved from logging) to sustainably manage BC's old-growth forests.
- Permanently stop old growth logging by making "old growth logging" **a crime against nature** and humanity.
- Suspension of harvesting **old growth cedar** is required until a detailed assessment is conducted that identifies instances where their harvest may be considered (e.g., for cultural purposes).
- Halt all old-growth logging on both **public AND private lands** in BC.
- We should protect additional intact old growth forests across scales much larger than the one hectare the **Big Tree Policy** protects around some (but not all) exceptionally large trees.
- Protect the vast majority of remaining old growth forests by **converting** them to parks and conservation areas.
- **Reinstate/revise legislation** to protect from logging view corridors from important highways, lakes, and tourist destinations.
- Recognize BC's acute need to have more **watersheds** protected by putting them off limits to logging.
- Adopt a goal to protect enough old growth in each ecosystem type to meet low risk to **biodiversity**.
- Consider the **Natural Heritage Conservation Program** (NHCP) to purchase and preserve old growth ecosystems and ecologically sensitive ecosystems on BC's private land base.
- Old growth trees like **cottonwood** found in floodplains must be permanently protected.
- The **ponderosa pine** forest types of the southern Interior should be included in the conversation about old growth forests.
- **End subsidies to fossil fuel industries** and instead direct those funds to the protection of old growth in permanent conservation areas, by buying private land or buying out logging rights on Crown land.

ADDITIONAL COMMENTS

- **Take a balanced approach** that recognizes the significant conservation measures taken in BC already to protect old growth and other forest values, and the extent to which BC leads its global competitors in sustainable practices. The **fibre supply** situation in BC is already challenging, and we will be reliant on old forest fibre for the near and mid-term as we transition to a more balanced age class distribution and second-growth harvesting.
- The recent protection of **"big trees"** is welcome but ecologically absurd. Entire old growth communities need to be saved. Should the fire department save only the biggest resident of a burning house?
- **Other countries and jurisdictions** in other parts of the world have halted old-forest or native forest logging in recent years. We can do the same.
- Sawing up 500-year-old trees to make 40-year shingles is insanity. Instead we need to learn to **share the planet** with the rest of the living beings we share this planet with.
- I just found out that The Clack Creek forest here on the Sunshine Coast is about to be slashed for... plywood. 10,000 mature and old growth trees are about to be **destroyed for...plywood**. How on earth, in good conscious, could our government allow this situation to proceed?
- Leave the Old-Growth Forests alone! Keep out of the remaining niches of Old-Growth Forest! **Protect what is left!**
- The **timber companies** have destroyed the vast majority of our old growth, and now they want to 'manage' and 'share' what's left. What's left MUST be put into conservation areas for the sake of a planet where the permafrost is melting all over northern Canada and wildfires are raging every summer.
- Forests are **ECOSYSTEMS** not tree farms! and we have no right to destroy them.
- Declare an **immediate moratorium** on logging the remnants of the ancient forest until we can gather the best science to determine what we *should* preserve, what we *can* preserve, and what we *must* preserve.
- There is nothing we can do in British Columbia that will more effectively contribute natural solutions to the climate crisis and to act on the rare opportunity to be wise carbon stewards than to safeguard the globally significant **critical carbon sink** that is embodied in these old-growth forests.
- Our **wildlife** are starving to death due to the lack of the availability of food, especially the huckleberries. Our Interior fir are impacted severely due to lack of water in summer months and the fir bark beetle is running rampant, thus making the trees less resilient. BCTS knows all these things but economics and the dollar (greed) continue to run the show and call the shots. At this point, if no one does anything to mitigate clear cut logging, we are all going to be out of jobs, out of food, out of water and our eco-systems will continue to die.
- Old growth-forests are **not a "renewable resource"** in that it takes hundreds of years for a tree to become "old growth" and the forests in which these trees grow can be even older. Once an old-growth forest is gone, it is gone forever within our grandchildren's and their grandchildren's lifetimes. I recognize the need to provide jobs for BC forest workers, but I urge you to allow logging in second-growth forests only.
- The Province of BC's recent (July 2019) **protection of 54 big trees is a red-herring**. A tree is not equal to a forest ecosystem.
- **Protecting intact old growth forest ecosystems** is one of the most important things we can do to ensure the health of our planet for generations to come. I have two young daughters and I want to be able to look them in the eyes and know that I did the best I could.

PROTECTION – NO MORE NEEDED

EXISTING PROTECTION

- When you take into consideration the entire coastal area which includes Vancouver Island, Haida Gwaii, Great Bear rainforest and South Coast, the provincial inventory indicates about 70% of the forest (2.8 million ha) has been set aside for non-timber reserves that is **not available for harvesting**.
- The Great Bear Rainforest Act, Old-Growth Management Areas and other safeguards were created to make sure **we will never, ever run out** of old-growth forests.
- Current forest policy in BC is sufficient to conserve the small amount of "Old Growth Forests" in the **southern interior region** of the Province.
- **More than half (55%) of Crown old growth forests** on BC's coast are legally protected in parks and protected areas, as well as other conservation reserves.
- British Columbia leads North American provinces and states in **parks and protected areas**.
- The province has more forested land under **third-party environmental certification** than any other country.
- Since 1990, the **Allowable Annual Cut (AAC)** from public coastal forest has declined by 30% largely as the result of conservation efforts and land use changes.
- Since 1991, **protected forests on the coast have tripled**.
- A great deal of the Crown Forest Land Base in Province of British Columbia is **already conserved** in Parks, Old Growth Management Areas, Wildlife Habitat Areas, Riparian Reserves, Cultural (spiritual) sites, Ungulate Winter Ranges, Archeological Sites, Recreation Sites and Trails, Low productivity sites, and inoperable areas.
- Much of the **old growth** is already not harvestable due to its protection status and much of it is in places where there are few people, so few people know these large swaths of virgin forest exist.

MANAGEMENT

- **Old growth is sustainably managed** now because it considers environmental, social, cultural and economic interests together.
- A ban on the harvest of old growth could also leave us open to **ecological disasters** such a major fire, or disease outbreak, fueled and fostered by **over-mature vegetation**.
- Restricting or prohibiting old growth harvesting from within the working forest will create an **unbalanced age class profile** and will contribute to a drastic further reduction in coastal harvest.
- **Crown forests** are managed with myriad values in mind, including recreation, soils, sustainable timber supply, wildlife, water, fish, biodiversity, visual landscapes and cultural resources.
- Today, **second-growth harvesting** accounts for approximately 50% of the annual cut on Vancouver Island, up from 5% in 1995 and will continue to rise as the industry manages its transition to second growth. I urge the province to support the continued transition in a manner that allows the forest industry to retool in a measured way that ensures a vibrant sustainable industry and a healthy forest.
- When you look at the existing profile on the coast all recognized timber supply models always plan to harvest the oldest timber first; thereby, allowing the second growth timber to mature at a rate that can mature and sustain future harvests. What has been happening on the coast for decades is a **very structured transition** from old growth to second growth.
- Today, **second-growth harvesting** accounts for approximately 50% of the annual cut on Vancouver Island, up from 5% in 1995.

- Sustainable harvest plans must include a mix of old growth and second growth logging. Presently, there is **not enough second growth** at a merchantable rotation age to be sustainable or to support the needs and demands for wood and wood products.
- Current forestry land base management regimes in BC **already have regulations and standards** that manage and protect "Old Growth Forests".

REFORESTATION

- By law, all areas harvested on public land in BC must be reforested. Every year, more than **200 million trees** are planted in BC.
- **Reforestation** ensures the opportunity to sustainably manage BC's forests for generations to come and the newly planted trees help our fight against climate change by fixing carbon as they grow.

SUPPLY / FINANCIAL

- Removing large areas old growth forests from the Timber Harvest Land Base (THLB) will lead to significant reduction in Allowable Annual Cut (AAC) and have **substantial economic consequences**.
- A moratorium would heavily impact **primary and secondary manufacturing/milling jobs** – this would be catastrophic to many small businesses and communities at large.
- Restricting the amount of old growth timber available for harvest this will have a **detrimental impact on communities, the industry and Provincial revenues**. This includes reduced capital investments, employment and revenues.

RECOMMENDATIONS

- Rather than a continual reduction to the available Crown Forest Land Base, look to **conserve interface forests** by limiting urban sprawl and promoting preserved areas within city lands. Work with BC cities to conserve forested areas outside of our working forest.
- Avoid or **exempt Woodlots** from further large-scale conservancies.

ADDITIONAL COMMENTS

- BC is the most **sustainably managed** forest region in the world.
- To further limit access to old growth would be an **irresponsible economic and social decision** that negatively impacts all communities in British Columbia.
- Old growth forests are a large part of the working forest and should remain as part of the working forest. … If we want capital investment in facilities and jobs, we need to **protect the working forest** and ensure it is available for sustainable harvest.
- We need to ask ourselves as a society: **Are we prepared to be a "have not" province** relying on tourism? How much park land is enough? Does anyone in the Lower Mainland or Victoria care about the stability and sustainability of our coastal communities? Do they understand how the failure of this industry will affect everyone? People will still demand wood products. Do we want to import them from countries that do not have to operate with the same environmental and safety standards?
- There is no shortage of forests and there is **no shortage of old growth forests**.
- The potential impact of further erosion of the coastal forest industry has to potential to put thousands more on the **unemployment line**. The burden on the provincial social support programs coupled with lost tax revenues is unacceptable.

- Having come to Campbell River from a very small coastal community (on the Queen Charlottes / Haida Gwaii), I have seen first-hand the results of **overprotection of old growth**– huge job loss, direct impact to communities, as well as financial decline for the many who have relied on the forest industry to earn their living and support their families.
- The question that the government must honestly answer is, **who are we managing old growth for?** ENGO interest groups with loud voices, the people of the lower mainland who have no understanding of current forest management practices, or the people and the industry that rely on old growth timber to sustain their livelihoods, their communities and contribute to the financial well-being of the province?
- Protection for old growth in Coast Douglas fir ecosystems may not be currently adequate, but the biggest threat is **deforestation as a result of urban development**, not forestry.
- **A clearer definition of what Old Growth is** needs to be defined. I believe the public views Old Growth as Cathedral Grove – Massive trees reaching for the stars. Yet the ENGO's are pushing for something broader which could include "First" growth and "Emerging" old growth stands. This would essentially shut down forestry in this province and wipe out a significant swath of rural BC.
- Protection of any additional THLB will not add to the ecological health of the forests in our region but will certainly result in the deterioration of the **economic health of the region** as more mills will close and jobs are lost.
- Regarding the conservation of individual Big Trees, it is important to **make the distinction between large trees and old trees**.
- We should be proud of our current forest practices and generally a sustainable industry compared to other parts of the world. What we need to do is **educate the public** and reassure people that the forests are in good shape and in good hands. We need to do a better job to counter the rhetoric or 'fake news' put out by certain individuals and advocacy groups.
- Please keep in mind that the **northern hemisphere has more trees** than at any point in human history and the fear-mongering only serves foreign interests.
- I am proud of the current management of BC's forests, and feel confident that the current old growth protection will allow for the continued habitat needs of **species at risk, ecological diversity of rare site series**, and will create a sustainable working forest for future generations.
- If Provincial Policy further reduces the area of Old Growth forests in the Timber Harvesting Land Base, we will be forced to either reduce harvesting or target young second growth forests, which are critical to our **mid-term timber supply**.

VALUE - ECONOMIC (NON-TIMBER)

TOURISM

- Old Growth forests support a multi-million-dollar **tourism industry**.
- Old-growth forests also play a critical role in the **tourist industry** in BC and specifically Whistler. Many of our most popular trails go through old-growth—and these same forests have either been logged by our Community Forest or are planning to be logged.
- Backcountry areas contain **world-class climbing, hiking, mountaineering, fishing, and exploring destinations** and are threatened to be destroyed by the logging of the last small areas of old growth.
- BC's old growth forests are a vital part of our **appeal as an international outdoor recreation destination**.
- The recreational value of hiking trails in old- growth forests boost the **economies of local communities**.
- **Hiking** is a great outdoor activity and the Big Tree Registry has promoted hiking to view the 'giants' of the old growth forest.
- **Mountain biking** is enjoyed by all age groups.
- Tourism is booming largely because **true wilderness** is a commodity more and more people want and need in order to rejuvenate, forest bathe, forage for mushrooms and all sorts of herbs and edibles, breath fresh air, experience pristine water and wilderness, view wildlife, hike, camp, refresh and regenerate, hunt, fish, and heal psychologically and physically from stressful urban lifestyles.
- The **overcrowding in many parks** is common knowledge, yet this province continues to log that which attracts local and foreign tourists.
- Beyond the Avatar Grove, there are many other record size old growth trees on Vancouver Island which remain unprotected. These trees are a huge **draw for tourists**, nature lovers, photographers, and hikers. Their enormous ongoing value to tourism and the local economy greatly exceed any one-time monetary value gained by destroying them for a few planks of lumber.
- Increasingly prevalent and **visible logging scars** are at odds with what international visitors come here expecting to see.
- Tourism already **employs twice as many** people as timber.
- There is a huge reservoir of untapped **opportunity for growth** in tourism, in particular ecotourism and Indigenous (Aboriginal) tourism.
- **Limiting access to old-growth forests is not required** to meet visual quality objectives of tourism operators. Plans to maintain visual quality while harvesting timber have been implemented to great success in many landscapes in B.C. in recent years.
- Adventure **tourism relies on the environment** and the everything that is wild and natural about it. From heli-skiing to bear viewing, all adventure tourism relies on what is present on the landscape.
- The money that could be made by increasing tourism in old-growth areas (with attractions such as hiking trails, guided tours, partnerships with First Nations, etc. would be more than the revenue from **stumpage fees**.
- With the successful campaign to protect the Avatar Grove and later, the highlighting of Big Lonely Doug, the town of Port Renfrew has become a great example of how a struggling, rural, resource-based **community can reinvent itself** as a tourism destination. People are now returning - in huge numbers.
- The **tourism, recreation, and fishing** (especially salmon) industries, for example, all benefit from intact old growth forests.

- Our unspoiled wild places, our huge trees, and our amazing variety of birds and wildlife are among the most **unique assets and tourism draws** to "Super Natural" BC.
- Along with tourism comes **restaurants, accommodation, rentals, transportation, etc.**
- In 2018, the **Discovery Island tourism** sector generated around 50 million dollars employing over 1,000 people. The success of the tourism sector here is built entirely on forested scenery and wildlife tours.
- The value of old growth to the tourism sector in the Discovery Islands rival or exceed revenues in the forest industry here. To protect and enhance tax revenues, governments simply **can't ignore tourism** any longer.

RECOMMENDATIONS

- **Recreation and Eco-Tourism must be considered** when looking at the complete economic picture of a region when considering allowing logging to happen.
- **Outdoor recreation** should be given significant consideration as an amenity value in regards to land use and be explicitly considered and incorporated into forest legislation and forest management and planning.
- **Conduct an assessment** to determine how much "old forests" are actually used by recreationalists and how much substitution can be done with other forests.
- Create a **provincial fund specifically for purchase of old growth** with a minor component of grants to bolster 'old growth viewing' tourism.

ADDITIONAL COMMENTS

- The old growth trees are **worth more standing up**, than being cut down.
- Protecting Whistler's natural spaces is … critical to Whistler's tourism industry and ensuring the destination continues to enjoy **a vibrant visitor-based economy** for many years to come.
- If you cut the trees you give economic advantage for 1-3 years then the area becomes dormant for the next 50-80 years. If you leave the trees standing you create economic advantage for each and every year for **the next 50-80 years**.
- Recreational users understand and appreciate that **access into these areas** has been made possible by the logging companies putting in roads and access points but again, there has to be some balance to what is being allowed to be harvested in these days of the reality of climate change and a warming planet.
- Old growth is effectively **a non-renewable resource-in human time frames**, at least. So we can stop logging them now and retain their significant public value, while suffering from minor economic hardship, or we can stop logging them when there are none left, at which point the forestry sector will suffer the same economic hardship but the public value will have disappeared.
- We have not even scratched the surface of the **economic potential** of protected old-growth forests in BC. Tourism.
- Moreover, tourism is long-term sustainable whereas harvesting of old-growth trees (centuries old) is **tantamount to mining** (since such trees cannot regrow to their former size in the time- frames typically allowed for cutblocks). Looked at in this way, in the long run, it actually makes more economic sense to idle more mills.
- Big Tree Tours has been in operation for the last 5 years, in which time I've seen interest and demand skyrocket. So much so that I can't possibly fulfill the full number of requests for tours that I receive. … This **'big tree boom'**, in my opinion, still only scratches the surface of what's possible for Port Renfrew - and all communities on route to old-growth forests for that matter - should these forests be safeguarded.

- Since 2015, **tourism has overtaken logging** as one of the largest employment sectors. The government needs to recognize that as fewer residents rely on the extraction of timber, more effort must be made to protect the spaces that draw so many visitors to our area.
- There are relationships between the forest sector and backcountry tourism for skiers, mountain bikers and hikers who gain **access to the forest on forest-industry service roads**. None of this would exist if not for a forest resource sector that includes harvesting some old-growth timber.

VALUE - ECONOMIC (TIMBER)

COMMUNITY BENEFITS

- Forestry companies support a wide range of **local businesses and suppliers**.
- Forestry companies support **community charities, events and organizations**.
- The coastal industry helps sustain the **financial and social fabric of coastal communities** that depend on the forest sector.

COMMUNITY FORESTS

- Through road construction, timber harvesting, silviculture and manufacturing, community forests provide **direct local employment** that allows the pursuit of other interests and values on and off the lands within the forest boundaries. The Crown benefits in the form of revenues from stumpage and taxes, and communities share the **revenues from the sale of timber**.

ECONOMY

- BC's forest industry, representing most lumber, pulp and paper, and manufactured wood producers from across the province, contributes $12.9 billion to **BC's GDP**, generates over $2.5 billion to provincial **tax revenues**, and supports over 100,000 **direct and indirect jobs.**
- Forestry contributes $4 billion in **taxes, royalties and fees** to various levels of government.
- The forest sector contributes billions in GDP and billions in the form of provincial taxes, logging taxes, fees, and stumpage, which **supports essential services** such as education, healthcare and infrastructure.
- It was expected to cost taxpayers nearly $1.3 billion dollars to run the Ministry of Forests, Lands, Natural Resource Operations and Rural Development in the 2017/18 fiscal year (and another $173 million to run the Ministry of Environment and Climate Change Strategy), but the $992 **revenue from the timber industry did not cover FLNRORD operation** let alone contribute to Climate Change Strategy!
- The **cost of forestry** includes massive expenditures communities must cover to pay for water treatment and flood damage and future costs of drought from deforestation and having to deal with nutrient depleted and toxin-loaded lands under glyphosate-sprayed monocrop tree plantations.

EMPLOYMENT

- Forestry companies support **stable, well-paid jobs** that allow people to work where they live and be part of the local community.
- The over 100,000 direct and indirect jobs generated by the working forest are spread across **140 forestry-dependent communities in the province**, including in the northern interior where one in five jobs are forestry-related.
- Forestry jobs are not only focused in rural areas – **40% of forestry jobs** are in BC's Lower Mainland and in the Southwest region of the province.
- The sector employs over **5,300 Indigenous Peoples** – more than any other resource sector, with many more engaged as contractors and in economic partnerships including equity ownership, joint ventures, forest management agreements and wood purchases.

OLD GROWTH QUALITY

- Old growth generates **higher-value timber** than second-growth trees.
- Old growth produces **stronger wood** with tight, dense grains, which is **valued higher** than the wider ringed, softer wood from second-growth trees.
- In general, old growth stands also have much **more timber volume per hectare** than second-growth stands. As a result, old growth forests per given site are higher in economic value than second-growth stands for logging.
- BC is gaining more traction with companies using old-growth wood to reach **high-end markets**, producing engineered wood products and drawing in millions of new investment dollars.

PULP AND PAPER

- BC's pulp and paper sector: represents 20% of the forest sector **GDP** and 34% of the total value of **forest products exports**; supports 11,000 **high paying jobs**; and generates $4.4 billion in annual **sales**.
- If a pulp and paper mills were to close permanently due to fiber shortages, hundreds of direct jobs and indirect jobs would be lost, especially in **vulnerable, rural communities**.
- The **demand for pulp logs** is increasing due to sawmill closures and curtailments, while the annual allowable cuts are decreasing. This is threatening the viability of the secondary consumers in the province and both interior and coastal pulp and paper operations.
- The pulp sector is and will continue to be an important component of BC's strategy to **move up the value chain of products** derived from BC's forests.

RAW LOG EXPORTS / APPURTENANCY

- **Automation** has killed jobs and rapidly increased the amount of logging done.
- Bring back **appurtenancy** - the longstanding requirement that to log public timber, companies had to operate local mills. The removal was a complete betrayal of our social contract.
- **Log exports** to off-shore mills must be halted in order to protect wood supply for BC lumber mills.
- Put exported **raw logs back into local communities** to increase job opportunities and employment levels.

SECTOR CHALLENGES

- The coastal industry has already lost significant **credibility as a supplier** due to labour issues, high costs, and environmental action.
- The forest industry is at a point where it cannot handle another significant **"take-back" of timber**.
- The province continues to impact the **cost structure of the forest sector** with various initiatives such as the Coast Forest Sector Revitalization Initiative, which has added cost to business and limited opportunities.
- Reductions in the Annual Allowable Cut throughout the southern interior because of fires, pests, and the removal of more and more land from the available THLB have placed West Kootenay mills in **precarious situations** where our ongoing viability is in question.

SUPPLY / ACCESS TO OLD GROWTH

- Licensees and their contractors **can't subsist without OG**.
- There is little reason to reduce cut on the coast. Many of the old growth stands are **post climax stands** and for maximum value should have logged many years ago.
- Without a **combination of first and second growth** managed in a proper sustainable manner, forestry in B.C. would wind down to a stop in very short order.
- While the amount of **forests being protected has tripled** since 1991, the AAC on the coast had declined by 25%.
- If a **moratorium** is put on OG – 2G harvest levels would rise to potentially unsustainable levels impacting the future economics of the coastal industry.
- If Old Growth harvest should end now rather than continuing the trend of mixing Old Growth and Second Growth harvest and continuing to slowly phase out of old growth, there will be a very **severe impact** on many Vancouver Island / Coastal Communities.
- The sector in BC continues to navigate challenges such as increased **US protectionism** and 20% tariffs.
- A shift in industry's ability to have secure **access to fibre at a reasonable cost** has forced many difficult decisions, including the curtailment and closure of dozens of mills – impacting thousands of jobs across over more than 50 communities in BC in 2019 alone.
- **Second-growth forests** should be the sole supplier of the province's lumber mills and should be logged at a slower, more sustainable rate than they are now.
- Along with challenging market conditions, **access to economically viable raw material** is becoming increasingly more challenging and is now a barrier to efficiently operating in the interior of British Columbia.
- The TSA has already been decimated by mountain pine beetle and wildfires. **Additional constraints** coupled with pending Caribou UWR orders and herd plans could have catastrophic cumulative effects on timber supply.
- The scope and scale of the industry greatly increased in the 1950s and 1960s with the **transition to sustained yield** following the 1945 Sloan Commission. This forest management model created units to be managed sustainably and those units basically still exist today. As such, the industry is approximately 60 years into the managed transition from natural forests to managed forests. With **managed stand rotation** ages often exceeding 80 and 100 years there is still 20-40 years to go before the transition is complete. Eliminating access to significant portions of the remaining natural forests within the working forest will disrupt this managed transition and significantly reduce harvest levels within most management units – likely in the order of 50% or more. This reduction would be due to a lack of managed stands old enough to harvest to maintain current AACs. The social and economic implications are enormous.

TRADE

- With dramatically reduced volumes there will be **fewer players** supplying our historic markets. The Japanese buyers have been complaining that they do not like the fact that there are so few suppliers of coastal BC old growth lumber, particularly hemlock. They cite the case of wood from Europe and Scandinavia where they have fifty suppliers to our five.
- Old Growth logs that produce **unique, high-quality products** diversify us from domestic and global competitors.

TRANSITION

- There must be **comprehensive compensation** for affected forestry workers. Workers and communities should not bear the brunt of decades of irresponsible government and industry action.
- The transition to second growth harvesting has been happening for the last 25 years and will continue over the coming years. I urge the province to **support the continued transition** in a manner that allows the forest industry to retool in a measured way.
- Consider a **fair transition for forest workers** with a combination of early retirement packages, deployment in the second growth, opportunities for retraining and long-term work in forest ecosystem restoration and intensive silviculture, like the Swedish model.
- With the recent uncertainty of BC lumber mills and their markets, anticipated retooling of mills and predicted drop down to annual second growth logging levels, **unemployed loggers and mill workers** could be retrained as 'Forest Restoration Specialists' on the sprawling Non Satisfactorily Restocked (NSR) lands, or employed at emerging secondary manufacturing businesses.
- If the BC government were to promote policies that **support greater processing and value-added manufacturing** of second-growth logs in the province, the total number of forestry jobs could be sustained and even increased in the province while old-growth logging is quickly phased out.
- The province could plan a careful and just **transition off of industrially-scaled logging**. Small forestry businesses and co-operatives could selectively log second-growth stands in a manner that improves the overall health of the forests. That is, they would not "high grade" the stands for their biggest and most valuable trees. Rather, they would remove trees in a manner that gradually improves the biodiversity and quality of timber available in each stand.
- Implement **regulations or tax incentives to retool old-growth mills** to process second-growth logs and to develop new second-growth mills and value-added facilities (for example, by forgoing the PST on new mill equipment and reducing stumpage fees or property taxes for companies which invest in second-growth mills).

WORKING FOREST

- B.C. has enough parks. **We need a working forest.** Our communities depend on it!
- The concept of the working forest, provides **certainty** for the Forest Industry, provides meaningful and long-lasting employment, as well as promotes sustainable management of our forests.
- Adopt a working forest strategy that protects and **maintains the forest harvesting land base** and utilization of old growth stands in its current form and seek to **increase the utilization and AAC through innovative practices and increased investment** in our provincial forests.

RECOMMENDATIONS

- Create a **transition program** where former loggers once retrained, have their pay tied to previous levels through a subsidy, consisting of contributions from various levels of government and company stumpage contributions.
- The implementation of any plans must first be preceded by **in-depth economic studies** to analyze the potential repercussions.
- Provide **fiscal incentives**, such as eliminating the PST for new second-growth milling equipment, reducing property taxes on private managed forest lands, and reducing stumpage and tenure licencing fees on Crown lands for companies that invest in second- growth manufacturing.

- Revenues from the fee in lieu of manufacture (log exports tax) could be directed toward **rebates** for companies that invest in second-growth manufacturing.
- Curb **raw log exports** through regulations and by increasing the fee in lieu (log exports tax).
- Expand the geographic scope of log export regulations and the fee in lieu (log exports tax) to include **private managed forest lands** that were previously encompassed within Tree Farm Licences managed by the province.
- Help market sustainable, **value-added second-growth forest products** using proceeds from stumpage fees or other sources.
- **Support First Nations** to engage in sustainable, second-growth forestry through conservation financing and skills training.
- Support high-end, value-added **wood working training** in post-secondary institutions, including apprenticeships.
- Undertake **structural changes**, such as tenure diversification (Community Forests and First Nations tenures) and establishing regional log sorts.
- Expedite the transition to a sustainable, value-added, **second-growth forest sector** in BC and support the **economic diversification** of forest-based communities.
- Conduct **long-term economic planning** that explores alternative means of economic development and employment for forest-based communities, including wood processing and value-added manufacturing from second-growth logs, new and innovative manufacturing and recycling initiatives, and the opportunities tied to protected old-growth forests such as carbon offsets, recreation, and eco- and cultural tourism.
- Enact **moratoria** in key old- growth forest areas while science-based timelines are identified to quickly phase-out logging of endangered old-growth ecosystems, giving the industry time to retool for second growth stands with accompanying government incentives and regulations to stimulate this transition.
- To increase certainty for the Forest Industry and encourage investment in BC, the land base of the working forest needs to be **defined and locked down**. Implement a timber harvesting land base **"no-net-loss" program** that can be reviewed periodically. Within the working forest we need to grow and maximize fibre, encourage investment, sustain employment, and ensure that communities and the forest products industry remain viable.

ADDITIONAL COMMENTS

- If the province wishes to protect forest jobs and communities, it should **halt raw log exports** to other countries' mills.
- It will not be possible to maintain **local manufacturing** if there is a sudden moratorium on old growth logging. Manufacturing facilities are aligned to the profile of the forest. Most coastal mills work with larger diameter, old growth logs. There would need to be a **structured, planned transition** to second growth volume.
- I find it challenging to overcome my own **fear of loss** when evaluating the issue of old growth forest management. I fear lost income. I fear losing employees. I fear losing the business my father started 25 years ago. A moratorium on old growth logging would surely bring all of those fears to fruition. I know that fear clouds my judgement.
- I believe that banning Old Growth logging altogether from the annual allowable cut will create an imbalance in our forest future as well as a **catastrophic impact** to the future of the families and communities that depend on forestry to maintain their livelihoods.
- Our reman plant is **100% reliant on old growth**. We have already seen a significant decrease in the availability of old growth and do not wish to see this situation exacerbated by alienating more of the cut.

- If there is a moratorium on the harvesting of old growth, our industry will completely shut down. We are currently the **highest cost producers** in the world, and the only way we will remain relevant in the log and lumber business going forward is to reduce our costs in second growth and to also sustainably harvest our "old growth" forests.
- Logging old growth will not save the industry. Dozens of mills have closed in British Columbia even with rapid logging of old growth forests. **Mills close for many reasons**—market factors, corporate decisions, labour strife, technological change, and others. Mill owners have known for decades that they should retool their mills for smaller logs. Those who have failed to invest in the transition should not be rewarded by granting permits to log remaining old growth.
- If government continues to erode our working forest area (i.e. THLB) with all of the additional measures being proposed at this time (i.e. increasing OGMA requirements, establishing Ecosystem at Risk encumbrances for late serial forests, increasing Visual Quality Objectives, imposing static Wildlife Habitat Areas for dynamic wildlife species such as the Northern Goshawk), the **economic viability of the small Woodlot** will be questionable.
- Lost jobs will translate into lost revenues to the small **resource-based communities** these workers live in. Businesses will close, property values will plummet, programs will be cancelled, as well as school enrolments will suffer. People will be forced to leave these communities to school their children and take part in programs no longer offered in the places they have called home for so many years.
- There has been a steady decline in good **jobs on the north island** in my twenty plus years here and if we keep losing more and more there will just be more ghost towns left in BC and less tax revenue for the province.
- People who have devoted their life's work to the current, unsustainable forest industry deserve help to maintain their families and **transition to other work in forestry** or otherwise.
- Why is such high-value timber not being finished here in Canada, to employ Canadian workers? If the goal is to employ as many Canadians as possible, then **maximizing local here-in-BC employment of all wooden products** would generate far more employment than cutting more trees faster.
- The whole premise of maintaining **sustained yield logging** has been undermined by the removal of the requirement to process those logs within local communities. As a result, the main jobs being "sustained" are the logging jobs which comprise a much smaller component of the forest industry. The industry, as a job employer, has declined so significantly in the last 50 years that it is not justifiable to liquidate the remaining old growth for its benefit.
- Shutting down the logging of old growth will cause **the demise of the coastal forest industry**. It is not just that half the logs would be gone, shutting down logging, sawmills, and pulp mills. The other impact would be to the large remanufacturing industry which relies primarily on old growth for making window and door stock, mouldings, and a myriad of other high-end products.
- The industry will run out of old growth to cut; the only question is when. Their arguments are reminiscent of those of the **Maritime cod fishing** industry, overfishing the stocks until they collapsed. What will happen when all economically viable old growth outside of parks has been logged? Will the logging in parks be next?
- Let's accept the fact that the Forest Industry is **no longer the backbone of the BC economy** and begin the retooling that is required.
- Forestry **feeds our families**.
- **Deregulation** was compounded by the vast majority of timber licensees being consolidated into the hands of very few companies, which freely traded tenures to create regional monopolies. The result is that the majority of public timber goes to large, centralized megamills cranking out cheap commodity lumber, while independent wood producers struggle to access the right logs for their mills.

- Utilize fibre already being conducted by organizations such as the Vancouver Island Economic Alliance (VIEA), Cowichan Tribes, FP Innovations, etc. to support the BC governments' goals under both the **Coast Forest Sector Revitalization Initiative** AND efforts to conserve and protect SPECIES AND ECOSYSTEMS AT RISK. Efforts include alternative fuels, new products and new technology (e.g. drying techniques) to improve the quality and usefulness of all sawn species**.**
- Now is the time for the government to **be bold**.

VALUE - SOCIAL AND CULTURAL

HEALTH

- Spending time in forests is associated with **lowered blood pressure, cortisol and heart rate**, amongst other benefits.
- **Forest therapy walks** are increasing popular and in California are considered medical prescriptions.
- Spending time outdoors is beneficial for **mental health**.

MISC.

- Determining the value of the services derived from old-growth forests is generally far more difficult than measuring the value of the commodity goods, such as logs and lumber, derived from these forests.
- The increased environmental quality of life afforded by protected old-growth forests and protected areas in general **attracts skilled labour** in the high-tech sector to live in adjacent cities and communities.
- Even if the BC government could perfectly replace these forests (which is incredibly unlikely) something of value would still have been lost. Old-growth trees are impressive in that they're tied to the context of their creation - that being centuries of work. They are **part of BC's history**.
- Old growth forests are **beautiful** and provoke a **sense of awe** in those who are in their presence.
- **Forest schools** are increasing making an appearance in modern school curriculum.
- Old-growth forests can serve as **"living laboratories"**, where students, scientists, and the public can learn more about forest development, tree genetics and climate change.
- Harvesting and processing old growth **supports charities and causes in BC communities.**
- Old growth jobs **allow people to work where they live** and be part of the local community.
- Several countries have granted **rights and legal standing** to nature.
- Old-growth forests have **heritage value** and potentially world heritage value.
- There has been a strong growth in the existing Burial Industry to create areas of regular cemeteries for **'green' burial plots**. Forests of old growth would be a natural extension for this new market.
- Old-growth forests provide r**ecreation, medicinal products, botanical products, spirituality and sustenance**.
- Protecting old-growth forests is a major **net benefit to the economy** relative to forestry – in real estate, tourism, recreation, angling/fisheries, carbon offsets, non-timber forest products, and attracting skilled labour/tech workers.

RECOMMENDATIONS

- Recognize the **cultural value of conserved old growth**.

ADDITIONAL COMMENTS

- Old-growth forests provide **recreation, medicinal products, botanical products, spirituality and sustenance**.
- The true value of a healthy old-growth forest ecosystem simply **cannot be measured in board-feet**.
- There are relationships between the forest sector and backcountry tourism for skiers, mountain bikers and hikers who gain **access to the forest on forest-industry service roads**. None of this would exist if not for a forest resource sector that includes harvesting some old-growth timber.

- I want my **great, great grandchildren** to be able to walk in untouched forests like I have and marvel at things older than they are, that were ancient when Captain Vancouver sailed past. It's humbling and in a time of climate upheaval not only provides the environmental benefits that forests do but can help make us feel that the Earth can rise above the challenges of hosting humans.
- We value old-growth forests for their **intrinsic beauty.**
- Now that I work as a teacher in public schools in the Kootenays, I deeply understand the **value of the natural world** to the physical, mental, and emotional health of both children and adults alike.
- Our old growth forests are comparable in beauty and majesty to California's Redwood forests, but for some inexplicable reason, the government does not seem to place any long-term value on this globally unique and irreplaceable asset.
- All living things are **intrinsically valuable**. Old growth trees are living things. Instrinsically valuable things should be preserved from destruction. Therefore, old growth trees should be preserved from destruction.
- Many people consider these last remaining stands of pristine old growth to be their temple, it is time we start to **protect these areas with intention**, the same as how we protect our man-made heritage sites.
- Two different people from two completely different walks of life could value the same old-growth forest for two totally different reasons. In an organized society, this places tremendous **responsibility on the government to ensure these values are fairly balanced**. All the controversy, all the tension in BC's forests, both now and over the decades, boils down to the loss of balance between these competing values. In short, the timber and fibre value of old-growth forests has been placed above all other values, over the vast majority of the land base, with only a few exceptions.
- It can be argued that **a healthy Forest Ecosystem is similar to healthy Village / Community**. The age classes given for the Trees / Forest can parallel Humans / Villagers: seedlings / child; immature forest / teens / young adults; harvestable trees / working parents; mature trees / seniors, old growth trees / grand parents. If the comparison between a Forest Community and a Human Community holds even some positive merit, then ensuring the continued life of all age groups up to and including Mature / Old Growth trees must be kept as part of the Forest Village, just the same as human Parents, Seniors and Grand Parents are valued?

INDEX (WRITTEN SUBMISSIONS)

Recognizing that there will be interest in reviewing the original written submissions we received, below we have identified which submissions focused on the themes we identified. The numbers below refer to the written submissions, which are numbered and available on the Province's Old Growth Strategic Review website. We acknowledge that the index provided below does not identify every single submission that may have made a reference to a certain theme.

Biodiversity / Habitat / Ecosystems

4, 8, 9, 13, 23, 29, 30, 33, 48, 56, 61, 65, 68, 73, 75, 81, 84, 86, 87, 90, 97, 105, 108, 109, 112, 114, 121, 132, 150, 159, 162, 171, 173, 189, 191, 197, 209, 219, 220, 230, 232, 234, 261, 275, 289, 293, 298, 301, 303

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Forest Industry Practices

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Forest Management – Recommendations

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Indigenous Issues

11, 20, 21, 23, 29, 50, 59, 69, 77, 81, 100, 105, 116, 131, 144, 165, 180, 189, 197, 213, 232, 251, 272, 275, 290, 300, 304, 306

Protection – More needed

4, 9, 11, 12, 13, 14, 16, 19, 29, 33, 34, 37, 38, 55, 59, 60, 61, 65, 67, 74, 75, 76, 77, 82, 85, 87, 90, 91, 92, 95, 105, 115, 116, 117, 120, 127, 129, 139,144, 148, 157, 158, 160, 163, 165, 169, 171, 174, 176, 178, 181, 193, 196, 204, 206, 211, 218, 219, 221, 224, 227, 230, 234, 235, 236, 237, 239, 256, 261, 262, 266, 269, 272, 281, 283, 292, 300, 302

Protection – No more needed

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Value – Economic (Non-timber)

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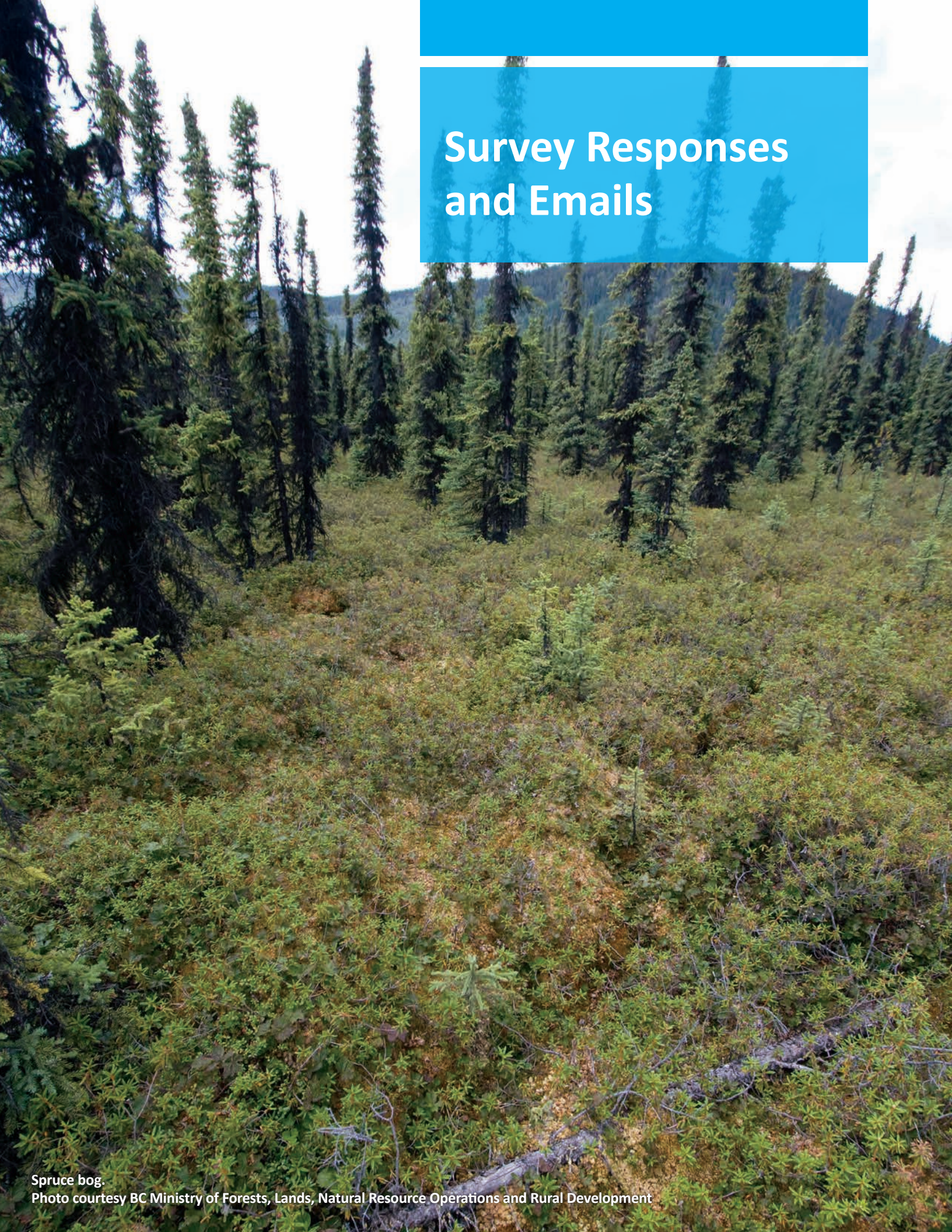
Value – Economic (Timber)

2, 11, 22, 24, 27, 28, 29, 31, 36, 46, 51, 53, 59, 62, 63, 70, 72, 78, 83, 84, 85, 89, 99, 102, 113, 115, 119, 126, 130, 133, 137, 151, 152, 153, 154, 172, 170, 171, 177, 180, 182, 188, 194, 199, 201, 202, 203, 208, 212, 214, 216, 222, 228, 229, 231, 232, 244, 253, 256, 259, 260, 268, 273, 276, 278, 280, 282, 284, 285, 287, 288, 294, 296, 297, 298, 299, 300

Value – Social and Cultural

6, 21, 23, 25, 26, 29, 70, 87, 100, 104, 105, 112, 114, 129, 178, 187, 195, 197, 206, 210, 228, 230, 232, 248, 252, 269, 270, 278, 285, 300, 304

Survey Responses and Emails



Spruce bog.
Photo courtesy BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Old Growth Strategic Review

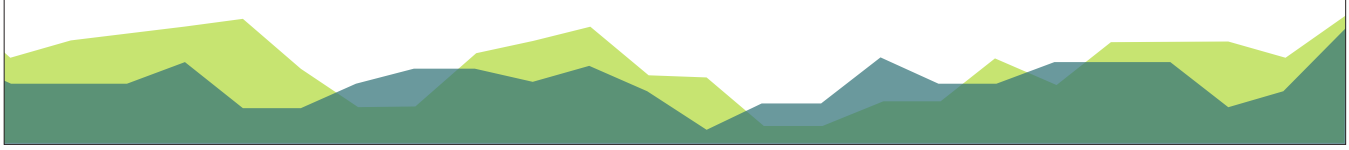
Summary of Public and Stakeholder Input

Prepared for the Old Growth Strategic Review Panel

Province of British Columbia

Final Version

April 2, 2020



1. Executive Summary

Background

In July 2019, the Government of British Columbia (Government) initiated a review of old growth forest management policies and practices in B.C. To undertake this review, Government appointed a two-person panel to engage with Indigenous Peoples, professionals and experts, members of the public, and other stakeholders to gather information and perceptions on existing old growth management practices and to inform subsequent plans on how old growth forests should be managed now and into the future.

Methodology

To gather input, the panel used several methods through which interested parties could provide their perspectives on old growth management. These included an online questionnaire, formal written submissions, an electronic mailbox, as well as opportunities to speak with the panel members face-to-face.

This report summarizes the key comments and themes identified through response to the online questionnaire and through the electronic mailbox, of which there were **18,523** responses to the online questionnaire and **9,000** emails received through the electronic mailbox.

The panel also received **387** formal written submissions from a variety of individuals and organizations. While not included in this summary report, each of these written submissions have been individually reviewed by the panel and those that meet the criteria for posting will be made available to the public.

What we Heard

While respondents included in this report generally agreed that there needs to be some balance of old growth values (environmental, economic, and social and cultural) present in old growth management plans, the dominant theme identified was for the protection and preservation of old growth forests in B.C.

Many respondents did recognize B.C.'s reliance on forestry as a key driver of our provincial economy, as well as the dominant sector in many rural communities across the province, and provided suggestions that called for Government intervention to transition the forestry industry away from old growth harvesting.

2. Introduction

The definition of Old Growth forests, and the tools and practices used to manage them, have been heavily debated in British Columbia for over two decades. The public debate on old growth management stem from the need to balance the broad range of values that old growth represents – the economic benefits derived from harvesting and employment in forestry; the ecological and environmental benefits provided by these forests; and, the social and cultural importance both to Indigenous Peoples and as symbols of the province's natural heritage.

Using Government's current definition for old growth, which is based on the age of trees, biogeoclimatic zones, and the frequency of natural disturbances, old growth forests comprise approximately 13.2 million hectares, or 23% of the forested land base in B.C[1].

Given the geographic prevalence of old growth forests and the public's interest, Government is looking to develop an updated approach to old growth management to balance stakeholders' interests and values surrounding old growth forests and to ensure long-term benefits are realized for future generations.

3. Methodology

To address this complex issue, in July 2019, the Government of British Columbia appointed a two-person panel to lead a strategic review of old growth management practices in B.C. As part of this process, the panel sought to gather information and perspectives on old growth and old growth management, and to report back to Government in the spring of 2020 with recommendations that will inform the Province's approach to old growth management.

To collect thoughts on old growth from a broad range of stakeholders, the panel offered four methods to participate in the review:

Forum	Target Stakeholder	Reflected in this Report
Online questionnaire	Public and interested parties	✓
Formal written submissions	Individuals, organizations and professionals	✗
Electronic mailbox	Public and interested parties	✓
Meet with the panel	Organizations, professionals, and interested parties in impacted communities throughout the province	✗

Insights collected as part of the meetings with the panel and the formal written submissions are not reflected in this report but will be used to inform the panel's recommendations to Government. Formal written submissions that meet the criteria[2] for posting will be made available to the public.

The public and stakeholder engagement began October 6, 2019 and concluded on January 31, 2020.

[1] BC Government's Old Growth Strategic Review site: https://engage.gov.bc.ca/oldgrowth/

[2] Those providing written submissions were asked to reference any organization that they were affiliated with and to indicate their place of residence in British Columbia. Parties submitting formal written submissions were informed that their submission may be posted and could become part of the summary report for this engagement. To be considered for public posting, submissions had to meet the criteria as stated at the following site: https://engage.gov.bc.ca/oldgrowth/guidelines-for-formal-submissions/

The information in this report will be used to inform the Old Growth Strategic Review Panel's recommendations to Government in the spring of 2020.

4. What We Heard

a. What we Heard Overview and Key Considerations

Of the two forums included in this report, the panel received the following number of responses from interested parties:

- **18,523**[3] responses to the online questionnaire
- **9,000** emails to the electronic mailbox

The engagement process revealed polarized positions on the underlying philosophy for old growth management in B.C. A large proportion of those that provided input were recommending reforms to policies and practices that would protect all old growth in the province, while the opposing position was to continue practicing sustainable logging practices that would ensure the province can continue to benefit economically from harvesting old growth.

Regardless of philosophy on old growth management, two overarching themes emerged across both the methods for stakeholder input described in this report –

1. **Act Now:** A call to action to Government to modernize its old growth strategy immediately
2. **Think Long-Term:** Ensure that the renewed old growth strategy considers the long-term effects on future generations

In addition to the overarching themes, many respondents highlighted the need for some modicum of old growth preservation or protection:

- In *Question 1*, "what does old growth mean to you", **6%** of respondents felt that **government must take necessary action to protect old growth**
- In *Question 6*, respondents (**25%**) thought the **preservation of old growth should be a key consideration** when developing plans, policies, and practices to manage old growth forests B.C.
- In *Question 9*, the most common recommendation from respondents (**38%**) was to **protect all of the old growth trees remaining in the province**

Feedback from respondents was both comprehensive and varied in terms of preservation and protection strategies; i.e., in defining the objectives for preservation, the construct and use of spatially-defined protection areas, developing protection targets and methodologies by region, and establishing a future-state assessment on the effectiveness of implemented old growth strategies.

[3] There were 18,532 total submissions to the online questionnaire. Nine of these submissions were considered invalid due to null responses being provided on every question and time to completion being under 20 seconds. These nine submissions have been removed from the findings.

b. Online Questionnaire Feedback

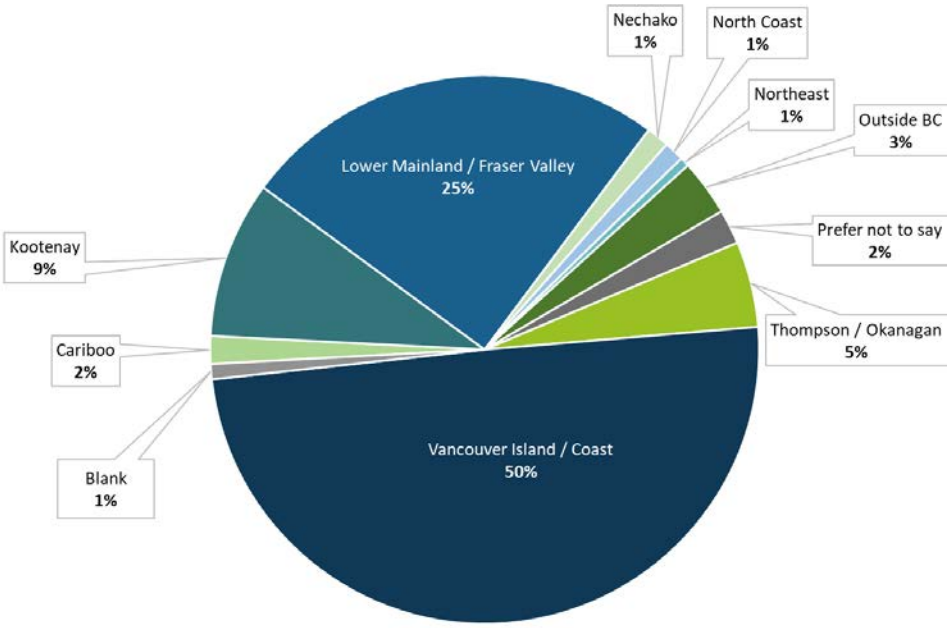
i. Survey Respondents Overview (Questions 10-13 Response Summary)

The online questionnaire was open between October 23, 2019 and January 31, 2020 and received a total of **18,523** responses.

The identified demographics of the respondents were as follows:

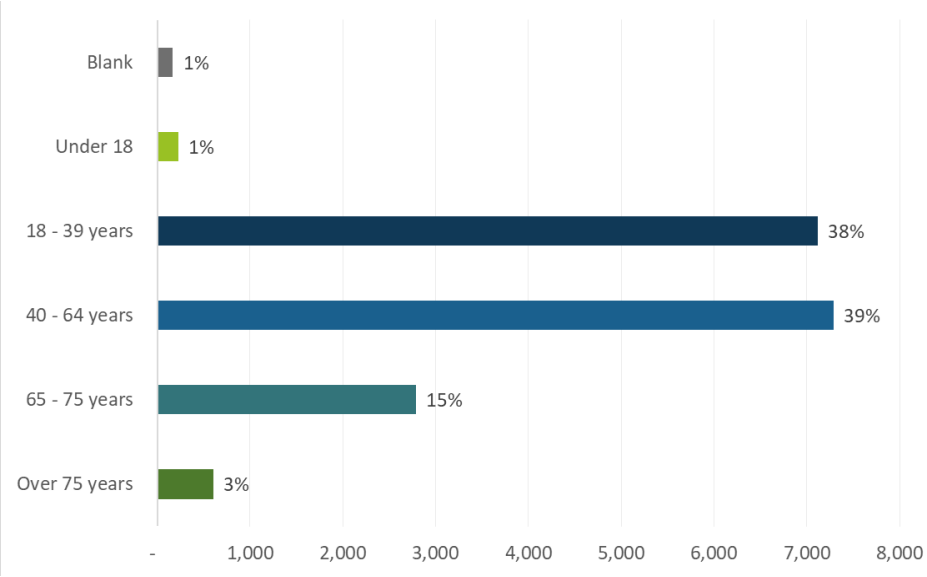
*In what **region of B.C.** or area do you live?*

Half (**50%**) of respondents live in the Vancouver Island / Coast region of B.C., with another 25% of respondents residing in the Lower Mainland / Fraser Valley.



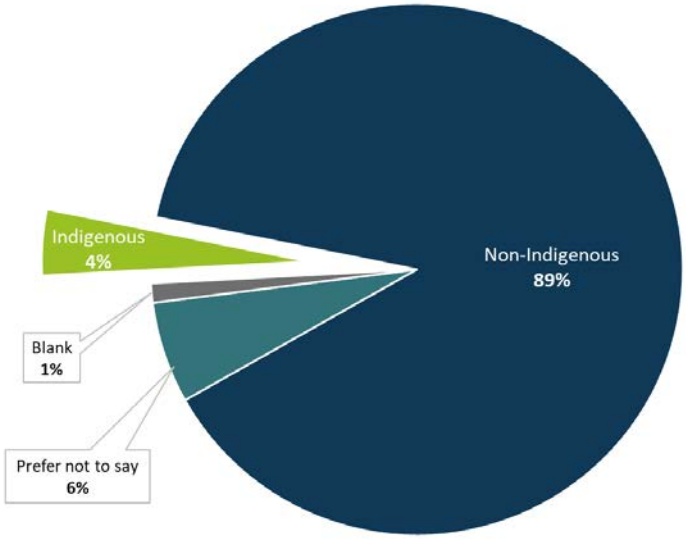
*Which **age category** do you belong to?*

The majority of respondents (**78%**) are between 18-64 years.



Do you identify as an **Indigenous person**?

Only **4%** of respondents self-identified as being Indigenous.



In what **sector** are you employed or involved in?

Primary sector of employment	Percentage of respondents
Education	12%
Health	11%
Forestry	10%
Retired or Unemployed	8%
Prefer not to say	6%
Arts	5%
Consulting	5%
Construction	4%
Retail or Customer Service	4%
Tourism	4%
Social Services	3%
Professional, scientific, and technical services	3%
All other sectors	24%

ii. Question 1: What does the term "old growth" mean to you?

Consistent themes emerged across respondents in their descriptions of old growth and the terms they used to describe the importance of old growth in B.C.

Old Growth Is…

Type of Response	Comment Theme	Comment Description
Unique Characteristics of Old Growth	Untouched	Trees that are original and untouched by human interference or industrial activity
	Rare & Irreplaceable	Rare forests that cannot be replaced
	Conserves Biodiversity and Ecosystems	Forests that conserve the biodiversity necessary to support complex ecosystems
Reflection of Values	Environmental	A habitat for many species and wildlife and a vital resource in fighting climate change through carbon sequestration
	Social	A reflection of our natural heritage and an essential part to preserving Indigenous culture and values
	Economic	High value lumber that is foundational to our provincial economy and provides meaningful employment in local communities
Maturity and Age of Trees	Old	Mature and ancient forests and trees, often large in size
	> 140 years	Trees that are older than 140 years in the interior of BC
	> 250 years	Trees that are older than 250 years in the Vancouver Island / Coast region

iii. Question 2: What are the top three reasons you feel old growth forests are important?

Based on **18,523 responses**, respondents felt that the top three reasons that old growth forests are important:

Old Growth forests are important because…	Percentage of respondents
They support biodiversity	**76%**
They provide a habitat for wildlife and fish	**53%**
They store carbon to mitigate climate change	**48%**
They regulate water storage and flow	**37%**
They contain big or rare trees	**32%**
They support traditional spiritual and cultural uses	**21%**
They generate tourism and can be used for recreation	**13%**
They provide economic benefits from timber harvesting	**7%**
Other	**6%**

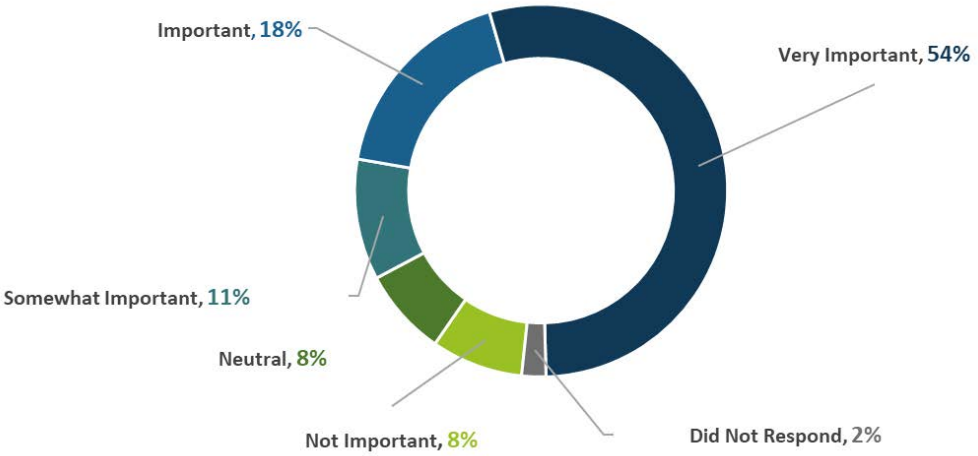
"Other" – Top Comment Themes

Based on **1,109 respondents** that selected "Other":

Comment Summary	Percentage of Comments
They are an essential part of functioning and diverse ecosystems	**25%**
They are a reminder of our heritage and are irreplaceable	**23%**
They are important for all of the reasons mentioned above	**19%**

iv. *Question 3: How important is it to weigh environmental, social, cultural, and economic interests together when managing old growth?*

72% of respondents think weighing environmental, social, cultural and economic interests together are **important** (18%) or **very important** (54%) when managing old growth.



v. Question 4: What do you consider to be the THREE greatest risk(s) to old growth?

Based on **18,523 responses**, respondents felt that the top three greatest risks to old growth are:

Old Growth forests are at risk because…	Percentage of respondents
Logging	**89%**
Urban development	**54%**
Other industrial activity	**49%**
Climate change	**40%**
Wildfire	**27%**
Other	**11%**
Unsure	**8%**
Not replanting fast enough	**7%**
None of the above	**1%**

→ **"Other" – Top Comment Themes**

Based on **2,106 respondents** that selected "Other":

Comment Summary	Percentage of Comments
Economic Interests and Development	**24%**
Inadequate Legislation and Government Policies	**19%**
Unsustainable Logging	**17%**

vi. Question 5: How important do you feel the following plans, policies and practices are in MANAGING old growth in British Columbia?

94% of respondents felt that **provincial parks protecting old growth** are important or very important in managing old growth

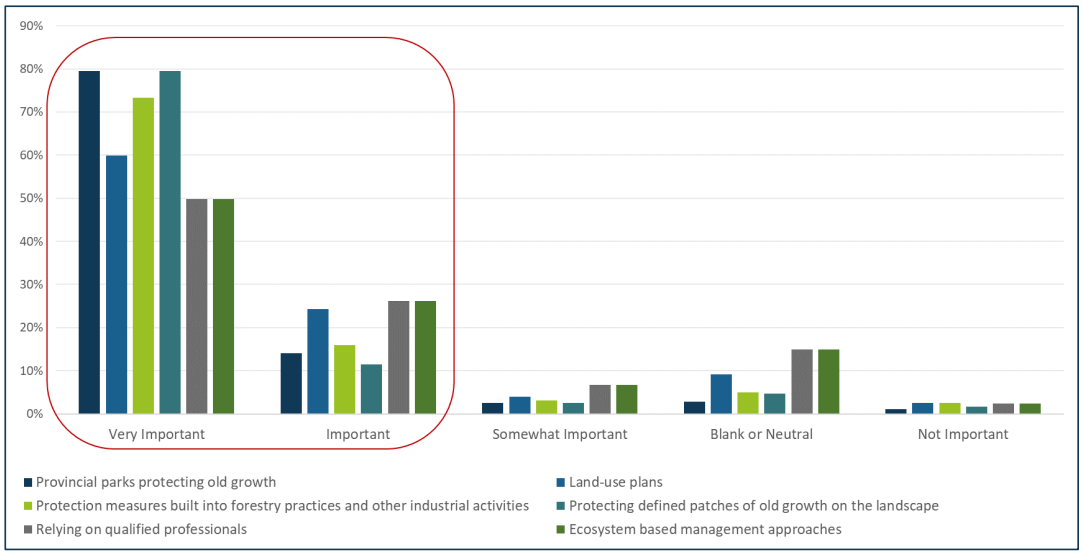
91% of respondents felt that **protecting defined patches of old growth on the landscape** is important or very important in managing old growth

89% of respondents felt that **protection measures built into forestry practices and other industrial activities** are important or very important in managing old growth

89% of respondents felt that **ecosystem-based management approaches** are important or very important in managing old growth

84% of respondents felt that **land-use plans** are important or very important in managing old growth

76% of respondents felt that **relying on qualified professionals** is important or very important in managing old growth



vii. Question 6: Are there any other plans, policies or practices you feel are important but that are not mentioned here? Please provide any thoughts.

Of the **18,523 total responses** to the online questionnaire, just under half of the respondents (**47%**) responded to Question 6. The tables below reflect the comments received from these **8,774** respondents, noting that most responses corresponded to multiple themes.

GOVERNANCE & PLAN DEVELOPMENT

Comment Theme	Comment Summary	Percentage of Comments
Preservation	Principles of preservation and protection for the benefit of future generations must be applied first in developing plans to manage old growth forests	**25%**
Climate and Ecosystem Implications	Old growth management plans need to consider the implications to climate change and other ecosystems (e.g., other species, wildlife)	**24%**
Indigenous Co-Management	Co-manage old growth forests with local First Nations, or at minimum, include indigenous perspectives and practices into old growth management	**17%**
Independent Oversight	Establish independent oversight and leverage the expertise of independent scientists and ecologists to inform policy development	**15%**
Other Industries	There needs to be broader consideration for other industries (e.g., recreation/parks, tourism) when developing policies and plans for old growth forests	**5%**
Local Communities	Integrate communities and local governments in decision-making on the preservation of old growth	**3%**
Public Engagement	Engage in more public consultation to inform old growth management plans	**1%**

POLICIES

Comment Theme	Comment Summary	Percentage of Comments
Legislation & Licensing	Make necessary changes to legislation, policy and licensing that protect old growth on both Crown and private lands	**12%**
Spatial Management	More robust land-use planning and stricter management of spatially defined old growth areas, with large buffer zones around protected forests	**8%**
Penalties	Implementation of severe financial penalties for logging old growth and more rigorous enforcement of existing legislation	**5%**
Exports	Reduce timber-related exports and ban the export of raw logs overseas	**4%**
Education	Educate the public on old growth management practices and policies	**3%**

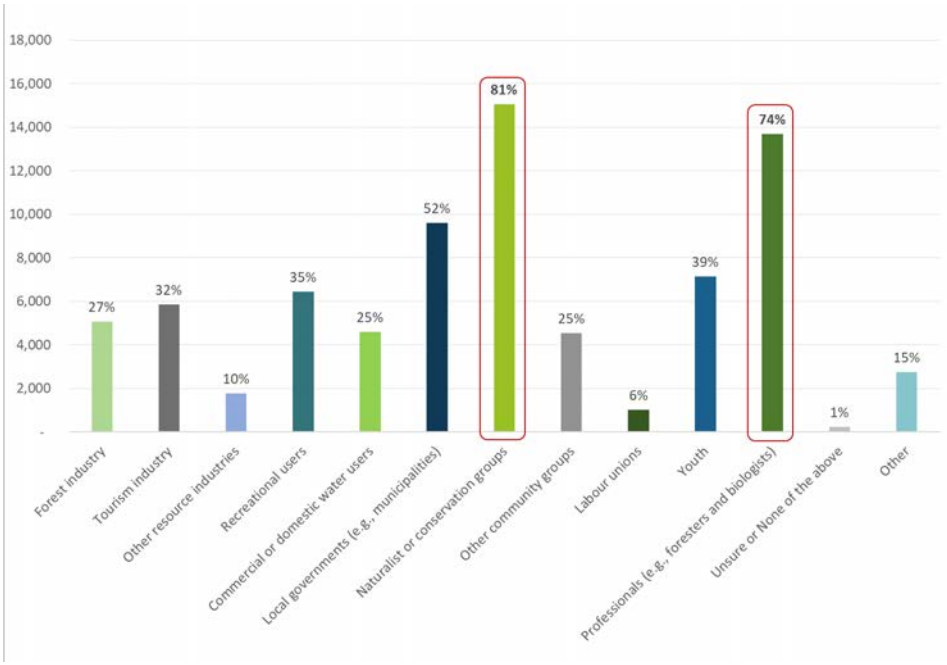
Comment Theme	Comment Summary	Percentage of Comments
Classification	Clearly define, classify, and inventory all old growth in BC	**2%**
Reform	Logging industry reform, retraining and transitioning of forestry workers	**1%**
Incentives	Offer incentives or subsidies to logging companies to stop the harvesting of old growth	**1%**

PRACTICES

Comment Theme	Comment Summary	Percentage of Comments
Moratorium	Impose a moratorium on old growth logging	**24%**
Selective Logging	Engage in sustainable logging practices, which may include some strategic and necessary logging of old growth	**13%**
Unsustainable Logging Practices	Stop engaging in logging practices that are destructive to the environment; e.g., not recycling wood, using pesticides, creating logging roads, and abandoning logging by-products and debris	**3%**
Management of Natural Causes	Establish conservation practices targeting wildfire, disease, and pest management	**2%**

viii. *Question 7: Other than the provincial government and First Nations, who do you feel should be actively involved with decision making about the future of old growth forests in British Columbia?*

Most respondents (**81%**) agreed that **naturalist or conservation groups** should be actively involved in decision-making about the future of old growth forests in B.C.; similarly, **74%** of respondents thought that **professionals (e.g., foresters and biologists)** should also be actively involved in future decision-making on old growth management.



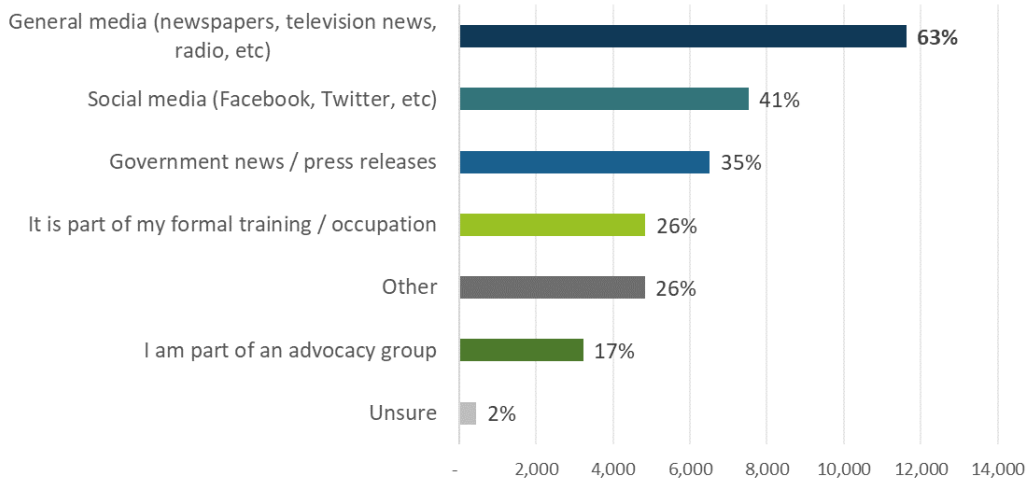
"**Other" – Top Comment Themes**

Based on **2,742 respondents** that selected "Other":

Comment Summary	Percentage of Comments
Independent Scientists / Specialists	**29%**
General public	**17%**
First Nations and local communities	**11%**

ix. Question 8: Where do you learn about old growth forests and their management?

Nearly two-thirds (**63%**) of respondents have learned about old growth forests and their management, at least in part, from **general media (newspapers, television, news, radio, etc.)**



"**Other" – Top Comment Themes**

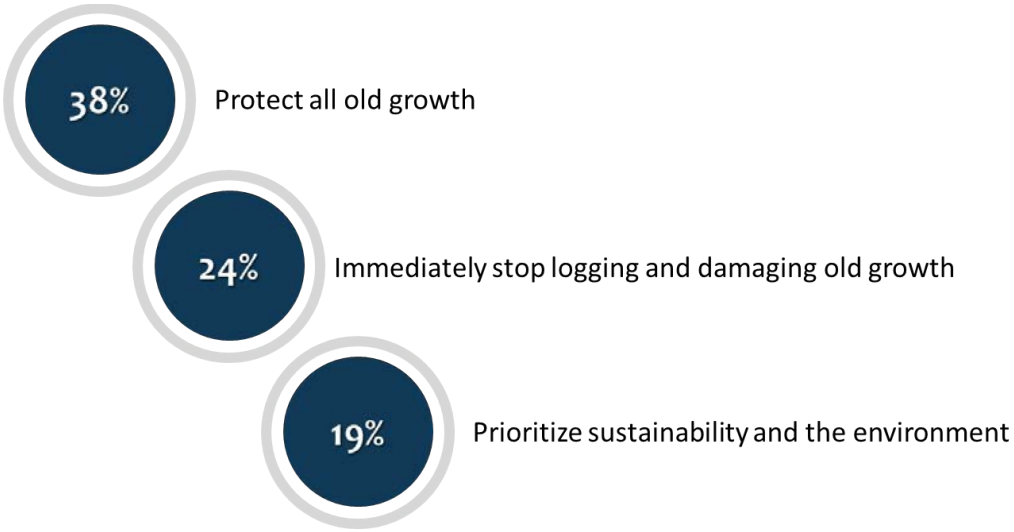
Based on **4,826 respondents** that selected "Other":

Comment Summary	Percentage of Comments
Personal interest and research (internet, journals, etc.)	**30%**
Direct and close observation (recreation, outdoor activities, etc.)	**24%**
Word of mouth (social or professional networks)	**19%**

x. Question 9: Do you have any further thoughts about old growth management in B.C.?

Of the **18,523 total responses** to the online questionnaire, over half of the respondents (**60%**) responded to Question 9. The tables below reflect the comments received from these **11,209** respondents.

TOP 3 RECOMMENDATIONS (by percentage of responses)



c. Email Submissions

In total, the panel received **over 9,000 emails** from organizations, professionals, Indigenous Peoples, members of the public, and other interested stakeholders.

Many of the themes identified upon review of the email submissions were aligned with those present in the responses to the online questionnaire. In general, the submissions discussed a range of topics from environmental issues and the impacts of old growth forests on mitigating climate change, to the economic benefits of harvesting old growth on local economies and businesses, to the important social and cultural values that old growth holds for current and future generations of people in B.C.

Due to the volume of submissions, this section is only intended to present a high-level summary of the themes that emerged from the 9,000 emails and is not intended to comprehensively reflect all the nuances of individual submissions and topic areas.

i. Primary Themes

From an **environmental perspective**, respondents spoke to both the need for old growth in terms of maintaining rare and threatened species and wildlife and longevity of biodiversity and ecosystems, as well as the benefits of carbon sequestration provided by old growth forests, particularly in the context of our climate change emergency. Many of the submissions that focused on the environmental benefits recommended that Government implement an immediate moratorium on harvesting old growth.

From an **economic perspective**, respondents highlighted the dependence of B.C.'s economy on forestry, which includes the high-value timber resulting from the logging of old growth, in addition to the potential devastating impacts to resource-based communities if old growth logging were to stop. Stakeholders also flagged the steady increase in second growth harvesting over the past several decades and recommended a continued strategic transition from old growth. Many of the submissions that focused on the economic benefits recommended that Government continue to support the sustainable harvesting of old growth.

In addition to the economic benefits that are generated from logging and sales of old growth timber, some respondents also identified the economic value that could be derived from protecting old growth, specifically the value-add of eco-tourism to the province's economy.

From a **social and cultural perspective**, respondents identified that old growth trees hold significant cultural value to the Indigenous Peoples of this province, in addition to providing myriad social benefits for citizens, and visitors alike. Respondents emphasized that B.C. is a world-renowned destination for eco-tourists wanting to spend time amongst ancient trees, with some submissions calling for old growth forests to be designated UNESCO-heritage sites.

ii. Suggestions for Old Growth Management

In addition to the above themes surrounding old growth values, many respondents made the following suggestions for consideration:

1. **Changes in Governance**
    - There is a need for independent oversight of old growth management plans in B.C., with more direct intervention provided by the provincial government

- Old growth management plans should be developed in consultation with Indigenous Peoples and old growth forests need to be co-managed with the First Nations upon whose traditional territories the forests are situated

2. Amending Legislation & Land Rights

- Legislation should be amended to enable stricter protections of old growth forests (consistent with suggestion #1 above), with defined regulatory and enforcement practices and penalties
- Old growth management plans should extend beyond Crown Land – to enable this, Government should consider investing in the acquisition of private lands that contain old growth forests

3. Transitioning the Sector

- Strategies should be developed that support the transition of forestry-dependent communities away from harvesting old growth; some strategies included focusing exclusively on second and third growth forests, identifying opportunities to generate more value out of our forest resources, or converting the industry to alternative resources, such as hemp or bamboo, for the creation of paper and other similar products
- Government should consider making investments towards retraining forestry workers impacted by changes to old growth management in B.C.

Technical and Scientific Briefings

Spruce–Lady fern-Oak fern ecosystem. Photo courtesy Deb MacKillop.

Old-Growth Forests: An International Comparison of Management Strategies

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Contents

Summary

In this report, we present a comparative analysis of old-growth forest management strategies in British Columbia, Alaska, US Pacific Northwest, Nova Scotia and New Brunswick, UK, Australia and Sweden. British Columbia has integrated Forest Stewardship Plans that in theory promote the retention of old-growth forests as legally enforceable tools for licensees in Old Growth Management Areas. Elsewhere, the old-growth forest restoration strategy designed to produce ecological and economic benefits on federal forests in the Pacific Northwest consists of reserving older forest stands, thinning plantations to accelerate development of structural complexity, and implementing variable retention harvests in younger forests to help provide diverse early seral ecosystems. In Alaska, all of the federally-owned forest and some of the State forest in the Southeast and Southcentral regions are effectively protected from management activities due to being located entirely within one or a combination of protected areas. However, forests outside these protected areas are subject to logging activities. In New Brunswick and Nova Scotia, the old-growth conservation targets are up to 8% on Crown land, but neither have a regulatory framework nor have evidence of achieving these targets. In Nova Scotia there is a strong old-forest policy underpinned by a quantitative scoresheet, coordinator, and database. In Australia, the level of protection in Regional Forest Agreements regions is very high by world standards. The 'JANIS' criteria set out targets for the conservation of ecosystems with 60% of the existing old-growth forest and 100% of remaining occurrences of rare and endangered forest ecosystems including rare old growth. In New Zealand, a decision was made in the late 1990s to exit harvesting of natural forests and rely almost completely on plantation forests. In the UK, there is a significant focus on the restoration of native woodland on ancient woodland sites through government funding. In Sweden, a few large forest companies own a significant proportion of the forest land and have been at the centre of public debate due to de-registering known woodland key habitats. However, attempts are being made to improve conservation measures in forests, particularly as they relate to biodiversity.

Public perceptions of old growth have varied over time, and cannot be generalized globally. Some countries, particularly in Europe, lost all their old growth, but never-the-less have very old forests and woodlands that have been, and continue to be, culturally modified. In areas where natural forest remains, it tends to be low productivity and remote old growth that is protected. The emphasis is now on the restoration of characteristics associated with old growth forests, including some of the fauna. In areas such as North America and Australia, where logging of primary forest is still taking place, there is a greater focus on conserving remaining areas of old growth forest. Taking total percentages of protected old growth in particular jurisdictions does not meet conservation needs, as certain types of old growth have been targeted by past logging operations. In particular, high productivity valley-bottom sites have been harvested much more intensely than low productivity and remoter sites. The 'JANIS' criteria adopted in Australia provides a suitable means to identify and protect old growth across a range of different forest types.

Several jurisdictions have tried to determine the extent of their remaining old growth, and then monitor trends in both its condition and its abundance. A variety of factors can result in the loss of old growth, and old growth can also be recruited as stands develop the required characteristics. Recruitment is very much dependent on the criteria used to define old growth. It it is only based on age, and the age threshold is relatively young, then more recruitment is likely to be recorded.

Keywords: Old-Growth Forests; Ancient Woodlands; Primary Forests; Old-Growth Management Strategies

1 Introduction

In recent years there has been considerable debate over the management of 'old-growth' forests in British Columbia and elsewhere, although there is no universal definition that could readily be used to physically delineate such forests. Old-growth forests in North America have declined significantly since European colonization as trees were cut for timber and forests were burned for agricultural and settlement purposes (Leverett 1996). Over the past few decades, a number of public protests have occurred due to conflicting views over old-growth harvesting. The most noticeable was the Spotted Owl controversy in Washington and Oregon which pitted timber interests against those in favour of protected areas for the endangered Spotted Owl (Yaffee 1994) and the protests in Clayoquot Sound, British Columbia (Berman 1994).

One of the difficulties in managing and conserving old-growth forests is defining them in a scientifically meaningful yet operational and policy-relevant manner (Mosseler *et al*. 2003). As Wirth *et al*. (2009c, p. 11) state, "it is probably a futile task to aim at providing a concise scientific definition of old-growth forest that encompasses the full spectrum of successional and structural options".

Recent results from research on old-growth forests in eastern Canada suggest that as tree populations age they tend to increase in genetic diversity and reproductive fitness, suggesting that old-growth forests may serve as natural reservoirs of genetic diversity and reproductive fitness for the constituent tree species. Old-growth conservation has become cross-sectoral issue with many interdisciplinary linkages that go well beyond the traditional areas of watershed (including water quality) and habitat protection and include emerging issues such as the conservation of genetic resources and carbon sequestration (Luyssaert *et al.* 2008). Old-growth forests also provide non-material values including sociocultural, economic, ethical, spiritual or aesthetic values that are often overlooked but have been subject to scholarly attention in recent years (Moyer *et al.* 2008; Berry *et al*. 2018). The range of values associate with old-growth forests demonstrate the need for old-growth forest conservation in British Columbia and elsewhere, in addition to the conservation of forests with the potential to develop into old-growth forests in the future. In this report, we conducted a comparative legislative and policy analysis to understand the differences and similarities in old-growth management strategies in selected jurisdictions. The findings of this report may support decision making in improving old-growth forest policy and legislation in British Columbia.

This report is structured as follows: In the first section we set the objectives of this research, followed by a methodological approach. In the third section, we summarize how old-growth forests have been defined in academic literature and shed light on the economic aspects of old-growth forest and the public opinion in the old-growth forests debate. In the fourth section we present old growth management strategies in British Columbia, Alaska, US Pacific Northwest, Nova Scotia and New Brunswick, UK, Australia, New Zealand and Sweden. A fifth section examines the some of the monitoring strategies that have been put in place to assess trends in old growth in particular jurisdictions. The final section presents our conclusions.

1.1 Research objectives

This research intends to provide an overview of old growth management strategies in selected jurisdictions around the world, including British Columbia, Alaska, US Pacific Northwest, UK, Australia, New Zealand and Sweden.

This review report aims to:

- Review and synthesize the knowledge surrounding the definition of old-growth forests
- Collate the information to assess the importance of old-growth forests in the light of its economic contribution and public opinion.
- Analyse the changes in perceptions about old-growth forests that led to their recognition and protection in certain jurisdictions
- Summarise the present state of knowledge concerning the management of old-growth forests in selected jurisdictions to inform future research and management strategy
- Determine how effective protection strategies have been over time.

2 Methods

The selected jurisdictions have existing old-growth forests although the proportion of old-growth forests significantly varies among jurisdictions. This sample was based on other key factors such as global and regional significance in terms of forest extent and forest trade. In addition to the forest extent and/or importance of the forest product sector, the environmental, social and economic contexts for forest policy and management in the selected jurisdiction are generally comparable to British Columbia. A review of literature was conducted using scientific literature, reports by government and non-governmental organizations and grey literature on topics related to old growth in British Columbia and other selected jurisdictions.

3.1 The evolving views of old-growth forests

Old-growth forests have no universal definition. Academic literature is divided on the issue of this lack of definition. Nevertheless, there is a consensus that only a small fraction of “it” is left. A range of terms such as over-mature, decadent, intact, primary, primeval, pristine, and virgin forests can be found in the literature, depending on the time period, discipline and scientific community (Wirth *et al*. 2009a). Yet the identification of old-growth forest and the development of management strategies to protect and sustain old-growth values are goals of many forest management agencies. Characteristic structural attributes of old stands include large, old trees, some of which are dying (leaving snags and creating canopy gaps) and falling (becoming logs) (Burton *et al*. 1999). In British Columbia, old-growth characteristics can include tree species, tree age, tree size, surrounding forest structure, ecological function, and historical disturbance.

Fig. 1. Old-growth temperate rainforest, Hoh Valley, Washington, USA.

Salwasser (2019) defined old-growth forest to be any tree-dominated ecosystem that has passed its early and middle developmental growth stage and is clearly in the later stages of its successional development. However, in many other studies, late-successional forests are separated from old-growth forests, although they may be treated together as late-successional – old-growth (LSOG) forests.

A generic definition of old-growth forest in current use by the U.S. Forest Service states that old-growth forests are "later stage(s) in forest development which may be distinctive in composition but are always distinctive in structure from earlier (young and mature) successional stages" (Moir 1992). Although structural and other features may help characterize old-growth forests, forest age is the essential feature. Old-growth has been defined by age by the B.C. government (B.C. Government 2003). B.C.'s coastal forests are considered old-growth if trees are more than 250 years old. In the Interior, where trees have a shorter life span and wildfires are more common, old-growth is defined as more than 120 years of age for forests dominated by lodgepole pine or broadleaf species, and more than 140 years for all other forests such as Engelmann spruce, white spruce and Interior Douglas-fir (BC Government 2010). In B.C., forests over 140 years old exist in all 16 biogeoclimatic zones and cover 22.6 million ha (41% of B.C.'s forests). Of this area, 7.1 million ha (13% of B.C.'s forests) are forests over 250 years old (SoF B.C. 2010). However, there is a fairly widespread view that old growth takes anything from 150 years to 400 years pr more to develop (Alaback 1982, Franklin *et al*. 2002, Spies 2004, Van Pelt 2008).

FSC Canada (2020 describes old growth as the oldest seral stage in which a plant community is capable of existing on a site, taking into account environmental factors and natural disturbance regime. Depending on the frequency and intensity of disturbances, and site conditions, old-growth forest will have different structures, species compositions, age distributions, and functional capacities than younger forests.

Fig. 2. Old-growth Douglas-fir and western redcedar, North Cascades, Washington, USA

Martin *et al*. (2018) studied structural diversity and dynamics of boreal old-growth forests in Eastern Canada and found that Boral stands can undergo numerous structural changes once the old-growth succession process in initiated. An increase in structural diversity when the true old-growth stage is reached, coupled with a variety of secondary disturbance characteristics, favour multiple pathways of structural evolution of these ecosystems over time. They argued that forest management planning should incorporate this complexity to improve the preservation of old-growth forests in managed territories.

In forest ecosystems, the old-growth stage can be defined as stands driven by gap-dynamics, with tree mortality caused by secondary disturbances (Wells *et al*. 1998). In the boreal biome, old-growth forests represent a significant proportion of the natural landscape, regardless of the differences in disturbance dynamic and species traits among the boreal regions.

Fig. 3. Old-growth forest in the Huon Valley, Tasmania. This cool temperate rainforest is dominated by myrtle (*Nothofagus cunninghamii*). The picture shows many of the characteristics that the general public associates with old growth: especially large, old trees.

The Canadian Forest Service organized a national symposium in 2001 to discuss the old-growth issue from a science perspective. The objectives were: (i) to bring together Canadian expertise on old-growth forests, (ii) to define old growth within the main forest regions of Canada, among others. There was a broad consensus among scientists that the difficulties in managing and conserving old-growth forests lie in defining them in a scientifically meaningful, yet in an operational and policy-relevant manner. This difficulty may be overcome by developing an "old-growth index" related to specific forest regions or forest types. Such an old-growth index would allow for the inclusion of specific attributes, composition, functions and processes seen as relevant to different ecological regions or specific forest types, and could serve as a basis for prioritizing local or regional conservation and management activities (Mosseler *et al*. 2003). Mosseler *et al*. (2003) identified three criteria for age structure:

1) uneven, multi-modal or inverse J-shaped age structure,
2) mean age of dominant species that approaches half the maximum longevity for the respective species, and
3) some old trees being close to their maximum longevity.

The adoption of the reverse J-shaped age structure, as this (applied to diameter distributions) has been used to inform selective harvesting managed under continuous cover regimes in some

central European forests for at least 150 years (e.g. Schütz 1997). In North America, the reverse-J size distribution has been associated with a complex, multi-layered forest typical of Old Growth conditions (Franklin and Van Pelt 2004),

Perhaps Lindenmayer (2009b) should have the last word on the issue of definitions: "a precise definition of old growth is ecologically meaningful only when it is applied to a specific vegetation type" (p. 357).

3.2 Economic contributions of old-growth forests

From 1990 to 2007, the U.S.A. harvested more trees than any other jurisdiction in the world, averaging 468 million m^3 of total wood removals. This figure fell substantially in 2008 when total wood removals dropped to 380 million m^3. The European Union steadily increased wood production, overtaking the U.S.A. in 2007 (Figure 4). Total wood removals in the European Union increased from 376 million m^3 in 1990 to 427 million m^3 in 2011. However, this masks considerable regional variation, with removals increasing in some countries and decreasing in others. B.C.'s forests contain approximately 11 billion m^3 of standing timber (PricewaterhouseCoopers 2017). Roundwood production volume held relatively steady from 1990 to 2007 at around 75 million m^3, with a sharp decline in 2009 (48.3 million m^3) due to the decline in the U.S. housing market. Production volume recovered significantly in 2011. British Columbia accounts for nearly half (42%) of Canada's industrial roundwood harvest, followed by Alberta and Quebec (SoF Canada 2017). Consequently, British Columbia accounts for the largest share (60%) of revenues from the sale of timber from Crown land (Statistics Canada 2018).

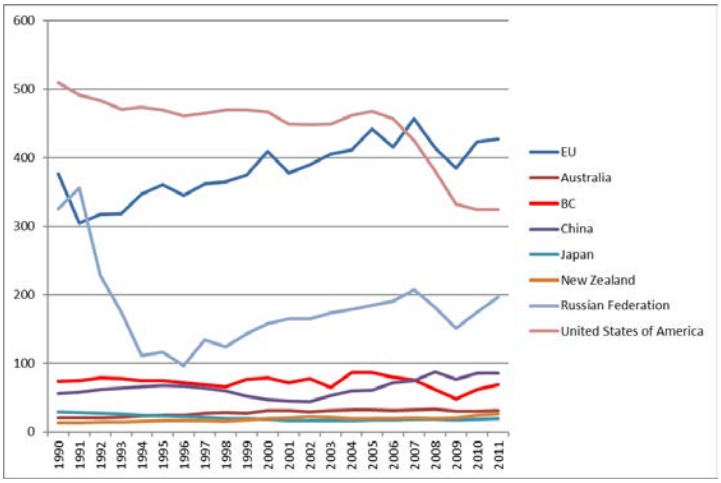

Figure 4. Total wood removals (million m^3 u.b.). FAO, 2015
u.b. denotes under bark

On B.C.'s Coast, old-growth forests that are older than 250 years comprise an important part of the forest economy and contribute about 50% of the timber harvesting land base. The production of specialty forestry products (such as cedar shakes and shingles) depends on timber from these unique forest types. Dependence on old-growth trees varies throughout the coastal region. Old-growth forests also have significant economic and cultural value, as a tourism and recreation resource. Old-growth forests in B.C. attract visitors from around the world. For example, Cathedral Grove (located in MacMillan Provincial Park) is one of the most accessible stands of old-growth Douglas fir trees on Vancouver Island.

British Columbia covers about 94.8 million hectares, while the forested land base covers about 57.2 million hectares. About 35% (20.3 million ha) of the forest area of BC is considered as the "timber harvesting land base" (THLB), where it is economically feasible to harvest. Based on the government's working definition, old-growth forests comprise about 23% of forested areas, or about 13.2 million hectares. Old Growth comprises 18% (3.6 million ha) of the THLB. Of the ca. 200,000 ha of forest harvested each year in BC, ca. 27% is in old growth. Mature forests, largely natural and generally greater than 140 years old on the Coast and greater than 80 years old in the Interior (but younger than old growth forests), comprise 26.1 million hectares, or about 46% of the forested area.

Old-growth trees are used to make lumber, wood pellets, pulp and paper, and many specialized forest products. Old-growth cedar trees are particularly valuable to certain sectors of the forest industry. For example, some shake and shingle manufacturers use old-growth cedar trees. Nine sawmills on Vancouver Island identify as "cedar only" mills. A reduction in the availability of cedar old growth could have a more significant economic impact on lumber and mill production than a reduction in the availability of non-cedar old-growth trees.

Fig. 5. Old-growth western redcedar is an extremely valuable resource, and a prized product on the B.C. costal forest industry.

Old-growth forests in this region can increase the supply of water in streams and aquifers. They also can improve the quality of the water and slow the runoff from storms, diminishing potential flood damage. An analysis of forest-practices rules proposed in Washington to protect and enhance salmon habitat found the probable benefits would be $9.1 – $13.3 billion, while the probable costs would be $7.5 – 8.5 billion (Perez 2001).

As fog filters through the old-growth forests of western Washington, Oregon, and northern California the trees often induce water vapour to condense and drop to the earth, increasing supplies of ground and surface water, especially during late summer when stream flows are low. Old-growth forests are especially productive because, compared to younger forests, they have more leaf area on which fog can condense (Franklin and Speis 1991).

Fig. 6. Coastal rainforest, Quinault Lake, Washington State, USA.

Englin and Mendelsohn (2001) investigated the relative value of different goods and services provided by federal lands in the Interior Columbia River Basin, between the Cascades and the Rockies. Even though they were unable to estimate values for many ecosystem services, such as providing high-quality water and habitat for at-risk species, they still determined that the federal lands' ability to produce services, such as recreational opportunities, has greater value than its ability to produce timber and other commodities.

3.3 Public opinion in the old-growth forests debate

Public participation theory suggests that involving citizens in decision-making creates a democratic skilled, literate, and empowered population which builds a credible political system and democratic nation (Fiorino 1990). Beyond democratic ideals, involving the public can create better decisions as local information and broader perspectives can lead to more effective problem solving (Isacson 1986). While the wide variety of old growth definitions are interesting to scientists and researchers, they tend to overwhelm the general public and further muddies the water of the public debate (Spies and Duncan 1993). In this section we make an attempt to establish how and why perceptions of old growth have changed over time.

The term 'old growth' raises many emotions, but are these universal, and has 'old growth' always been valued? First of all, despite the occasional book such as *Old-growth forests* (Wirth *et al*. 2009a), the term 'old growth' is essentially a North American one, based on North American views of forests in the region. There are words in European languages, such as *gammelskog* (Swedish) or *Urwald* (German), but these don't necessarily have the same meaning as 'old growth'. The term 'old growth' was developed to describe "tracts that have escaped obvious logging or modern forestry practices within the lifespan of the existing trees" (Rackham 2006, p. 103). The concept does not necessarily refer to virgin forests, since most North American forests were utilized to some extent by Indigenous peoples and, more recently, many have been subject to efforts to prevent wildfires, changing their composition and dynamics.

Wirth *et al*. (2009b, p. 11) provide an insightful introduction to a discussion on old-growth forest definitions and perceptions:

> "Many of us possess an archetype of old-growth forest appearance. We expect majestic trees, small pockets of regenerating trees thriving (*sic*) to meet the sun, heaps of dead wood covered with mosses, snags spangled with cavities and bracket fungi, and rare wildlife. However, thinking twice we may realise that this archetype (1) is not a scientific definition but merely a picture, and (2) is not generic but rather describes the late stage of succession in the temperate forest biome where the great majority of ecologists live and work".

Wirth *et al*. (2009b) point out that such a vision does not reflect the nature of old forests globally, nor does it even encompass all old forests within the temperate zone. This is the source of much conflict, with scientific definitions of old growth relying on mean stand age or the presence of particular structural characteristics, but the general public having an impression more akin to that expressed in the quotation above.

In their analysis of the definition and use of the term 'old growth', Wirth *et al*. (2009c) found that there was a massive increase in the number of publications looking at 'old' forests in the English-language scientific publications in the second half of the 20th century. The number increased from an average of 9 per decade between 1940 and 1960, to 46 per decade between 1970 and 1980 and to 2,089 per decade between 1995 and 2005. They interpret this as evidence of renewed interest in old-growth forests, as well as increasing awareness of the threats that they face. Of the 18 studies of older forests published before 1960, the term 'old growth' was used only once, with the most widely used term for older forests being 'virgin forests'. In the 1970s, the term increased in use, with 39% of publications referring to old growth. In contrast, 13% referred to primeval forests and only 9% to virgin forests. In the 1995-2005 period, 62% of publications dealing with older forests referred to old growth. They attribute this increase to a number of important publications defining old growth that occurred in this period (Wells *et al*. 1998, Kneeshaw and Burton 1998, Mosseler *et al*. 2003, Gratzer *et al*. 2004). It is notable that three of these were studies from Canada, including two specifically from British Columbia.

According to the study by Wirth *et al*. (2009c), the term 'old growth' also has a regional bias. Most (80%) publications from North America referred to older forests as 'old growth', as did authors from Scandinavia, Australia, New Zealand, Chile, Argentina and Japan. This may be because of the close relationship of many of these authors with scientists in the USA. European authors, with the exception of Scandinavia, did not use the term 'old growth', with the term 'primeval' generally being preferred. However, this likely reflects the fact 91 of the 135 eastern European studies related to one site, the Bialowieża Primeval Forest. There is very little forest left in western Europe that has not been subject to significant human disturbance, although where it does occur it is often celebrated (e.g. Kälin 1997).

How did concerns about old growth start? It seems that views about old growth are intricately connected to views about the need to conserve natural habitats. It is difficult to separate the issue of old growth from more general concerns about conservation, although old growth concerns seem much more recent. Some of the earliest worries about forest conservation were more about ensuring that sufficient land was left forested and available for timber harvesting, rather than being converted to agriculture. For example, the colony of New South Wales in what is now Australia started setting aside forest areas for timber production as early as 1871-1872, and by 1882, there were 160 such reserves (Cavanaugh 2010). These areas would later be designated as state forests, managed for both timber production and scenic values. National Parks set up at this time in Australia, Canada and the USA rarely, if ever, mentioned the need to conserve late successional and old growth forests.

It is impossible to generalize across all jurisdictions, and in the following account different regions have been examined separately.

British Columbia

British Columbia has seen major changes in the ways that its forests are viewed. As elsewhere, the debate is polarized and policy initiatives aimed at forest conservation have received significant criticism (e.g. Robinson 1995). Similarly, the logging industry has come under repeated attack (e.g. Swift, 1983). Several attempts have been made to document the rise of the forest conservation movement in British Columbia, notably the study by Wilson (1998). Like the protests at Terania Creek in New South Wales, Australia, British Columbia also had an event that changed the dynamics of the public appreciation of the province's forests: the demonstrations at Clayoquot Sound in 1993 (see, for example, MacIsaac and Champagne 1994). This was the largest of a number of blockades by First Nations and environmentalists that included Meares Island, the Stein, the Carmanah, and the Walbrand (Blomley 1996). It resulted in multiple arrests, and the ensuing media coverage drew world attention.

Wilson (1998) and Hayter (2000) have described how the environmental critique of forest practices emerged in the 1970s. They argue that environmentalism was initially based locally, and was primarily related to the fear that British Columbia might be running out of wood (e.g. Marchak 1983). Attention was drawn to the implications of the reliance on the harvesting of high-volume old-growth stands to the much lower volume second-growth stands growing in

their place. There was less concern expressed about the inferior quality of the second-growth, as provincial harvest calculations were based on volume.

Fig. 7. Old-growth forest on Meares Island, in Clayoquot Sound, British Columbia. This was the site of one of the early (1984) protests against old-growth logging in British Columbia.

Concerns about timber supply were added to by a prolonged economic crisis in the early 1980s. This forced many to think about the viability of alternatives to logging, especially tourism and recreation. Yet another line of pressure came from international organizations and their argument that biodiversity loss was a global crisis. The loss of rainforests was singled out for particular attention, especially by organizations such as Greenpeace Germany and a number of environmental groups and foundations in the USA. They were very concerned about the logging of old-growth rainforests, arguing that these would not be replaced once harvested.

The relatively sophisticated environmental lobby in BC was able to use alarming images of BC forest practices to its advantage, placing these in newspapers, magazines, television and the emerging internet, triggering media coverage that described Canada and particularly British Columbia as the 'Brazil of the North' or the 'Amazon of the North' (*Maclean's* 1991a, 1991b, McCrory 1993). The use of images of large-scale clearcuts was widespread (e.g. Devall 1993) and very effective, as few would contest the aesthetic appeal of an old-growth forest against an industrial clearcut. Pictures of a 140-hectare "clearcut" on Mount Paxton on northern Vancouver Island was featured in *National Geographic*, although the true and complex story

behind the removal of the forest at this site was not mentioned. The conservation efforts were largely concentrated in coastal British Columbia, with the importance of other old-growth forests, especially inland rainforest old growth, only being recognized later.

British Columbia has made some attempts to develop a more consensus-based approach than see in the USA, which has relied largely on the federal government and the courts (Hoberg 2000). One such attempt, established in late 1989, was the Old-Growth Strategy Committee. This Committee had a mandate to develop a strategy for the preservation of old growth. It made its recommendations directly to cabinet in 1992, and its mandate was later incorporated under the Protected Areas Strategy. Another was the Vancouver Island roundtable of the Commission on Resources and the Environment, which recommended additional protection to forest areas on Vancouver Island.

A major step forward was taken with the declaration of the Great Bear Rainforest, which resulted in the protection of a substantial proportion of the old-growth forests on the central coast of British Columbia. However, much of this area is relatively inaccessible to the majority of the public. Instead, they are more likely to encounter old growth in areas such as Vancouver Island. Here continued felling of old growth in areas such as the Nahmint Valley has caused outrage amongst environmental groups, especially as it appears from government documents that not all required practices were properly followed (Ancient Forest Alliance 2019, Lavoie 2019). Some public complaints about old-growth harvesting have been followed up by the BC Forest Practices Board (e.g. Forest Practices Board 2011), and the Board has made many recommendations made, including to the Old Growth Strategic Review.

Within British Columbia, the frequent exclusion of environmental groups from forest policy discussions has resulted in alternative approaches being adopted. In particular, they have cultivated a strong constituency in major urban centres, especially in the Lower Mainland and southern Vancouver Island. The fragmented nature of the environmental lobby in the province has resulted in numerous small-scale protests, although occasionally some have come together to mount advertising campaigns outside the Province. These have been countered by strong advertising campaigns by the Province of British Columbia, drawing attention to major improvements in forest practices and drawing attention to the extent to which old-growth forests, as defined by the Province, have been protected.

While much attention in the period 1970-2010 focused on coastal old-growth forests in British Columbia, there has been growing concern about the fate of inland old-growth forests, particularly in the “interior wet belt”. Information about these has grown rapidly over the past 20 years (e.g. Stevenson *et al*. 2011). These forests have been found to contain unique floras (DellaSala *et al*. 2011), particularly amongst their lichens. The lichen floras of old-growth inland rainforests are particularly rich, with new species continuing to be discovered (e.g. Spribille *et al*. 2009). However, lichens generally don’t catch the public interest, or that of politicians, whereas another inhabitant of these forests, the mountain caribou, does. In the past, the mountain caribou populations moved through old-growth forests from high elevations to valley bottoms. With the loss of many valley bottom forests, they are now largely restricted to higher

elevations, where in winter they are dependent on hair lichens such as horsehair lichens (*Bryoria* spp.) and witch's hair lichens (*Alectoria* spp.), which in turn are closely associated with forests that are at least 100 years old (Edwards *et al*. 1960, Goward, 1998, 2003, Rominger *et al*. 1996). Mountain caribou have become an important a conservation icon for these forests, just as the spotted owl did for Pacific Northwest forests (see for example Yaffee 1994).

Fig. 8. Interior cedar-hemlock forest, Glacier National Park, British Columbia.

As in the USA, Australia and elsewhere, British Columbia has seen its share of well-illustrated publications aimed at providing information to the general public while at the same time encouraging a more conservation-oriented mindset. Some relate to the forest ecosystem (e.g. Mackenzie 1995, McAllister and McAllister 1997, McAllister 2014), others are more about particular organisms, such as bears (McAllister and Read 2010a, or wolves (McAllister 2007, McAllister and Read 2010b). An unusual variant of such books was one produced by the Western Canada Wilderness Committee that presented a variety of artists' impressions of a threatened old-growth forest at Carmanah (Western Canada Wilderness Committee 1989).

There have also been well-illustrated books celebrating the history of logging (e.g. Gould 1975, Drushka 1992, Mackie 2000). One publication used time-lapse photographs to show how forests grow back after clearcuts (Working Forest Project 1995), emphasizing that when forests are cut, they are quickly replanted so that a second-growth forest develops. While successfully demonstrating that clearcuts can be reforested, the publications missed the point that second-

growth forests cannot replace old-growth forests, at least over the timescales envisaged by most forestry operations.

The two themes well illustrate the dichotomy that has developed between loggers and environmentalists, a theme also very apparent in the US Pacific Northwest and analyzed in detail by Satterfield (2002).

The old-growth forests of British Columbia have been at the centre of large-scale social and political conflicts for over the past 30 years, where conservationists have often been at odds with timber extraction interests. Most remaining old-growth forests in the province are found on low-productivity sites at higher elevations, or on rocky mountainsides and in bogs (ELC 2000). In British Columbia, over 6,482 Old Growth Management Areas (OGMAs) have been established, covering over 1.8 million ha (Ministry of Forests, Lands and Natural Resource Operations 2014). However, regulatory protection, outside the provincial parks, of old-growth in British Columbia is "soft" and inconsistent. Under the current framework for old growth protection contained in Forest and Range Practices Act (FRPA), forest tenure holders are required to submit a forest stewardship plan which must specify results or strategies that are consistent with objectives set by government, which includes objectives for old growth retention.

There are a number of problems with the current system for old growth protection in British Columbia. In most areas, existing old growth retention targets are considered by many to be too low and fail to distinguish between productive and unproductive forest types. Moreover, measures in place to ensure these targets are met are inconsistent between regions, and protection even for "legal" OGMAs is insufficient (70% of all OGMAs are non-legal). A 2012 investigation by the Forest Practices Board found significant gaps in government's oversight of old growth, including tracking and monitoring. Also, the requirements for old growth retention do not apply to all users of the Crown forest since some tenured users on multi-tenured Crown forested land bases are required to maintain old growth and others are not (Forest Practices Board 2012). The public perception with respect to old growth and the current scientific understanding of this forest state must be based on ecological studies and experience (Kimmins 1999).

USA

In the USA, eastern old-growth forests have been the subject of popular works such as Maloof (2016) and more technical studies, such as Davis (1996) and Barton and Keeton (2019). However, it is the western USA that some of the biggest controversies over the logging of old-growth have occurred, possibly because much of the eastern forest was liquidated before the rise of environmental consciousness in the USA.

One of the most rancorous of the debates surrounding the conservation of old-growth forests occurred in the Pacific Northwest of the USA, and ultimately involved the intervention of President Clinton. The background to this debate is provided by the Forest Ecosystem Management Assessment Team (1993), and is reproduced here:

> "Timber cutting and other operations on lands managed by the U.S. Department of Agriculture, Forest Service and the U.S. Department of the Interior, Bureau of Land Management, have been brought virtually to a halt by federal court orders for several reasons. Foremost has been the failure of the agencies to produce plans that satisfy the requirements of several laws including the National Forest Management Act of 1976, the Endangered Species Act of 1979, and the National Environmental Policy Act of 1969. Shortcomings have included delays in meeting court-imposed time schedules, inadequate environmental impact statements, and numerous proposed management actions (e.g., timber sale proposals) that resulted in "jeopardy opinions" from the U.S. Department of the Interior, Fish and Wildlife Service.
>
> This series of events (Thomas *et al*. 1993: 32-45) can be dated back at least to 1972 when scientists first suspected that at least one sub-species (the northern spotted owl) might be closely associated with the habitat conditions most frequently found in old-growth forests.
>
> Over the period 1972 to 1993, the issue evolved from a question of dealing with a single species, now considered by the Fish and Wildlife Service to be threatened, to dealing with several such species simultaneously within the same ecosystem, to considering the effects of broadscale management plans on all species associated with old-growth or late-successional forests. This latter consideration – and the evolving concerns with "sustainable forestry", "multiple-use", "threatened and endangered species", "retention of biodiversity", "landscape ecology", and other concepts – led the Bureau of Land Management, the Forest Service, and political leaders to embrace the concept of ecosystem management." (pages II-1 and II-2).

Forest Ecosystem Management Assessment Team (1993) went on to say:

> "Shortly after World War II and subsequent to the invention of the gas-powered chain saw and improvements in transportation, logging began in earnest on federal lands in the Pacific Northwest. European methods of forest management were gradually adopted on most federal and private lands, including techniques such as clearcutting, removal of logs and snags, slash burning, thinning, and planting of single species stands on cutover areas. The assumption was that forests managed in this manner could be cut and regrown at relatively short intervals (e.g., 40-80 years) without negatively affecting other resources such as water quality, fish, soils, or terrestrial animals.
>
> As a result of over a century of logging and fire control, the forests of the Pacific Northwest presently consist of a highly fragmented mosaic of recent clearcuts, thinned stands and young plantations interspersed with uncut natural stands. The natural stands that remain range from 1,000-year-old or older forests of

large trees to relatively young, even-aged stands that have regenerated following wildfires. Because wildfires and windstorms often killed only part of the trees in a stand, natural stands are frequently characterized by uneven-aged mixtures of trees that survived a catastrophic event and younger trees that filled in the understory after the event. Where many large old trees remain in the overstory, these stands are usually referred to as "old growth" or "ancient forests". Where only scattered individuals or patches of large old trees remain and the majority of the stand consists of young or mature trees, stands are referred to as "mixed age" or even "young". Mixed-age stands are particularly common in some areas, such as the Oregon Coast Range, where extensive fires occurred in the 1800's. Mixed-age stands defy categorization – they are not "old growth" in the classical sense (Franklin and Spies 1991; Spies and Franklin 1991), and they are certainly not young even-aged stands. It is these mixed-age stands that have led to much of the debate over how much "old growth" or "ancient forest" is left in the Pacific Northwest.

As studies on the ecology of late-successional forests began to proliferate in the 1970's and l980's, it gradually became apparent that a simplistic approach to forest management based on high-yield, short-rotation forestry was not going to adequately protect the considerable biodiversity that was present in late-successional forests and their associated aquatic ecosystems. The northern spotted owl was the first species to receive recognition in this regard followed closely by the marbled murrelet, anadromous fish, and the recognition that a wide variety of species are closely associated with old forests (Thomas *et al*. 1993). More recently, ecologists, foresters, and the public have begun to recognize that the old forests that remain in the Pacific Northwest may be unique ecosystems that developed under climatic and disturbance regimes that may never be duplicated.

Changes in public perceptions and expectations concerning management on federal lands in the Pacific Northwest and elsewhere have led to a gradual increase in protection of unique ecosystems and species, increased concern with riparian areas, and experimentation with methods of "new forestry" designed to retain some of the structural features found in old forests and thereby more closely imitate natural disturbance regimes. As these changes have occurred, harvest rates of timber on federal lands have declined, and considerable controversy has ensued. The Forest Ecosystem Management Assessment Team was formed to develop and evaluate possible management options for resolving this issue." (pages II-2 and II-3).

Fig. 9. A pair of Marbled Murrelets (*Brachyramphus marmoratus*) in summer plumage. This was one of the species subject to special assessments during the preparation of the Northwest Forest Plan (Ralph *et al*. 1995).

The degree of polarization between those for and those against logging old growth in western Oregon has been examined in depth by Satterfield (2002). This study is unusual in that she conducted it from an ethnographic perspective, looking at both sides. She attempted to determine the extent to which the dispute was cultural, rather than driven by legal, scientific and land-managerial perspectives. She concluded that the differences between loggers and environmentalists were "profound, morally rooted, and ethically challenging" (p. 160). She goes on to explain that:

> "… loggers see themselves as members of historically rooted land-based communities whose experiential knowledge of the forest is sound and wise but who have nonetheless been cast unfairly as violent antagonists and treated without respect, despite their wood-producing contribution to society. Conversely, many ancient-forest activists lean towards, and derive insights from, cultural arrangements that they imagine as resembling Aboriginal practices. They are wary of, though they also endorse, a science that stands metaphorically for nature as mystical, complex, enchanting, and vulnerable to disruption (Yearley 1993); and some are creatively resistant to emotional norms that interfere with a deeper bond between the human and biotic worlds". (pp. 160-161).

The reference to environmentalists imagining their desired practices being similar to those of Indigenous people is interesting. Certainly, at points, environmental groups and Indigenous people in the US Pacific Northwest and in British Columbia have formed alliances when blockading particular logging operations, and there are some suggested intellectual affinities (e.g. as expressed in Suzuki and Knudtson 1993). However, environmental groups and Indigenous peoples do not always agree, and there has been resentment amongst some Indigenous peoples of the appropriation of aspects of their culture and their economic future by some environmentalists (e.g. Willems-Braun 1997). In Alaska, one Native Corporation in particular has been responsible for large-scale logging of old growth in the Tongass National Forest (see below).

Fig. 10. Old-growth rainforest, Hoh Valley, Washington, USA.

The debate over old-growth forests in the Pacific Northwest has generated a plethora of publications, some aimed at specialist readerships, others aimed at the general public. As an important industry, logging has received the attention of historians looking at how the industry developed over time, either in the North America generally (e.g. Cox 2010), or in the Pacific Northwest and British Columbia (e.g. Rajala 1998, Hayter 2000, Brock 2015). Some books were clearly intended to sway public opinion. For example, the cover of Norse (1990) *Ancient forests of the Pacific Northwest* contains the subtext 'The grandeur, complexity, diversity and impending destruction of a fragile and vital ecosystem'. Similarly, and more provocatively, the

inside cover of Lien (1991) *Olympic battleground: The power politics of timber preservation* describes the book as:

> "A provocative chronicle of intrigue, political chicanery, and citizen activism, this first account of the struggle to create and preserve the Olympic National Park in Washington State provides an eye-opening history of forestry in the Pacific Northwest from 1890 to our time. *Olympic Battleground* offers a searing critique of the U.S. Forest Service, a National Park Service in need of drastic restructuring and redirection, and forest policy in general. Interwoven are more than 100 pivotal struggles – many continuing today – which have pitted the park's advocates against those who would exploit the protected lands and timber of one of the world's greatest old growth conifer forests".

Many of the publications written about the forests of the west refer to battles (e.g. Dietrich 1992) and wars (e.g. Widick 2009), and *Clearcut*, a 1971 book by Nancy Wood is one of the Sierra Club "Battlebooks". In so doing, clearcutting was elevated to the same scale of environmental issue as energy, oilspills and mercury in the environment. The disputes in the Pacific Northwest and British Columbia are frequently referred to as the "War in the Woods" – with some justification given the violence that occurred on occasion. Others try and adopt a more objective view, explaining the natural history of old-growth forests in accessible text (e.g. Maser 1989) or featuring the natural history of the forest in beautifully illustrated publications (e.g. Kelly and Braasch 1988, Middleton 1992, Kirk 1992, Ketchum and Ketchum 1994, Kirk and Mauzy 1996). There are also a number of illustrated books presenting the perspective of the loggers, many featuring the photographs of Darius Kinsey taken in the 1890s and 1900s.

Elsewhere on the Pacific Coast, the value of even small patches of old growth forest have been recognized. For example, Zielinski and Gellman (1999) found that small areas of old-growth redwood (*Sequoia sempervirens*) growing in a matrix of younger regrowth stands were critical for some species of bats. Major confrontations occurred over the conservation of redwoods in California, such as over first the creation and then the extension of the Redwood National Park (Harris 1995, Speece 2017). They have also been the subject of a fictional novel, *The giants' last tear* (Powers 2014).

Fig. 11. Coastal Redwoods (*Sequoia sempervirens*). This is part of the Hunnewell - Donald Memorial Grove in Redwoods National Park, California.

Concerns in Alaska have generally pitted environmentalists against resources users. There has been strong political support for the maintenance of a forestry industry in areas such as the Tongass (Soderberg and DuRette 1988), but the actions of some of the forestry companies have resulted in considerable public opposition. Durbin (1999) provides an account of how concerns over the actions of two of the major forestry companies operating in the Tongass led to a national campaign to try and achieve what was viewed as a more sustainable approach to forest management. Some pressure for conservation was already occurring, with the Alaska National Interest Lands Conservation Act 1980 leading to the protection of some key locations, such as Admiralty Island. This Act also mandated large logging subsidies and unsustainable rates of logging in the 1980s; these activities were curtailed by the Tongass Timber Reform Act of 1990. A major turning point in public opinion was the ruling on March 5, 1981, by U.S. District Judge Barbara Rothstein in favour of Reid Brothers Logging Co. in its antitrust suit against Ketchikan Pulp Company and Alaska Lumber and Pulp initiated distrust in the two companies. When the initial ruling was followed by her findings that the companies had engaged in collusion, conspiracy and lying, and her award of triple damages (totaling nearly $1.5 million) set in motion, the activities in the Tongass came under national scrutiny.

While the role of the industrial companies involved in the Tongass have been examined in detail, others were also involved. The Alaska Native Claims Settlement Act, signed into force in

December 1971, resulted in the transfer of 162,000 km^2 of land to 12 Alaska Native Regional Corporations and over 200 Native village corporations. The village corporations received title to the surface estate of ca. 89,000 km^2, selected from 25 township withdrawal areas surrounding each village. The 12 regional corporations received the mineral rights for the 89,000 km^2 as well as the surface and sub-surface title to an additional 65,000 km^2. The Alaska Native Regional Corporation in the Tongass area was Sealaska Corporation. It was responsible for logging large areas of old growth, including a now renowned clearcut on Long Island.

As elsewhere, environmental pressure groups singled potentially iconic species that might symbolize the plight of the old-growth forest. Considerable attention was placed on the Alexander Archipelago Wolf (*Canis lupus* ssp. *ligoni*), a subspecies of the grey wolf. Attempts to have it listed under the Endangered Species Act failed, with the US Fish and Wildlife Service determining in January 2016 that listing was not warranted. This is the same subspecies of grey wolf that has been celebrated in coastal British Columbia, and used an icon there of old-growth coastal forests (e.g. McAllister and Read 2010b).

Fig. 12. Stephen's Passage in the Tongass National Forest.

Other issues have come to dominate the debate about forests in the American west since the Northwest Forest Plan was established. In particular, the Healthy Forests Initiative announced by George W. Bush in August 2002, and the subsequent Healthy Forests Restoration Act, has resulted in major policy changes and regulatory reform. In particular, it reduced the extent of

environmental analysis of proposed actions, the ability to make administrative appeals and the possibility of turning to litigation (Vaughn and Cortner 2005). This legislation is particularly important for the forests of the inland west, an area that has seen in its own controversies over the logging of old growth (e.g. Langston 1995).

Europe

In Europe, feelings towards completely natural forests have historically been quite varied. In England, the 'Wildwood' was often views as a place of danger, harbouring outlaws and dangerous animals such as wolves. The older the trees, the more the forest was associated with mythical creatures, and there are long-standing Pagan traditions associated with the forest (Porteous 1928). In many cases, Pagan traditions were carried forward to more recent times, and it has been speculated that one mythical occupant of English forests, Herne the Hunter, was actually the continuation of *Cernunnos*, the Celtic horned god, or a more recent manifestation of the Norse god *Odin*. This in part reflects the complex social history of England, where successive waves of colonists, each with their own mythologies, arrived and co-opted traditional magical sites.

Many mythological ideas had no place in 18th century Europe, with the gradual ascent of science, systematic descriptions and the attempts to establish 'order'. Wirth *et al*. (2009b) cite the work of the Comte de Buffon, who in his multi-volume book *Histoire Naturelle*, wrote:

> "There, a desolate tract of land lies, a sad and sullen region, never used as a man's abode. Its mountains are covered with forests, dark and dense. Trees without bark and without tops, stand bent or half-broken, withered by age. Others, far more than those first ones, lie down full length, only to decay on those heaps of wood already rotten and to suffocate the seedlings that were about to come through. Nature seems to be worn out here; earth – heaped with the ruins of what she brought forth – carries piles of debris, instead of her flowery green, and holds trees loaded with parasitic plants, poisonous fungi and mosses, and those impure fruits of rottenness".

At this time, concepts of beauty were very much aligned with order, symmetry and geometric arrangements, and this would have been reflected in the royal gardens in France, where the Comte worked (Gaier 1989). Natural forests were seen as untidy, messy, and places of disease, although the 'dangerous' animals that had previously occupied them had either already been extirpated or were in the process of extirpation. Most such forest had already been lost, with a few exceptions that had been preserved as royal hunting forests (e.g., Bialowieża in Poland) or which were in particularly inaccessible locations. Most forests were highly managed, often with destructive practices such as overgrazing, over-extraction of wood and litter raking. This formed the background for the emergence of 'scientific forestry', with Heinrich Cotta being credited as one of the early pioneers in the discipline (Cotta 1817). The European tradition of forestry is exemplified by textbooks such as Mayer and Ott (1991) and Mayer (1992). Since the 1980s, there has been increasing interest in trying to emulate old growth characteristics (e.g. Otto

1994, Scherzinger 1996). This is being done by modifying silvicultural practices, particularly through the use of continuous cover silvicultural systems.

While forestry was emerging as a scientific discipline, there was also an emerging romanticism in the early 19th century that attached much greater value to nature. This emerged from the 18th century work of individuals such as William Kent and Capability Brown, who rejected the very formal garden and landscape designs that had been previously favoured. It resulted in a move away from the regular patterns favoured in the 17th century towards a more natural, but still artificial, landscape.

In the United Kingdom, ideas about 'old growth' have been heavily influenced by ideas and experiences associated with ancient woodlands. Such woodlands are not natural: they are characterized by long and intense use. They are defined as areas that have been woodland since at least 1600. Much of the work on woodlands as a feature of the cultural landscape came from the work of Oliver Rackham, an academic at Cambridge University (e.g. Rackham 1986, 1990).

Fig. 13. Beech woodland in the New Forest, England. The pollarded tree on the right is likely at least 200 years old, and while this woodland has existed since at least the 11th century, it is highly managed and has been heavily influenced by humans and their livestock.

Through the 20th century, tensions between conservation bodies and Forestry Commission escalated. These tensions led to a conference organized jointly by the Forestry Commission and the Institute of Chartered Foresters, and it was this that led to the establishment of a Broadleaves Policy (Nail 2008). In 1985, the Forestry Commission announced its new policy in favour of broadleaves, reversing the stance it had taken for the previous 60 years. The policy resulted in grants and special measures to support ancient semi-natural woodland to ensure that their area was not further reduced, as well supporting the establishment of new broad-leaved woodlands and the replacement of some conifer planting with broadleaves (Forestry Commission 1985a, 1985b). The guidelines for managing broadleaved woodland issued in 1985 have been revised and updated (Harmer *et al*. 2010) and there are also special guidelines for managing ancient woodland (Forestry Commission 2010). Books aimed at the general public have appeared, such as those designed to educate the public about the different types of woodland habitats found in the United Kingdom (e.g. Lake *et al*. 2015). The changes in policy have produced real results. In the mid-1980s, the Forestry Commission in England was planting 25,000–30,000 ha a year, 95% of which consisted of conifers. By the late 1990s, it was planting about 5,000 ha a year, 80% of which were with broadleaves.

The change in policy also required that ancient semi-natural woodlands be protected. An inventory of ancient woodlands was established by a government body, the Nature Conservancy Council, in 1981, and management grants for these woodlands were introduced in 1992. These were supported by new legislation, the 1985 Wildlife and Countryside (Amendment) Act that introduced the requirement for management for multiple objectives by the Forestry Commission. The Act specified that:

> "In discharging their functions under the Forestry Acts of 1967 to 1979 the Commissioners shall, so far as may be consistent with the proper discharge of their functions, endeavor to achieve a reasonable balance between:
>
> - The development of afforestation, the management of forests and the production and supply of timber, and
> - The conservation and enhancement of natural beauty and the conservation of flora, fauna and geological or physiographical features of special interest" (cited in Miller 1995, p. 68).

Australia

In Australia, many concerns have surrounded the rapid change in the Australian environment since European colonization (e.g., Beale and Fray 1990; White 1997). A watershed moment seems to have occurred in the 1960s when the Minister of Lands of the state of Victoria (Sir William McDonald) announced a rural settlement scheme for the Little Desert in the northwest part of the state. A sophisticated campaign against the scheme ensued, and it was eventually abandoned (Robin 1998). A number of popular books have been produced that emphasize native forests, such as *Woodlands: A disappearing landscape* (Lindenmayer *et al*. 2005) and *Life*

in the tall eucalypt forests (Lindenmayer and Beaton 2000). While being a series of different issues (e.g. salinization, forest clearance, loss of native fauna), there has been some focus on forests. Many of the publications use the same terminology as used in North America, describing the 'battles' (e.g. Buckman 2008) and 'wars' (e.g. Turvey 2006, Ajani 2007). It is also interesting that the term 'old growth' is increasingly being used in Australia.

Some of the campaigns led by politicians appear to have had significant impacts. In particular, Bob Brown, who held a seat for the Green Party in Tasmania's House of Assembly before being elected to the Australian Senate, became a focal point for eco-activism in Tasmania (see, for example, Brown 2004). His efforts drew international attention, and in 1987 he was recognized with a United Nations Environment Program Global 500 Award. This was followed by the 1990 Goldman Environmental Prize.

The preservation of forests was not a priority in the establishment of Australia's national parks between the 1880s and 1960s (Cavanaugh 2010). This changed in the 1970s, when scientific evidence mounted about the uniqueness of Australia's rainforests, previously considered to be an invasive element from the Indo-Malayan floral region. There was a growing recognition of their uniqueness and, at the same time, a growing recognition of their loss to agriculture and logging. This resulted in a series of campaigns to protect rainforests from development including at the Border Ranges, Terania Creek, Washpool, Werrikimbe and the Nightcap Range.

Initially, the pressure to have forests put aside was based on lobbying, as in the case of the Border Ranges. This met with limited success and tactics changed at Terania Creek. This is a small watershed at the base if the Nightcap Range, near Lismore in New South Wales. Road-building to provide access into the basin started on 16 August 1979, but was unexpectedly opposed on the ground by local protestors (Cohen 1997). Some of the protestors obstructed the logging peacefully, others resorted to sabotage, and 41 arrests were made. The ensuing media drew major attention to the attempts to preserve rainforests in the area. There had been no forest protest in Australia up to this point that used the types of direct action adopted at Terania Creek, and it set the scene for many future antagonistic conflicts in the forest. It resulted in an independent inquiry that last 18 months, and which was used by environmental groups to emphasize the importance and uniqueness of Australia's rainforests. The inquiry itself was conducted under adversarial conditions, with considerable amounts of evidence being deemed irrelevant at the request of the NSW Forestry Commission. The inquiry found in favour of continued logging, but this finding was not accepted by the Government. Protestors returned to the Nightcap Range three years later, trying to block logging developments in the Griers Scrub and then at Goorgarna Road in the Mt Nardi area. They were hampered by the remoteness of the area and new legislation allowing the holding and arrest of protestors for trespass. The Forestry Commission started logging in the area without an Environmental Impact Statement, but was then subject to several stop-work orders by the Land and Environment Court.

The situation in New South Wales was complicated by the very different opinions held within the New South Wales government. On the one hand Forestry Commission NSW was a strong

advocate on rainforest logging, and was responsible for opening areas up for development. On the other hand, the NSW National Parks and Wildlife Service (NPWS) argued in policy papers from 1979 onwards that all publicly-owned rainforest should be protected from logging and placed into reservations. The NPWS started inventorying all remaining rainforest areas at the level of the vegetation community and individual species (Cavanaugh 2010). This information was eventually published in Floyd (1990).

Another factor that came into play at this time was the introduction of the NSW Environmental Planning and Assessment Act 1979, which required that environmental impact assessments be undertaken prior to any logging and roading. Until its introduction, the need for such assessments had been decided on a case by case basis by the NSW State Pollution Control Commission. With its passing, conservation groups could use legal means to aid their campaigns, and they did so successfully in the cases of proposed logging in the Forbes Valley (Prineas v Forestry Commission) and the Nightcap Range (Kivi v Forestry Commission). The Department of Environment and Planning also started making use of the Act, forcing an inquiry into proposed logging in the Washpool.

Cavanaugh (2010) describes how the Forestry Commission NSW adopted a 'siege mentality' during this period, refusing to accept the need for a politically acceptable compromise. While it won the legal case for logging in Terania Creek, it then voluntarily protected it as a flora reserve. It was heavily criticized for its uncooperative attitude towards independent attempts to quantify the extent of the resource, and for its failure to assess properly the resource remaining in previously logged rainforest and moist hardwood forests. As a result, it lost the confidence of both the government and the general public, and its underlying philosophy and land management practices were increasingly questioned. As stated by Cavanaugh (2010):

> "It was revealed that the Commission had become 'a captive of the industry it was set up to control' (Prineas and Elenius 1981, p. 15) and had not effectively resisted industry demands for more timber than the forest will grow, so much so that native forests were being over-cut and the current supply of native timber was going to decline (Hammond, 1980)." (p.268)

Release of financial documents revealed that the Forestry Commission had accrued deficits, with roading costs for timber extraction being a major expense that were not being recouped through stumpage payments.

The New South Wales government, meanwhile, had been monitoring the situation closely. The Cabinet decided in late 1979 that a state-wide policy on the future of the rainforest was needed as it was concerned that confrontations such as the one at Terania Creek might re-occur. While the Forestry Commission had a plan to phase out rainforest logging, this appeared to coincide with the area of rainforest (Cavanaugh 2010), with only one area of rainforest on the north coast surviving into the mid 1990s. This reduced the credibility of the 'jobs-or-conservation' argument: the jobs would ultimately all be lost as the resource diminished. Eventually, in October 1982, the Cabinet decided on a policy involving the conservation of 89,500 ha of state

forests as national parks, nature reserves and flora reserves. This decision created the Nightcap National park, Mt. Hyland Nature Reserve, Murray Scrub Flora Reserve and the Cambridge Plateau Flora Reserve. Large additions were also made to existing national parks, including Border Ranges National Park, Dorrigo National Park, New England National Park, Werrikimbe National Park and Mt. Seaview Nature Reserve. Known as the Rainforest decision, it protected in national parks 43.8% of the mapped areas of rainforest on public land. The protection was not equally divided amongst all rainforest formations, with a preponderance of areas that might best be considered old growth being protected. Cavanaugh (2010, p. 273) cites Alex Floyd's description of these as 'towering figs, yellow carabeens and booyongs', as well as 'ageless Antarctic beeches', adjectives that could be used of many old-growth areas meeting the public's concept of old growth.

Fig. 14. New England National Park, New South Wales, Australia. Multiple fires are apparent in the distance.

The moves by the NSW government coincided with rising global concerns about the loos of rainforests. There was a widespread feeling that Australia should not be seen as leading rainforest destruction, and conservation of the nation's rainforests was added to the election manifesto of the Australian Labour Party, which won the 1983 Federal election.

New Zealand

The West Coast of New Zealand is a highly scenic area, and tourism has been a major industry since the early 20th century. In the early 20th century, there was a growing realization that many endemic species, particularly birds, were being threatened by loss of habitat and competition with or predation by introduced species. This led to the creation of organizations such as the Native Bird Protection Society (founded 1923). This was later renamed (in 1935) the Royal Forest and Bird Protection Society of New Zealand, and is today known simply as Forest & Bird. By the 1970s, the Royal Forest and Bird Protection Society of New Zealand was the only conservation organization in New Zealand, and so was at the forefront of campaigns against a proposal put forward by the New Zealand Government in October 1971 proposed to harvest large areas of native (old-growth) South Island lowland beech forest, with half the cleared area to be converted to exotic radiata pine.

The threat to native forests prompted the formation of new environmental groups, including the Beech Forest Action Committee (later the Native Forest Action Committee, the Maruia Society and then the Ecologic Foundation. On 4 July 1975, the Royal Forest and Bird Protection Society of New Zealand and the Beech Forest Action Committee started the Maruia Declaration, a public petition that demanded an end to native forest logging and legal recognition of native forests. The petition was presented to Parliament in 1977, carrying 341,160 signatures. It repeated and expanded on previous recommendations made in 1937 that protected forests be established and that commercial forestry be compelled to manage the forests as a perpetual crop without interfering with their scenic value. The Declaration contained six principles that became the basis for a continuing public campaign against natural forest logging:

- Native forests, wherever they remain, need recognition and protection in law.
- The wholesale burning of indigenous forests and wildlife has no place in a civilized society.
- The logging of virgin forests should be phased out by 1978.
- Our remaining publicly owned native forests should be placed in the hands of an organization that has a clear and undivided responsibility to protect them.
- To reduce commercial pressures on native forests, the growing of fine quality exotic and native timbers on land not presently forested should be given encouragement.
- It is prudent to be conservative in our consumption of these forest products, especially newsprint and packaging paper, which make heavy demands on our precious resources of land, energy and water.

Further concerns were raised over the concerns about the felling of native forests by Japanese timber companies for the woodchip industry during the 1980s. The concerns were occurring at the same time as the Labour Government (centre right) was dismantling New Zealand's welfare state and re-regulating the economy to compete globally. The conflict between conservation and old-growth harvesting eventually led to an agreement, the West Coast Accord. This was signed on 6 November 1986 between government, industry and environmental organisations. The major focus of the Accord was for the sustainable yield of timber from the indigenous forests on the West Coast. 79% of the remaining West Coast forest lands were protected, 8% were to be

available for sustainable management, and 15% would remain in private ownership. The parties agreed that all unsustainable harvesting would end by 2000. Under the terms of the agreement, the area of indigenous forest allocated to harvesting was supposed to have sufficient beech and beech/podocarp forest to have a sustained yield, initially set at ca. 150,000 m^3 annually in order to sustain the timber industry. North and South Westland were to reach a long-term sustained yield of 140,000 m^3 by 1994 and the Buller area was to reach 17,200 m^3 by 2006. On private land, forest could be felled to increase pasture area on a farm, but the wood could only be sold if the owners had an approved sustainable management plan.

The Accord provided protection for specific areas of native forest for their natural values. Some areas had already been set aside in the 1970s, but they were not representative of the range of forest types in the region (West Coast Forests Working Party 1986). The Accord sought to protect ecologically diverse areas, especially lowland vegetation types not already represented in the reserve system. 'Indigenous production zones' were also established that allowed the continued clearfelling of podocarp forests, the sustainable management of rimu (*Dacrydium cupressinum*) forests and the development of logging in beech forests.

Fig. 15. Native old-growth forest (a mixture of broadleaves and podocarps) in the Omoeroa Saddle area of the West Coast region of New Zealand.

Memon and Wilson (2008) argue that a major difficulty within the report existed over differing interpretations of the term 'sustainable forestry'. Some believed that it had a bio-centric meaning, whereas others interpreted it from an economic (specifically jobs in the timber

industry) perspective. The former included the Secretary for Environment, West Coast local authorities and some environmental groups. Those in favour of the latter approach included the West Coast Timber Association, the Westland Timber Workers' Union and some local authorities. Considerable faith was placed by central and local government politicians in the contested science of sustainable harvesting (Memon and Wilson 2008).

Fig. 16. Old-growth Red Beech (*Nothofagus fusca*) forest, New Zealand.

The government reorganisation of the mid 1980s involved a restructuring of the forest administration scheme, including dissolving the New Zealand Forest Service in 1987. The Department of Conservation assumed responsibility for the management of almost all remaining state-owned native forests, while the state-owned Forestry Corporation assumed responsibility for all state-owned plantations of exotic trees. Under the Conservation Act 1987, all state-owned native forests were to have non-timber management goals. Further developments occurred with the passing of the Resource Management Act (RMA) 1991 and the Forest Amendment Act 1993, both of which provided mechanisms to deal with the adverse environmental impacts of logging native forest on private land. Administration of the RMA was devolved to local government.

In the 1990s, logging of native forests had been confined to communally-owned Maori land, land owned by non-Maori farmers and state-owned native forests on the West Coast. The state-owned forests were managed by a state-owned company called Timberlands West Coast Ltd. The

West Coast had been singled out for special attention because the economy there was so resource-dependent. However, as indicated above, it was scheduled for a gradual reduction in the logging of native forests.

Throughout this period, there was friction between two major groups. The first consisted of local government and the sawmilling industry, which came together in a group known as West Coast Resource Interests. The second was a group of 'deep green' environmental groups, led by an organization called Native Forest Action. The first group concentrated, via the courts, on persuading central government to keep local sawmills open by ensuring the Timberland West Coast Ltd. Maintained timber supplies to mills. The environmental group concentrated on developing a political constituency in major cities aimed at achieving 100% protection of lowland native forests on state-owned land.

The Accord ran into difficulties in the 1990s with the court proceedings against West Coast Timberlands being unsuccessful. However, it seems to have been a proposal by Timberlands to develop a sustained yield beech harvesting programme that triggered the greatest opposition (from Native Forest Action as well as concerned scientists). The concerns were about the potential impacts on the ecological integrity and biodiversity of the beech forests. The beech scheme was supported by the Parliamentary Commissioner for the Environment, the New Zealand Institute of Forestry and some scientists, and received formal approval in principle from the government in 1998. Timberlands West Coast Ltd. mounted a very aggressive public relations campaign to try and save the beech scheme in the vent that a Labour government was elected in the 1999 election that was subsequently heavily criticized (Hager and Burton 2002). The Labour party had actually committed in their election manifesto to terminate the Accord.

The Labour Party won the election, and the Labour Alliance coalition government promptly changed Timberland West Coast's statement of corporate intent to exclude beech logging, thereby preventing the company from seeking planning permission for its beech logging operations. The West Coast Accord was cancelled on 15 May 2000 by the Forests (West Coast Accord) Act 2000. A new accord was agreed to in 2001, with the objectives being to:

- define those areas where it is inappropriate to establish plantation forestry
- recognize the important heritage values of New Zealand's remaining natural indigenous forests and the need for their protection and conservation
- acknowledge that the existing area of natural indigenous forest in New Zealand should be maintained and enhanced
- recognize that commercial plantation forests of either introduced or indigenous species are an essential source of perpetually renewable fibre and energy offering an alternative to the depletion of natural forests
- acknowledge the mutual benefits emanating from an accord between New Zealand commercial forestry enterprises and conservation groups and the example that this unique accord can provide for the international community.

The 2001 Accord did not exclude all harvesting of old-growth forests. However, one of the instruments of the accord stated: "The parties support the production management and harvest of naturally occurring indigenous forest only where such activity is conducted on a sustainable basis and principally for the production of added value solid wood products in New Zealand. A "sustainable basis" is considered to be a rate and method of tree extraction that does not exceed the replenishment so that the forest ecosystem in the area under consideration is maintained in perpetuity". On March 31 2002, all logging was halted on forests in public ownership, and the forests were reclassified for conservation purposes.

The saw-milling industry contested the 2000 decision in the courts, arguing that they had been encouraged to invest based on promises of a future supply of beech timber, and that ending the Accord breached contracts and expropriated property rights without compensation. The Courts rejected these arguments, ruling that the state cannot be stopped from exercising legitimate power, even if this causes some injustice to some individuals (Memon and Wilson 2008).

According to Memon and Wilson (2008, p. 759), their work on the way that the New Zealand government was able to shut down the logging of old-growth forests on the west coast of New Zealand:

> "… challenge critics of the role of the state as the overriding agent of authority in society in shaping environmental policy (e.g. Young, 1994; Stoker, 1998; Durant *et al*., 2004). Rather, and in line with recent analyses by Wilson & Bryant (1997), Bryant & Bailey (1997) and Bryant (2005), it confirms the pivotal role of both the state in pluralist democracies as a powerful actor in shaping indigenous forest allocation policies and of certain non-state actors (in particular 'deep green' environmental groups) who, at times, may share common objectives with the state. Therefore, the findings are in line with recent debates on devolution, 'hybrid neo-liberalism', and the reconfiguration of actor spaces in forestry in other temperate latitude forests (e.g. McCarthy, 2005, 2006; Wilson, 2006), and demonstrate that solutions to controversial environmental and socio-economic problems can, in some instances, only be successfully tackled by government acting as an 'objective' collective public entity and based on an institutional structure of authority and accountability (Young, 1994; Johnston, 1996; Gleeson & Low, 2001)."

These findings have considerable implications for the interventions of governments in complex environmental issues.

International concerns

Internationally, there has been very little attention paid to old-growth forests in the multiple political processes that have been underway for the past 50 years (Freibauer 2009). Most of these processes have proved remarkably ineffective for the simple reason that mo international

body has the power to determine the way a country chooses to utilize its resources. In addition, most policy has aimed at helping developing countries reduce deforestation and forest degradation, with very little attention being paid to old-growth forest issues in more developed countries. A few environmental organizations have tried to draw attention to certain issues: the work of the World Resources Institute on frontier forests comes to mind. There have also been efforts by international certification bodies, notably the Forest Stewardship Council, to affect management practices associated with old-growth forests, and these have had some impacts.

Patterns in the adoption of old growth as a valued element of forests

As shown in this section, it is very difficult to draw generalizations about the factors that led to the identification of old growth as something to be protected rather than liquidated. However, in all the jurisdictions that were studied as part of this report, old growth has become something that is widely valued, although there also remain groups that see old growth differently, essentially as a resource to be developed. In most cases, it is possible to identify a growing trend in environmental awareness through the 20th century, accelerating in the 1980s and 1990s into the 21st century. Much of this seems to have come through education: the general public is more aware of environmental issues thanks to the written and visual media. Initially this consisted of well-illustrated books, bit more recently, television and online videos (not reviewed in this study) are likely to have played a major role in raising environmental consciousness. Television series like Sir David Attenborough's *Life on Earth* have undoubtedly had an impact, as have many other series.

Campaigns by environmental groups have also helped both raise awareness and swung public opinion in favour of preserving old growth. Court actions brought about as a result of cases brought by environmental groups have been successful in stopping old-growth logging in some areas, and have been particularly effective in the USA. The campaigns by environmental groups have benefited when they have attracted extensive and prolonged media coverage: the protests at Terania Creek in Australia and Clayoquot Sound in British Columbia are good examples of this. While physical confrontations in the forest draw a lot of media attention, a variety of other techniques have been used, especially campaigns in overseas markets for old-growth forest products. Some markets (e.g. Europe) are more easily influenced by such campaigns than others (e.g. China). This seems, for example, to have influence opinion in British Columbia, and certainly provoked a major counter-campaign by the government/industry.

In several cases, the strongest advocates for the liquidation of old growth have been government forest services or state-owned companies. Environmental organizations and some scientists have been quick to exploit mistakes by such organizations, whether it be examples of violations of their own rules, below-cost timber sales or the use of flawed science. Most governments have generally had considerable difficulty finding the elusive (and possibly non-existent) line that meets the needs of all stakeholders and, as a result have failed to manage old growth effectively.

A small group of scientists seem to have played a very large role in developing our knowledge of old growth, and have also been important advocates of the preservation of old growth. They include Jerry Franklin and Tom Spiess in the USA, David Lindenmayer in Australia, Per Angelstam in Sweden and Oliver Rackham in England, although Oliver Rackham's work focused more on ancient woodlands than old growth *per se*. Science panels and scientific working groups have also been effective in influencing both government and public opinion. Examples include the Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee (ANZECC: Australia and New Zealand Environment and Conservation Council; MCFFA: Ministerial Council of Forestry, Fisheries and Aquaculture) in Australia, the Forest Ecosystem Management Assessment Team in the Pacific Northwest and the Clayoquot Sound Scientific Panel in British Columbia. Obtaining consensus from multiple scientists clearly adds credibility to policy and management decisions concerning old growth.

4 Conserving old-growth forests

There is a large body of research that described the value of old-growth forests in supporting a wide range of biodiversity including lichens, fungi, insects, bats, spiders, and other organisms found only in structurally complex mature forests (Spies and Duncan 2009; MacKinnon 1993). Here, we studied the old growth legal frameworks and management strategies in British Columbia, the Pacific Northwest, Alaska, UK, Australia, New Zealand and Sweden.

4.1 British Columbia

Old-growth forests represents 55% of British Columbia's Temperate Coastal Rainforest (Moyer *et al*. 2008). In British Columbia, Old Growth Management Areas have been established under legislation, and must be addressed in forest management plans (Indufor 2016). British Columbia has integrated Forest Stewardship Plans that promote the retention of old-growth forest as legally enforceable tools for licensees in Old Growth Forest Management Areas. Although British Columbia does not have a statute that specifically relates to old-growth forests, there are several provincial statutes and regulations that have a bearing on old-growth forests, including the *Land Act* (BCFLNRO 1996) and the *Forest and Range Practices Act* (BCFLNRO 2002).

The *Forest Planning and Practices Regulation* (BCFLNRO 2004) sets out ten government objectives that must be addressed in the legally binding Forest Stewardship Plan. Section 3 of Schedule 1 of the *Regulation* provides guidance to the licensee on how to address the government objective for wildlife and biodiversity. To meet the landscape-based objective set out in section 9 of the *Regulation* the licensee must address:

"... the extent to which wildlife habitat areas, ungulate winter ranges, riparian management areas, scenic areas and other areas established to manage forest resources complement efforts to resemble natural disturbance patterns in a landscape, including old-growth" (Forest Planning and Practices Regulation, Sch. 1, s. 3(1)(c)).

Subsection 14(3) of the *Regulation* requires that all OGMAs located in a particular development unit be included in a Forest Stewardship Plan. As part of its strategy to conserve biodiversity, the B.C. government has established 6,482 Old Growth Management Areas. However, only 30% of these have protection under the law through integration into Forest Stewardship Plans (Forest Practices Board 2012). Although the approach used by British Columbia is somewhat convoluted, it provides a legally enforceable tool for old-growth retention (Berry *et al*. 2018). The forest license is enforced via the *Forest Range and Practices Act* and the Act requires the licensee to complete a Forest Stewardship Plan, including specific protections for old-growth forests. Despite the fairly comprehensive legal process to incorporate old-growth forests into forest management planning in British Columbia, there is no legally mandated provincial monitoring pro- gram to assess the effectiveness of old growth retention. Moreover, not all identified old-growth forests in the province are legally protected (Berry *et al*. 2018).

The British Columbian system allows for the recruitment of old growth, although as long as 40 years it was recognized in the Pacific Northwest that old-growth forests cannot be recreated (Thomas *et al*. 1988, Lindenmayer and Franklin 2002). This is because of the timespans involved, with some habitat features continuing to develop over several centuries (Franklin *et al*. 2002). However, it has been frequently suggested that in areas where the remaining old growth is lacking, younger forest should be reserved, and allowed to gradually accumulate old growth characteristics over time (e.g. Mladenoff *et al*. 1994, Lindenmayer and Possingham 1995, Økland 1996). This is one of the policies adopted by British Columbia.

4.2 US Pacific Northwest

Old-growth forests west of the Cascade Range are dominated by massive stems of Douglas-fir and shade-tolerant species as western hemlock and western redcedar. Individual structures include live trees, snags, and logs of varied species, sizes and conditions. This complex structure of old growth requires several centuries to develop following a stand replacement wildfire (Franklin and Johnson 2002). Fires leave behind immense legacies of snags and logs. Trees regenerate, and a forest eventually regains dominance of the site. Young forests experience an extended period of exponential growth following canopy closure; smaller trees die from intense inter-tree competition in the dense stands. As stands mature, mortality agents shift toward bark beetle, root diseases, and windthrow, which kill dominant trees, producing canopy gaps and opportunities for shade-tolerant trees to grow into the overstory. Ultimately, the old-growth forest consists of fine-scale structural mosaic (Franklin and Van Pelt 2004).

Steps to improve the conservation of old-growth forests in the Pacific Northwest were closely tied to protect the supposed habitat of the Northern Spotted Owl. A complex process was established, ultimately resulting in the Northwest Forest Plan USDA Forest Service and USDI Bureau of Land Management 1994a, b). The Plan made provisions for the retention of all remaining late successional forests in mid-scale watersheds (500 – 5000 km^2) that currently contain less than 15% of such forests. The plan also provided for a a well-distributed network of

late-successional reserves, as well as the retention of aggregates within harvested areas (Lindenmayer and Franklin 2002).

Assessments of the biodiversity associated with Spotted Owl range revealed that almost 1,100 species were associated with late successional forests within the range of the Northern Spotted owl (Forest Ecosystem Management Assessment Team 1993). In some cases, particularly with plants, small patches of old growth were sufficient. For others, especially vertebrates, larger areas were considered to be important. Remnants of late-successional forest within developed landscapes were considered to be very important for spotted owls, acting as core areas for breeding pairs (Thomas *et al*. 1990).

On the US Pacific Coast, threats to the continued presence of old-growth forests include a lack of managing younger forests with a goal of creating old-growth forests, timber harvesting, invasive species, pests, pathogens, forest fragmentation, fire suppression, catastrophic wildfires and climate change (NCSSF 2008). In frequent-fire forests of the western US, logging is no longer the primary threat to old growth, and instead threats also include land management policies that suppress fire and fail to mimic the effects of fire through active management (Vosick *et al*. 2007). In the Southwest, fires suppression remains the greatest threat, along with invasive species, climate change and development (NCSSF 2008). While the Northwest Forest Plan has significantly reduced the loss of old growth to timber harvest on federal lands guided by the Plan, losses continue at lower rates. Additionally, losses on non-federal lands in the Northwest, particularly private lands, have continued at much higher rates than on federal lands. Supporting evidence of these conclusions and generally that old growth is still being lost to timber harvest in the Northwest can be found in status assessments for species that are dependent upon late successional forests. (Krankina *et al*. 2014; Desimone 2016).

Appropriate conservation measures for old-growth forests on sites historically in the US Pacific Northwest characterized by low-severity wildfire are still being debated. Forest managers and other stakeholders advocate aggressive active management to move forests toward more historic conditions, thereby reducing the potential for uncharacteristic high-severity fires. Others oppose such programmes because of concerns about allowing significant logging and potential negative impacts on wildlife habitat. Current policies for conserving existing old-growth forests in moister areas of the Pacific Northwest have coalesced primarily around their reservation from timber harvest and protection from wildfire, as reflected in the Northwest Forest Plan. Programmes to accelerate structural development in young forests can be developed from existing knowledge of natural stand structures and development processes. Franklin (2009) suggests the following silvicultural activities to enhance complexity on moist sites:

1) Highly targeted silvicultural activities to create ecological complexity that require the silviculturalist to be more intimately familiar with the candidate stand than timber production-oriented thinning, where the objectives are usually simpler and better defined. The personal familiarity allows the silviculturalist to effectively build upon the diversity and complexity already present in the stand.

2) The practice of manipulating young forest to stimulate development of structural and biological diversity is in its infancy. Hence, broad-scale application of generic silvicultural prescriptions is inappropriate; this limits opportunities to learn and fails to respect the diversity of forest conditions and social goals. For example, there are strong regional differences in westside forests in the aggressiveness of western hemlock and local site-based differences in potential for aggressive response by clonal understory plants, such as salal and bracken fern. Hence, it is appropriate to vary restoration approaches at multiple scales – stand, landscape, and region.

On Dry Forest (DF) sites, the strategy calls for silvicultural treatments that retain and release older trees, reduce stand densities, shift composition toward fire- and drought-tolerant tree species, and incorporate spatial heterogeneity at multiple spatial scales (Franklin and Johnson 2012).

4.2 Alaska

Alaska is unique in the US in that it contains large sections of intact forest land and undisturbed old growth, as well as species-rich rainforests. There are no comprehensive datasets for all old-growth primary forest in Alaska and the information regarding old-growth is scattered. Due to data availability and similarities in forest types and ownership, the old-growth assessment consolidated the four forested regions into two broad categories: The Southeast and Southcentral Regions, and the Interior and Southwest Regions.

The majority of old-growth forest land in Alaska's Southeast region, and 95% of the forest land in the Tongass National Forest is owned by the federal government (the remainder is state land, native land and private land) (US Forest Service 2016). All of the federally owned forest and some of the State forest in the Southeast and Southcentral regions are effectively protected from management activities due to being located entirely within one or a combination of protected areas: USFS Inventoried Roadless Areas, National Parks, USFS Wilderness, National Wildlife Refuge, or Alaska State Parks and Reserve land. Although much of the Southeast and Southcentral old-growth forest land is legislatively protected, most of the remaining old-growth forest land contiguous to the legislatively protected forest land faces a low / negligible threat of management due to inaccessibility. These inaccessible, old-growth forest lands include BLM, native, and state ownership (Alaska Department of Natural Resources 2016).

Substantial amounts of logging have already occurred. After World War II, the USDA Forest Service signed three contracts with companies based in Ketchikan, Wrangell and Sitka.

The Tongass National Forest is of particular interest because of the significant amounts of old-growth forest that it contains. It covers nearly 6.75 million ha, although only about half of this is forested. About two thirds of the forested land comprises old growth. The old growth varies significantly within the forest, and a significant proportion of the highest volume stands has been harvested, particularly on Prince of Wales, Mitkof and Chichagof islands. Currently, only 97,000 ha of high-volume old growth is protected.

Fig. 17. Old-growth forests in the Tongass National Forest, Alaska.

A key piece of legislation related to forest management in the USA is the National Roadless Area Conservation Rule (Roadless Rule), passed in January 2001. The rule was introduced to protect the social and ecological values and characteristics of inventoried roadless areas from road construction and reconstruction and certain timber harvest activities. Inventoried roadless areas in the Alaska Region include 3.7 million ha (55 percent) of the Tongass National Forest and 2.2 million ha (99 percent) of the Chugach National Forest. The 2001 Roadless Rule generally prohibits construction or reconstruction of roads in inventoried roadless areas of the National Forest System, but with some exceptions. A USDA Forest Service Line Officer may authorize construction or reconstruction of a road in an inventoried roadless area if they determine it is needed for specific reasons, including some timber harvest. The Roadless Rule has been repeatedly challenged, and an exemption from the Rule existed for the Tongass National Forest from 2003 to 2011, but is currently in effect in the Tongass and Chugach National Forests. A process is now underway to develop a state-specific Alaska Roadless Rule that would open up areas of the Tongass National Forest, including old-growth forest, to economic development.

The 2016 Tongass National Forest Management Plan allows for the continued logging of old growth. Objective O-YG-02 states “During the 15 years after plan approval, offer increasing

annual volumes of economically viable young-growth timber. Old-growth timber harvest would gradually be reduced to an average of 5 million board feet (MMBF) annually, to support Southeast Alaska mills". The Plan thus indicates that there will be a transition from Old Growth to Young Growth harvesting, although a residual level (5 million board feet) of Old Growth harvesting will continue. In the Plan, the Forest has been divided into a number of Land Use Designations (LUDs), and each has been given separate objectives and management prescriptions. One of the designations is old-growth habitat, and the management prescriptions in the Plan are reproduced in Appendix 1. The Plan also contains provisions for the modification of Old Growth Habitat Reserves, and these are reproduced in Appendix 2.

There is a small amount of old-growth forest within Native and municipal ownership that may be threatened by forest management activities. This old-growth forest has no permanent logging protection, there is present potential for logging, especially on Native land, and there is road access. These old-growth forest areas are found mostly on the Kenai Peninsula and the nearby mainland (Lehnhausen 2009).

Fig. 18. Young-growth forest at Yakutat in the Tongass National Forest. Current management objectives indicate that there will be a transition from old growth to young growth in the period 2016 to 2031.

The US Forest Service continues to promote heavily subsidized logging of forests in the Tongass National Forest. In 2018, it planned to invest $3.1 million in new roads and spent more than $1

million in an environmental impact assessment to support a timber sale on Kuiu Island, west of Petersberg. A waiver was issued to allow the logs to be exported. It was estimated that the 31,320 m^3 sale would generate less than $200,000 in revenue. The sale didn't proceed as there were no bids, despite this being the second attempt to sell the timber.

The forest land spanning the Interior and Southwest regions has many different ownerships, including timberland and non-timberland managed by the State of Alaska, federal lands (e.g., National Parks, U.S. Military lands, Bureau of Land Management-administered lands, National Wildlife Refuges), privately-owned lands, municipal lands and native lands. State timberlands in the north of the Southcentral region do not include primary forest (Federal Register Alaska 2018).

All primary forests that are not legislatively protected and have road access are considered to be threatened by forest management activities. Although there is currently very minor management or no activity in these road buffer areas, these roads provide an established infrastructure for developing a larger scale and more robust timber industry. Primary forest land ownerships not legislatively protected are Bureau of Land Management (BLM), Indigenous, private, and municipal. Although the BLM does conduct some limited small-scale ecological forest management operations and limited timber management is conducted on native land for small scale, local uses such as house building or firewood, local facilities or transportation networks can potentially be developed to allow a more robust timber industry and more extensive timber management in this accessible area. All municipal and private primary forest lands are at a high risk due to accessible timber and minimal logging restrictions.

4.3 New Brunswick and Nova Scotia

The Acadian Forest Region covers these Maritime Provinces., where less than 1% of the total forest cover is old growth. In Nova Scotia there is a strong old-forest policy underpinned by a quantitative scoresheet, coordinator, and database. Nova Scotia does not have a specific regulatory framework to address old-growth forests. In August 2012, the Nova Scotia Department of Natural Resources (NSDNR) released *Nova Scotia's Old Forest Policy.* The policy covers a number of objectives, plans and guidelines, including the objective to establish and sustain an ecologically representative network of old forest and the designation of a Provincial Old Forest Coordinator. In section 6.1 of *Nova Scotia's Old Forest Policy,* the province commits to preserving eight percent of the land within each of Nova Scotia's 38 ecodistricts for old-growth conservation or restoration. Section 7.0 of the policy provides guidelines for selection of these areas, using an Old Forest Scoresheet. The scoresheet is used to evaluate quantitatively the biophysical conditions of potential old forest stands and to guide management practices.

The protection of old-growth forests in Nova Scotia is not mandatory and the regulatory framework does not ensure conservation. The protection is spatially implicit, but can be exchanged for others within the same ecodistrict in accordance with Procedures and Guidelines for Selecting Old Forest Section 7.1 of the Nova Scotia's Old Forest Policy. That said, according to

section 6.3, it is required that any "exchange or replacements of old forest stands be neutral or improve conservation of old forests and their associated ecological processes and biodiversity" (NSDNR 2012; p. 4). There is no guarantee that an area protected within the eight percent of each ecodistrict will remain protected in perpetuity unless it is designated a protected area.

Regulation of forests in Nova Scotia is primarily via the *Crown Lands Act* (1989), *Forests Act* (1989), and the *Wildlife Habitat and Watercourses Protection Regulations* under this Act, and the *Forest Enhancement Act* (1989). In New Brunswick and Nova Scotia the conservation targets are up to 8% on Crown land, but neither have a regulatory framework nor have evidence of achieving these targets.

New Brunswick does not have a regulatory framework to address old-growth forests. Forest management is addressed by the *Crown Lands and Forests Act* (NBDNR 1980) and administered by the Minister of Natural Resources. Protection of old-growth forests may be achieved through the *Protected Natural Areas Act* (NBDNR 2002) and the *Conservation Easement Act* (NBDNR 2011) with the Minister of Natural Resources being responsible for the administration of these statutes as well.

The *Crown Lands and Forests Act* uses a licensing approach to manage forestry activity on Crown land. Any Crown land managed under a timber license agreement is required to be certified under a third party, the Forest Stewardship Council (FSC), Sustainable Forest Initiative (SFI), or Canadian Standards Association (CSA). However, there are differences in the priorities and criteria for certification among these certification bodies, particularly with regard to the protection of old-growth forests (Sample *et al*. 2003). The *Crown Lands and Forests Act* in New Brunswick does not specifically contemplate the protection of biodiversity or old-growth forests. It does, however, mandate that "objectives" for use of the land be set in the forest management agreement. In New Brunswick, the protection of old forests is driven by vertebrate wildlife species (NBDNR 2013), and although the current policy incorporates scientific and ecological knowledge, it neglects to take into account other values associated with old-growth forests.

Fig. 19. Riparian management zone, Halifax, Nova Scotia.

4.4 United Kingdom

The United Kingdom Government (2020) defines an ancient woodland as a woodland that has existed continuously since 1600 AD or before in England, Wales and Northern Ireland or 1750 AD in Scotland. The term ancient woodland is used to describe an area of forest or woodland that has existed continuously for a long period of time. They tend to contain old trees, but most have been subject to varying levels of management, sometimes documented for almost 1000 years (many ancient woodlands are documented in the Domesday Book of 1086). Management practices included the exercising of variety of common rights, such as pannage (releasing pigs to feed on acorns and beech mast), estovers (the collection of wood) and turbary (cutting turf or peat). They sometimes involved the modification of trees, especially the use of coppicing and pollarding. Between the 1930s and the early 1980s nearly 40% of ancient semi-natural woodlands were converted into plantations, most of which were of non-native coniferous species. Other woodlands have been colonised by invasive non-native species such as rhododendron and sycamore (Forestry Commission 2003). The conversion of broad-leaved woodlands was actually encouraged by the *Forestry Act* 1951: it foresaw the disappearance of deciduous broad-leaved woodlands and their replacement by conifer plantations.

Once covering vast areas of the UK, ancient woodlands currently span just 2.4% of the UK (Woodland Trust 2020). Recognizing the importance of ancient woodland, the UK Government introduced the Broadleaves Policy in 1985 (Aldhous 1997). Many woodlands in Britain are regarded as PAWS (Plantations on Ancient Woodland Sites). In recent years there has been considerable interest in identifying and prioritising these sites under coniferous plantation for conversion back to native woodland species. Such restoration could increase the cultural value, heritage value and biodiversity of the site in question. Greater impetus has arisen from restoration targets within the native woodland Habitat Action Plans (HAPs) and the requirements of UK Woodland Assurance Standard (UKWAS).

Fig. 20. Beech woodland in the New Forest, Hampshire, England. Woodlands such as this may contain old trees, but have been managed as forests for almost 1000 years.

The *UK Biodiversity Action Plan* includes targets to restore substantial areas of these Plantations on Ancient Woodland Sites (PAWS) back to native woodland by 2020. While the complete reinstatement of past conditions was not a realistic target, the UK Government has initiated a substantial number of restoration programmes, with most activity so far being concentrated in former native pinewoods, upland oakwoods and lowland mixed broadleaved woods. Financial support, such as European 'LIFE Nature' funding, has contributed significantly to existing achievements. In most circumstances the aim of restoration is to create the conditions needed to promote the development of native woodland over the longer term. The practical guide issued by the Forestry Commission on "*Restoration of Native Woodland on Ancient Woodland Sites*"

provide advice to owners and managers on the restoration of those ancient woodland sites which were planted predominantly with non-native species since the 1930s. Policies, programmes and mechanisms for restoration are developed at country level.

This UK government has issued its policy towards woodlands and trees by re-emphasising their value, evaluating threats and opportunities and setting out a range of actions to improve their protection and quality (DEFRA 2019). This policy is a framework under which specific initiatives, projects and delivery measures are being developed. An Action Plan is designed to deliver tangible change in the way woodlands and wooded landscapes are used and perceived. The Forestry Commission acts as the lead body, but it also involves action from many other sectors of Government, statutory agencies and non-governmental organisations, and private and other woodland owners.

4.5 Australia

In Australia, Regional Forest Agreements (RFAs) safeguard biodiversity, old-growth forests, wilderness and other natural and cultural values. This is achieved through the Comprehensive Adequate and Representative (CAR) reserve system and through ecologically sustainable forest management outside of reserves (Australian Government 2020):
The CAR reserve system is based on three principles:

- including the full range of vegetation communities (comprehensive)
- ensuring the level of reservation is large enough to maintain species diversity (adequate)
- conserving the diversity within each vegetation community, including genetic diversity (representative).

The CAR reserve system is based on nationally agreed criteria, also known as the 'JANIS' criteria. Under the CAR reserve system, it is necessary to approach old growth criteria in a flexible manner according to regional circumstances, especially when forest ecosystems are still relatively widespread and retain large areas of old growth. Interestingly, old growth was not consistently defined in government documents in the early 1990s. Lindenmayer (2009a) has examined this in some detail. The resource Assessment Commission (Resource Assessment Commission 1992) considered that old-growth forests have nigh conservation and intangible values, defining it as "both little disturbed and ecologically mature" (p. 29). The National Forest Policy Statement (Commonwealth of Australia 1992) defined old growth as "forest that is ecologically mature and has been subject to negligible unnatural disturbance … in which the upper stratum or overstorey is in the late mature or overmature growth phases". This differs from the definition adopted by the regional Forest Agreement process, which defined old growth as "ecologically mature forest where the effects of disturbances are now negligible (Commonwealth of Australia and Department of Natural Resources and Environment 1997).

Wherever possible, areas of old growth requiring protection should be included in the area identified to meet biodiversity criteria (Ministerial Council on Forestry, Fisheries and Aquaculture 1997).

1. Where old-growth forest is rare or depleted (generally less than 10% of the extant distribution) within a forest ecosystem, all viable examples should be protected, wherever possible. In practice, this would mean that most of the rare or depleted old-growth forest would be protected. Protection should be afforded through the range of mechanisms described in section 4.
2. For other forest ecosystems, 60% of the old-growth forest identified at the time of assessment would be protected, consistent with a flexible approach where appropriate, increasing to the levels of protection necessary to achieve the following objectives:

- the representation of old-growth forest across the geographic range of the forest ecosystem;
- the protection of high quality habitat for species identified under the biodiversity criterion;
- appropriate reserve design;
- protection of the largest and least fragmented areas of old growth;
- specific community needs for recreation and tourism.

The way in which a reserve is designed can influence the protection of conservation values, and efficiency and effectiveness of subsequent management for conservation. However, reservation alone may not ensure conservation of biodiversity or other natural and cultural values, and active management may be required to ameliorate threatening processes (such as wildfire) and ensure that the reserve system retains the biodiversity and other values of old-growth forest, for which it was established. Such management may involve the use of specific fire regimes, and even managed disturbance or selective reduction of certain populations.

In Australia, concerns over the maintenance of old-growth forests have been closely linked to concerns over the maintenance of native forests. Many native forests have not been previously harvested, but have been subject to natural disturbances such as wildfires. There is a long and complex history of interaction between rainforests and sclerophyll forests, and the extent to which natural forests have been altered by Indigenous peoples over the past 60,000 years is strongly debated. In most areas, sclerophyll forests (dominated by eucalypts) are maintained by fires, as the fires eliminate any rainforest species that might have successfully established in the understorey. With fire suppression, rainforest species may gradually replace the sclerophyllous species, resulting in significant changes in the flora and fauna of the forest.

As sclerophyllous forest appears to be a successional state, designating old-growth areas within them has been problematic. In wetter areas, if fire is excluded, many will change to rainforest. In drier areas, fire exclusion increases the risk of catastrophic wildfire due to the build-up of fuels. This problem is recognized by Lindenmayer (2009a) who argues that the criteria used to identify old-growth forests to not work well for Mountain Ash (*Eucalyptus regnans*) as it is rarely without

any form of disturbance. The old-growth stands are often characterized by overstorey eucalypts with multiple ages (Lindenmayer *et al*. 2000). Such structures indicate the survival of some pre-disturbance trees.

Fig. 21. Mountain ash in Tarra Bulga National Park, Victoria, Australia. This is an example of older sclerophyllous forest. The trees are all about 200 years old, and developed following a stand-replacing fire.

A second issue, and one that is highly pertinent to any discussion of old-growth forests, is that stands of old-growth Mountain Ash often develop as a result of major, stand-replacing disturbances such as wildfire. These disturbances can occur in the absence of human activities (Attiwill 1994). A third issue is the scale, it is possible to have an old-growth tree surrounded by other old-growth trees in a landscape dominated by old trees. However, it is also possible to have an old-growth tree standing alone in a regrowth-dominated patch. Even a single tree may provide important habitat for some species.

Lindenmayer (2009a) also points out another feature of old growth. Most definitions focus exclusively on the overstorey, and this is also what most people associate with old growth. However, it is possible that the understorey plants such as tree ferns (*Dicksonia antarctica* and *Cyathea australis*) in a mountain ash forest may be 350 years old while the overstorey consists of regrowth that is much younger (Mueck *et al*. 1996).

Lindenmayer (2009b) therefore developed some different criteria for the identification of old-growth mountain ash stands. Old-growth stands were considered to have the majority (>70%) of living overstorey trees exceeding 180 years in age. At this age, the trees had characteristics associated with old growth: they were large (>1 m dbh) and most contained hollows. Even small stands of such trees can be important, forming foci for the expansion of the area of late-successional forest in order to protect arboreal marsupials (McCarthy and Lindenmayer 1999).

Fig. 22. Sub-tropical old-growth rainforests in Dorrigo National Park, New South Wales, Australia.

While the approach to conserving old growth in Australia has involved a detailed process, the wildfires of 2019–2020 revealed a major weakness:

4.6 New Zealand

The situation in New Zealand is very different to most other jurisdictions examined in this report. Significant changes to the flora and fauna occurred after the arrival of the Maori about 1100 years ago. In drier and higher regions, forests were replaced by tussock grasslands whereas in milder, moister parts, they were replaced by bracken fern (*Pteridium esculentum*). The grasslands and and fernlands maintained with repeated fires. The changes accelerated dramatically following European colonization (primarily from Britain), starting in ca. 1830, with the introduction of crops, introduced grasses (and use of fertilizers), exotic conifer plantations, sheep and cattle,

massive naturalization of exotic plants (and birds and animals), and extraction of timber. Despite these changes, native vegetation still covers about 60% of New Zealand.

The history of forests and forestry on the West Coast provide an example of a trajectory in forest development. The first sawmill established in 1865, producing lumber for local use. Silver pine (*Manoao colensoi*) and totara (*Podocarpus totara*) were used first, but later the demand shifted to kahikatea (*Dacrycarpus dacrydioides*) and rimu (*Dacrydium cupressinum*). The timber industry gradually grew in importance, and by the time the New Zealand Forest Service was established in 1919, it was a major employer on the west coast. The Forest Service was given the task of planting exotic conifers, with the first exotic conifers planted on the West Coast in 1928. However, in 2000, virtually all logging of native forest was halted, with the country instead relying instead on plantations of radiata pine and imported wood for its timber supply. The steps leading up to the decision are described in Chapter xx.

4.7 Sweden

The long history of human use and intensive forest management in Sweden has had severe impacts on forest ecosystems, resulting in remnant natural forests with threatened natural biodiversity. Approximately 60% of Sweden is forested, covering an area of 23 million hectares (McEachern and Gray 2020). There are three main forest types: northern coniferous forest (boreal), southern coniferous forest (hemiboreal) and southern deciduous forest (nemoral). The two dominant indigenous coniferous species are Norway spruce and Scots pine, which presently account for 83% of the standing volume of Sweden's forests. Birch and aspen are found throughout Sweden, and oak, beech, and ash are found in the south. Ninety-five percent of Sweden's forested land is currently being used for commercial forestry purposes.

The situation in Sweden partly reflects its history. By the 17th and 18th centuries, forests had been severely depleted throughout the country (Wieslander 1936). This resulted in major efforts to reforest and improve productivity. Some recognition was given to the need for nature protection (Aminoff 1951), including setting aside retention trees and small remnants on sites with poor forest production, leaving riparian strips and favouring deciduous trees near settlements. As knowledge of the requirements for conservation grew, scientific arguments for the protection of nature were developed (e.g. Ahlén 1977, Ahlén *et al*. 1979). This resulted in changes such in the amount of coarse woody material left in the forest after harvesting (Aldentun and Sondell 1991), as well increases in the retention of individual and groups of trees and edge zone habitats. These changes were the result of a massive education programme aimed at forestry staff working in public authorities, private companies and for private owners (Persson 1990, Sandström 1991). In 1994, a new forest policy was introduced with the goal of managing forests in such a way as to produce a sustainable yield of wood products while maintaining biological diversity.

There are approximately 350,000 private landowners in Sweden with an average woodlot size of just under 50 hectares (Skogsindustrierna 2001). Private landowners hold 51% of Sweden's forests and account for 60% of roundwood production. About 25% of the Swedish forest land is owned by companies, with the largest being SCA, Holmen Skog, Bergvik Skog and Korsnäs.

Bergvik Skog was formed in 2004 when Bergvik acquired all of Stora Enso's and Korsnäs' former forest holdings in Sweden. The Swedish state owns about 20 percent of the Swedish forest land through the state forest company Sveaskog, the National Property Board and the Swedish Fortifications Agency (for defensive purposes). The National Property Board primarily owns sub-alpine forest in the northwest of Sweden. The largest state landowner is Sveaskog, which holds about 3.3 million hectares of productive forest land. The Swedish Environmental Protection Agency owns 1.1 million hectares of land, much of which lies in mountain areas, national parks and nature reserves in the north of Sweden. The remaining forest land is owned by others, including municipalities and the Swedish Church.

Consolidation within Sweden's forest industry between 1980 and 2000 resulted in fewer private companies owning the land and a reduction in the number of pulp, paper and saw mills. The amount of older forest has drastically declined because stands are harvested as soon as they are mature. As a result, less than 5% of Sweden's forests are classified as old growth. The remaining old-growth patches are generally very small (less than a couple of hectares). Forest companies continue to log old-growth forests and other forests with high conservation values.

Sweden has very little productive forest that is formally protected – the current figure is about 3%. Protection types include national parks, nature reserves, habitat protection areas and by nature conservation agreements. The protection is very unevenly distributed, with about 40% of subalpine coniferous forest protected, <0.5% of other northern forests and about 0.1% of southern forests. Only about 1.5% of productive forests outside mountain zones are protected. Over 1 800 animal and plant species in Swedish forests are red-listed. Many of these are dependent on old trees, dead wood and deciduous trees (Berg *et al*. 1994), features that have become so rare in some areas that even old stumps may be protected.

Fig. 23. A protected tree stump in an operational broad-leaved (beech) forest in southern Sweden. Features such as this are sufficiently rare to warrant protection.

The steps needed to conserve old growth forests in Sweden have been described by Angelstam and Pettersson (1997). They advocate first identifying stands with high conservation value, or potential value (e.g., particularly old, and/or diverse tree species composition, large volumes of dead wood), and recording these on maps. They then suggest visiting these stands to assess their actual conservation value. They should then be assessed in relation to their position within the landscape, especially in relation to existing roads and the position of other forest stands with high conservation value. They also suggest prioritizing stands located close to high quality core areas.

The Key Woodland Habitats initiative was designed as a response to the low amount of high-quality forest habitat formally protected in Sweden. These are areas that either contain or are expected to contain red-listed species or otherwise threatened taxa (Gustafsson *et al*. 1999). The majority are located on private land and are typically 0.5 to 5 ha in area. Many contain large quantities of dead wood, old large-diameter trees and multi-aged stands (Gustafsson 2000). A recent report entitled “The old-growth forests threatened by the Swedish state” by Protect the Forest Sweden and Greenpeace Sweden alleges that Sveaskog, Sweden's largest forest owner, and a government-owned company, has deregistered known woodland key habitats (Greenpeace 2020).

As in many jurisdictions, there are mixed reports about the extent and effectiveness of conservation efforts in Sweden. It is evident that forestry has had massive impacts on forests, and more than 90% of the forest area has been affected by forestry activities. This means that old growth conservation is primarily concerned with protected the few remaining areas of old growth, and encouraging the restoration of old-growth characteristics in areas already impacted. Sveaskog claims to have a number of strategies in place. In particular, the company claims to conduct nature conservation initiatives on 624,000 ha (20% of their operational area). The conservation initiatives are aimed at increasing the proportion of old forest while creating more varied and species-rich forests. The initiatives occur at three scales: individual trees in production forests, widespread forest areas of major significance to forest fauna and flora, and entire forest landscapes with high natural values. This is expressed as:

- general consideration for nature in the production forests
- nature conservation forests i.e. forests used for nature conservation
- ecoparks i.e. large forest landscapes where nature conservation takes precedence over commercial interests.

“Nature consideration” in Sveaskog’s production forests covers an average of 9% (i.e. a nature conservation area of 250,000 ha). The focus is on what to leave behind after harvesting, and may include riparian strips, stands of old growth or other features considered to be of value to nature conservation.

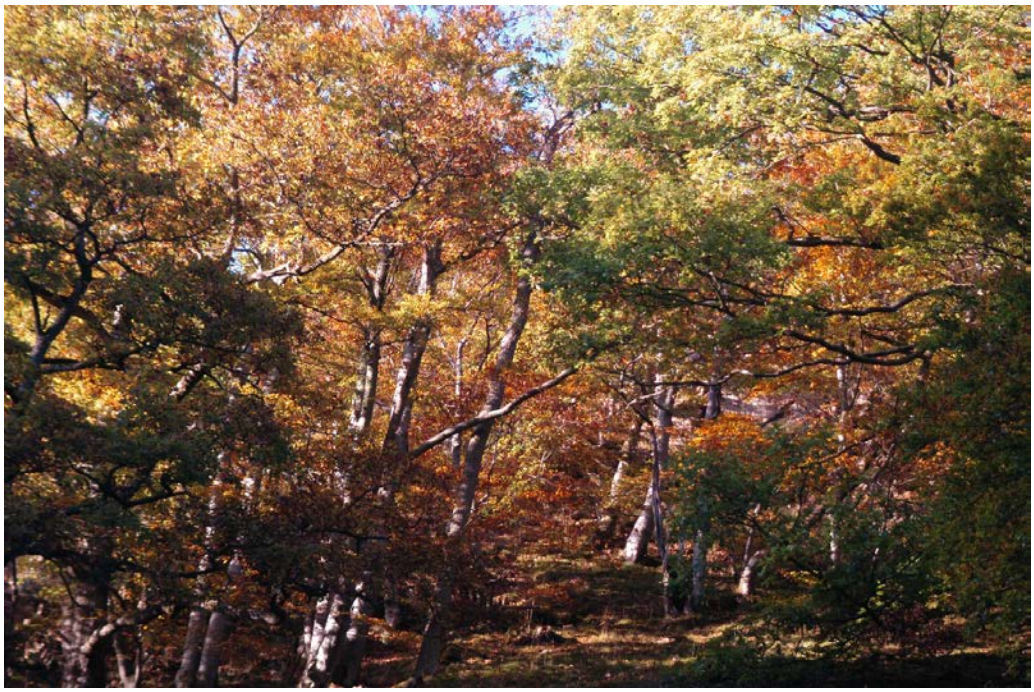

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Fig. 24. Beech forest, southern Sweden. Attempts are being made to restore old-growth conditions in forests such as this.

Nature conservation forests are Sveaskog's largest initiative in the field of nature conservation strategy (in terms of size). They total about 300,000 ha, namely 10% of Sveaskog's productive forest land below the montane region and outside the ecoparks. They vary in size from half a hectare to several hundred hectares. There is no production-focused forestry within the conservation forests, but some management occurs aimed at enhancing the natural values. The nature conservation forests include restoration forests, forests with the ecological potential for future high natural values that are lacking in Sweden. These include hardwood and deciduous forests.

The third scale of activity involves ecoparks, large contiguous forest landscapes with major natural values. Their average size is about 5,000 ha. They all have unique ecological characteristics. There are 37 ecoparks, corresponding to 5% of Sveaskog's productive forest land, or a total of 156,000 ha. Over 100,000 hectares are protected as pure nature conservation areas through legally binding 50-year ecopark agreements with the Swedish Forest Agency. The ecoparks also contain several important recreational forests that provide opportunities for increased eco-tourism.

Fig. 25. Interior of an old-growth Norway spruce (*Picea abies*) forest in Karelia, western Russia. Late-successional forests in Russia are frequently used as a model for Swedish forests, as there

are almost no old-growth areas left in Sweden. However, the disturbance history of these forests is often virtually unknown.

5 Monitoring changes in old growth

Many jurisdictions around the world have committed to detailed forest monitoring, although in practice many default on the requirements. Many of the jurisdictions examined in this report are part of the Montréal Process (https://www.montrealprocess.org/), which has a set of criteria and indicators to guide reporting. However, as Chandran and Innes (2014) have discussed, very few countries are adhering to the guidelines, with only a few of the members publishing regular state of the forest reports.

Reporting of old-growth forests under the Montreal process should come under Criterion 1, *Conservation of Biological Diversity*. There are three indicators under the theme of ecosystem diversity, namely:

> 1.1.a Area and percent of forest by forest ecosystem type, successional stage, age class, and forest ownership or tenure
>
> 1.1.b Area and percent of forest in protected areas by forest ecosystem type, and by age class or successional stage
>
> 1.1.c. Fragmentation of forests

In theory, this should enable the area of old-growth forests in each jurisdiction to be tracked over time. British Columbia last published a 'State of the Forests' report in 2010, before moving to an online format in 2012. The current reporting (available at https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/reporting/environmental-reporting-bc/previous-reports-indicators) does not include any reporting on the area of old-growth forest in British Columbia. Similarly, national reports do specify the area of old-growth forest.

In Australia, the federal government has been publishing 'State of the Forest' reports every five years (1998, 2003, 2008, 2013, 2018). This includes Indicator 1.1b Area of forest, by growth stage. Four classes of growth stage are recognized: regeneration (<20 years since disturbance), regrowth (20-80 years since disturbance), mature (80 or more years since disturbance), and senescent (various ages after 80 years since disturbance, with irregular crowns forming). The categories can be applied to even-aged forests, but are less applicable to mixed age forests, such as some drier eucalypt forests, rainforests and open acacia woodlands.

Growth stage information was collected in 1995-2000 as part of the Comprehensive Regional Assessments completed in 11 forested regions of five states in preparation of the regional Forest Agreements. The information covered 15.4 million ha of the forest area of Australia. It has not been updated since then, except for Tasmania.

Old-growth forests are not defined on the basis of time since disturbance, and are instead defined by stand structure and ecological features. They comprise a subset of areas of mature and senescent forest (Pitman *et al*. 1996, Davey 2018). Old-growth forests were mapped in the same areas and at the same time as the growth stage information in 1995-2000, with 5 million ha being identified in the RFA regions. There has been no survey of old-growth forest since that period, although there have been occasional studies in specific localities (e.g. for jarrah (*Eucalyptus marginata*) and karri (*Eucalyptus diversicolor*) in Western Australia. Old growth is known to have diminished in the period: 413,000 ha in Victoria were lost to bushfires in 2003, 2007 and 2009, 13,000 ha in Western Australia was lost to harvesting (prior to 2001), improved mapping, bushfire and disease, 33,000 ha in Tasmania were lost to harvesting, bushfire and conversion to plantations and agricultural land. The impact of the 2019-2020 bushfires has yet to be assessed, but is likely to be very substantial.

In the United Kingdom, the Nature Conservancy Council (and it then was) launched an Ancient Woodland Inventory project in 1981. It was continued by its successor, English Nature, in 1991, and was then integrated into the National Digital Archive of Datasets in 2001-2002. Approximately 52,000 sites have been identified, many of which are isolated and fragmented. The information is available at: https://data.gov.uk/dataset/9461f463-c363-4309-ae77-fdcd7e9df7d3/ancient-woodland-england. Following devolution, separate inventories are now maintained for England and Wales, with Natural Resources Wales being responsible for the Welsh inventory (https://naturalresources.wales/evidence-and-data/research-and-reports/ancient-woodland-inventory/?lang=en).

The most detailed plan for monitoring old-growth forests was developed under the auspices of the Northwest Forest Plan in the northwest USA (Hemstrom *et al*. 1998). This report addressed a number of questions, specifically

- How much late-successional forest is there on federal land?
- What is the pattern across the landscape?
- Is the amount of late successional and old growth (LSOG) forests on Federal land changing?
- If so, from what causes and at what rates?
- Is the Northwest Forest Plan providing for conservation and management of LSOG forests as anticipated?

The authors proposed that a monitoring report be prepared every five years describing the status and trend of LSOG forests in the Northwest Forest Plan area. They proposed that a panel of experts would review the report and provide recommendations to regional interagency executives. This has actually happened, with peer-reviewed reports being published every 5 years (e.g. Moeur *et al*. 2005, 2011, Davis *et al*. 2015). Other monitoring reports cover northern spotted owl habitats (Davis *et al*. 2016), northern spotted owl populations (Dugger *et al*. 2015) marbled murrelet population and habitat trends (Falxa and Raphael 2016), amongst others. A 25-year report is planned for next spring. The key findings are shared with interagency executives through the Regional Interagency Executive Committee (RIEC). Monitoring leads

present findings to the Senior Managers Group and RIEC for consideration. Public outreach is also important, with public and partner webinar or meeting to share the findings.
The monitoring team has developed maps using several definitions, although two are now being used to assess changes in the forest. The first relates to forests older than 80 years (OGSI-80) that are considered to have a structure similar to mature, late-successional and old-growth forests in the region. The second relates to forests older than 200 years (OGSI-200) that represents forests that have progressed past maturation and have developed the structures commonly found in the later stages of succession and which are associated with the old-growth stage. The OGSI refers to an Old Growth Structure Index developed by Spies and Franklin (1988) that uses (1) density of large live trees, (2) diversity of live tree size classes, (3) density of large snags, and (4) percentage of cover of down woody material. The methodology is explained in detail by Davis *et al*. (2015).
Their work showed there has been a small decrease (2.8-2.9%) in the amount of older forests on federal lands managed under the Northwest Forest Plan (NWFP). Gross losses included 4.2-5.4% due to wildfire, 1.2-1.3% due to timber harvest and 0.7-0.9% due to insects and other causes. These have been partly compensated by recruitment into the two age classes. Decadal gross losses of about 5% per decade as a result of timber harvesting and wildfire were expected. Wildfire losses were as expected, whereas losses due to timber harvesting were lower than expected. Wildfire losses were not evenly distributed, meaning that some portions of the landscape are losing older forest faster than others.

A valid monitoring programme might also start to fill in some of the gaps in our knowledge about late-successional and old-growth forests. It might also help determine the differences in value between "young" and "old" old growth. We have made little progress since Lertzman *et al*. (1997, p. 375) commented:

> "We have just begun to understand the dynamics within late-successional ecosystems. Forests are routinely labeled old-growth whether they are 200 or 1000 years old, yet we know that substantial structural and compositional change occurs between these ages. Relatively little is known about changes in soil biology that occur late in succession, for instance, or about changes in the forest canopy structure and canopy biodiversity. Some general ideas have been proposed about the dynamics of late-successional forests vary across landscapes and over the temperate rain forest region as a whole, but the details of this variation have not been described. The role of late-successional remnants in the recovery of disturbed landscapes is a problem of obvious importance, but one about which we know almost nothing".

6 Conclusions

There is a common understanding that there are important spiritual, aesthetic, wildlife, and environmental values associated with old-growth forests, and the area of such forests is declining. As the area of old-growth forest declines, forestry in regions that still have extensive old forests is beginning to adapt, or has had imposed on it by society an old growth management paradigm to replace the conversion paradigm of the past. This is expressed both in the establishment of forest reserves and restoration of native woodland, among others. This research provides a comparative analyses of old growth management strategies in jurisdictions with extensive old-growth forests.

British Columbia uses Old Growth Management Areas as a mechanism to protect or attain old-growth forests. This is achieved through integrated Forest Stewardship Plans that promote the retention of old-growth forests as legally enforceable tools for licensees in Old Growth Management Areas. A large amount of older forest in the US Pacific Northwest is susceptible to catastrophic wildfires. On moist forest sites in the US Pacific Northwest, the old growth management strategy calls for retaining older forests on such sites as well as commercial thinning in plantations to increase structural complexity. On dry forest sites, the strategy calls for restoring and maintaining natural ecological conditions with a network of dense patches in treated landscapes, tailored to the situation and wildlife species of interest.

Alaska contains large sections of intact forest land and undisturbed old growth and all old-growth forest land in Alaska's Southeast region, and the majority in the Southcentral region, is owned by the federal government. Most of these forests are effectively protected from management activities due to being located entirely within one or a combination of protected areas. There is a small amount of old-growth forest that may be threatened by forest management activities.

Nova Scotia and New Brunswick do not have a specific regulatory framework to address old-growth forests. However, in Nova Scotia, there is a strong old forest policy underpinned by a quantitative scoresheet, coordinator, and database. In New Brunswick, protection of old-growth forests may be achieved through legislative provisions in the *Protected Natural Areas Act* and the *Conservation Easement Act Crown Lands Act*. Nevertheless, there is no evidence that either province has achieved the old growth conservation targets of 8% on Crown land.

In Australia, the CAR reserve system is made up of dedicated reserves, informal reserves and areas within production forests where values are protected by prescription. The 'JANIS criteria' included specific targets for old-growth forests for each forest ecosystem. The criteria provided for 100 per cent reservation of old-growth forests that are rare or depleted.

The UK Government has initiated a substantial number of programmes of to restore substantial areas of Plantations on Ancient Woodland Sites (PAWS) back to native woodland with significant financial support. Finally, in Sweden, a few large forest companies own a large proportion of the land where they continue to log old-growth forests and as a result these companies have been a target for environmental NGOs.

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Appendix 1.

Management prescriptions for the Land Use Designation of Old Growth Habitat, as laid out in the Tongass National Forest Management Plan.

Goals

Maintain areas of old-growth forests and their associated natural ecological processes to provide habitat for old-growth associated resources.

Manage early seral conifer stands to achieve old-growth forest characteristic structure and composition based upon site capability. Use old growth definitions as outlined in Ecological Definitions for Old-growth Forest Types in Southeast Alaska (R10-TP-28).

Objectives

Provide old-growth forest habitats, in combination with other LUDs, to maintain viable populations of native and desired non-native fish and wildlife species and subspecies that may be closely associated with old-growth forests.

Contribute to the habitat capability of fish and wildlife resources to support sustainable human subsistence and recreational uses.

Maintain components of flora and fauna biodiversity and ecological processes associated with oldgrowth forests.

Allow existing natural or previously harvested early seral conifer stands to evolve naturally to oldgrowth forest habitats, or apply silvicultural treatments to accelerate forest succession to achieve oldgrowth forest structural features. Consider practices such as thinning, release and weeding, pruning, and fertilization to promote accelerated development of old-growth characteristics.

To the extent feasible, limit roads, facilities, and authorized uses to those compatible with old-growth forest habitat management objectives.

Desired Condition

All forested areas within this LUD have attained old-growth forest characteristics. A diversity of oldgrowth habitat types and associated species and subspecies and ecological processes are represented.

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Allow administrative and recreational facilities when compatible with LUD objectives.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards for this LUD, such as soil and watershed concerns.

Fuel Improvements: FIRE2

Prescribed Fire

A. Allow management-ignited prescribed fire only where its use maintains old-growth characteristics.
B. As a general management practice, do not use prescribed natural fire. (Consult FSM 5142.)

FISH

Fish Habitat Planning: FISH2

A. Emphasize the protection and restoration of fish habitat, fish production, and aquatic biodiversity. Enhancement projects that may change the natural distribution of fish species within a watershed are consistent with LUD objectives.

FOREST HEALTH

Forest Health: HEALTH1

A. Insect and disease management measures consistent with this LUD may be implemented to protect the old-growth forest component and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.

1. Identify, classify, and evaluate known heritage resources.

2. Identify heritage properties to be nominated to the National Register of Historic Places.

3. Identify heritage properties that require stabilization or other protective measures.

4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Permit only improvements (such as tent platforms, fish weirs, minor waterlines, minor powerlines, etc.) that are compatible with LUD objectives.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and Forest Service Mining Regulations 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Mineral Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. Manage recreation and tourism use to meet LUD objectives for fish and wildlife resources and habitat.

1. Design and locate recreation-related structures to be compatible with habitat needs of old-growth associated species.

B. Generally provide for Semi-Primitive ROS settings, recognizing that more developed settings may be present due to authorized activities, existing use patterns, and activities in adjacent LUDs.

C. Designation of motorized routes for off-highway vehicles is generally not allowed. Designation may only occur where documented local traditional use has occurred and the route does not degrade water quality or flow.

Recreation Special Uses

A. Minor recreation and tourism developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Apply Forest-wide Standards and Guidelines for High Scenic Integrity Objective. Design activities to not be visually evident to the casual observer.
B. Exceptions for small areas of non-conforming developments, such as recreational developments, transportation developments, log transfer facilities, and mining development, may be considered on a case-bycase basis. Use designs and materials that are compatible with forms, colors, and textures found in the characteristic landscape.

SOIL AND WATER

Watershed Resource Improvements: SW4

A. Undertake watershed improvements only where deteriorated soil and hydrologic conditions create a threat to the goals and objectives for which the old-growth habitat is managed. Rehabilitation or stabilization projects will seek to enable the area to retain its natural appearance.

TIMBER

Timber Resource Planning: TIM4

A. Old-growth forest land is classified as not suitable for timber production.
B. Beach log salvage is compatible with this LUD.
C. Avoid Old-growth Habitat areas when other feasible locations for personal use sawtimber, firewood, and Christmas tree cutting are available. If personal (free) use timber harvest is allowed, personal use permit requirements must satisfy LUD objectives (refer to Chapter 4, Personal Use Program, Section TIM4). Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are unsuitable for timber harvest to ensure that the LUD objectives are fulfilled.
D. Harvest of bridge stringer logs is allowed.

Timber Sale Preparation: TIM5

A. Salvage of dead or down material is permitted, but is limited to roadside windfall and hazard trees immediately adjacent to existing permanent roads and catastrophic windthrow events or large insect or disease outbreaks (generally exceeding 100 acres). Limited standing undamaged timber (up to 20 percent of total salvage) may be removed only for safety reasons or for feasibility of salvage operations. Salvage sales must be compatible with LUD objectives as determined through the environmental analysis process. Stands once salvaged will be managed to achieve old-growth habitat characteristics. During the environmental analysis, consider the scale of the affected area salvaged. If reserve design criteria are no longer met, adjust reserve locations to better meet reserve size, spacing, and composition criteria if lands are available (see Wildlife Habitat Planning, section B below, and Appendix K).

TRANSPORTATION

Transportation Operations: TRAN

A. New road construction is generally inconsistent with Old-growth Habitat LUD objectives, but new roads may be constructed if no feasible alternative is available.

1. Perform integrated logging system and transportation analysis (including Access and Travel management planning) to determine if other feasible routes avoiding this LUD exist during the project environmental analysis process. If no feasible alternative routes exist, locate, design, and construct roads in a manner that minimizes adverse impact to fish and wildlife resources to the extent feasible, and will be compatible with LUD objectives. Keep clearing widths to the minimum feasible. Consider enforcement costs of road closures in the integrated logging system and transportation analysis.

2. If reserve design criteria are no longer met, adjust reserve locations to meet reserve size, spacing, and composition criteria if lands are available (see Wildlife Habitat Planning, section B below, and Appendix K).

3. For timber salvage, use logging systems that do not require additional permanent road construction.

B. Manage existing roads to meet LUD objectives.

1. In Old-growth Habitat LUDs with existing roads, develop or update road management objectives to meet LUD objectives (see Wildlife [brown bear and wolf] and

Transportation Forest-wide Standards and Guidelines). Use of existing roads may continue pending the update of the access and travel management plan.

2. Road management objectives may include temporary or permanent road closures, and may be specific to individual road specification types (e.g., keep mainlines open, close arterial and spur).

3. Road maintenance and reconstruction may be permitted if consistent with road management objectives.

C. Sites for log transfer facilities are generally not appropriate in this LUD. If no other feasible alternative sites exist, locate, design, construct, and manage these facilities in a manner that will be compatible with LUD objectives. Consider the Log Transfer Facility Guidelines (Appendix G) when making the selection for the facility.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Maintain contiguous blocks of old-growth forest habitat in a forest-wide system of old-growth reserves to support viable and well-distributed populations of old-growth associated species and subspecies.
B. A system of large, medium, and small old-growth habitat reserves has been identified and mapped in the Forest Plan as part of the Old-growth Habitat Conservation Strategy. The mapped large and medium reserves generally achieve reserve strategy objectives, and few major modifications are anticipated. The small mapped reserves have received differing levels of ground-truthing and integration of site-specific information in their design. During project-level environmental analysis, for projects areas that include or are adjacent to mapped old-growth habitat reserves, the size, spacing, and habitat composition of mapped reserves may be further evaluated (consult Appendix K).

1. Adjust reserves not meeting the minimum criteria to meet or exceed the minimum criteria.

2. Reserve location, composition, and size may otherwise also be adjusted. Alternative reserves must provide comparable achievement of the Old-growth Habitat LUD goals and objectives. Determination as to comparability must consider the criteria listed in Appendix K.

3. Adjustments to individual reserves described in 1 and 2 above are not expected to require a significant plan amendment. Adjustments Forest-wide shall be

monitored yearly to assess whether a significant plan amendment is warranted on the basis of cumulative changes.

C. Allow previously harvested or natural early seral stands to develop into old-growth, or provide young-growth management to accelerate attainment of old-growth characteristics (see WILD2, below).

Wildlife Habitat Restoration: WILD2

A. Manage early seral forest stands for purposes of wildlife habitat development. Allow techniques such as thinning, pruning, and planting to accelerate development of advanced seral stand structure, including maintenance of shrub and forb understory

Appendix 2.

Old-growth habitat modification procedures as described in Appendix K of the Tongass National Forest Management Plan.

Appendix K

Old-growth Habitat Reserve Modification Procedures

Introduction

This appendix describes criteria for changing the boundaries of old-growth reserves (OGRs) at the project level as described in the Old-growth Habitat Land Use Designation (LUD) Standards and Guidelines (Wildlife section). For a complete review of the Conservation Strategy, including assumptions for the design of the OGR system, refer to Appendix N of the 1997 Final EIS and Appendix D of the 2008 Final EIS.

Significant modifications to OGRs (e.g., in the case of a land exchange) require consideration of other factors outside the scope of this appendix. Factors include connectivity, size, and shape of the reserve, as well as basic assumptions behind the location of the reserves. Some activities (i.e., major land conveyance or substantial timber harvest in non-development LUDs) could significantly affect the integrity of the Conservation Strategy. In this case, an overall review of the effects on the Conservation Strategy would be necessary. These activities are anticipated to be infrequent events.

Review of OGRs

During the 2008 Amendment process, the USDA Forest Service, U.S. Fish and Wildlife Service (USFWS), and Alaska Department of Fish and Game (ADF&G) reviewed all of the small OGRs and a few of the medium and large OGRs. These were reviewed primarily because under the 1997 Forest Plan, small OGRs were not adequately mapped, so it was necessary to review and designate them at the project level. Medium and large OGR locations were finalized in the 1997 Forest Plan and brought forward. The location of the majority of the small OGRs was completed during the 2008 Forest Plan review; therefore, project-level reviews are not necessary, except as outlined below.

Minor modifications to any OGR boundary as a result of imprecise mapping are considered an administrative change. The changes will not be considered changes in the Forest Plan and may be completed without project level or other review provided that changes meet OGR goals and objectives. Changes should only be completed to follow physical and other recognizable on-the-ground features or defined boundaries (e.g., roads, streams, LUD, watersheds).

Under limited circumstances, a line officer may decide to modify the size and location of an OGR. Modifications of OGRs, other than minor as described above, will require the completion of a project level review. This review may be necessary if:

A. The project occurs in VCUs 1930, 2010, 5371, 5620, 6100, 6140, 6150, 6160, 6170, 6320, 6710, 6750, and 6760. A project-level review is required because critical site-specific information for these small and medium OGRs was not available for the 2008 Forest Plan review. This review requires an assessment of landscape connectivity (refer to Appendix D of the Final EIS). Once a review and approval through the NEPA process is complete, no further review for these OGRs is necessary.
B. The project proposes young-growth harvest in the Old-growth Habitat LUD.
C. Site-specific information for a small OGR indicates that the OGR habitat criteria are not met in the mapped location.
D. Actions are proposed within the OGR that will reduce the integrity of the oldgrowth habitat in the OGR.
E. The OGR will be affected by a land conveyance, power line, mine, or other project that was not considered in the Forest Plan. An overall review of the Conservation Strategy is not necessary for a modification to an individual small OGR, but it could be necessary for modifications to medium and large OGRs, or if a proposal affects multiple OGRs. If an overall review is deemed unnecessary by the line officer for modification to medium and large OGRs, documentation of the rationale will be done through the NEPA process.

Project-level review

Project-level reviews will ensure that OGRs meet Forest Plan OGR criteria while addressing forest-wide multiple use goals and objectives. There are two levels of review included in the project-level review: 1) the interagency review, and 2) the decision process.

Step 1, Interagency Review Process—The purpose of an interagency review is to identify the biologically preferred location for the OGR. An interagency team of USDA Forest Service, USFWS, and ADF&G biologists will jointly evaluate the location and habitat composition of the OGR by reviewing all the large productive old growth blocks within a Value Comparison Unit (VCU). The interagency review team will develop a proposal for the OGR that meets the criteria of this appendix and document why other proposals were not recommended.

The review will include the following steps:

A. Review the purpose and rationale for current location of the Forest Plan OGR as documented in the current Tongass Old Growth database.
B. Assess whether the purpose and rationale for the location of the OGR has changed.
C. Use the design criteria to define the biologically preferred location for the OGR.
D. Document this proposal as the interagency proposed OGR in the Tongass Old Growth database and in an Interagency OGR Review report.

Step 2, Decision Process—Line officers will incorporate the interagency review team OGR recommendation in the NEPA process, considering the best biological location for the OGR while balancing other considerations. The interagency team will work with the decision maker to develop alternate proposals, if necessary to meet other Forest Plan objectives. The implemented OGR must meet the minimum criteria as described below.

The Decision process will include the following steps:

A. Attempt to develop a viable project that avoids conflicts with the biologically preferred OGR. At a minimum, the biologically preferred OGR will be considered in an alternative in the NEPA document.
B. Where modifications to the biologically preferred OGR are required to meet Forest-wide multiple use goals and objectives:
    1. Follow the management prescriptions as defined for the Old-growth Habitat LUD; and
    2. Document the rationale for modifications to the biologically preferred OGR.
C. Changes to the OGR LUD require a NEPA analysis and a Forest Plan amendment.
D. Analyze the amount of land suitable for timber production impacted by the change in OGR.
E. Add the updated information (including the rationale for the final location) to the Tongass Old Growth database.

Criteria for small OGRs

A. Review Appendix D of the Final EIS, which includes the assumptions for the design of the old-growth reserve system.
B. Small reserves are a contiguous landscape of at least 16 percent of the National Forest System land area of each VCU and at least 50 percent of the small reserve, should be productive old growth. The size and location of small OGRs will consider the following:

1. OGRs shall contain a minimum of 400 acres of productive old-growth forest. Do not map isolated reserves with less than 400 acres of productive old growth.
2. The preferred biological objective is for each reserve to contain at least 800 acres of productive old-growth forest.
3. In VCUs that are partially allocated to a Non-development LUD, compare the computed acreage required to the acres of productive old growth in the Non-development LUD. If the Non-development LUD acres are less than the area necessary for a small reserve, first use the productive old growth acres in the existing Non-development LUD to establish a small reserve, and then add additional acres of productive old growth to achieve the required small reserve size and composition.
4. In VCUs that are separated by saltwater channels, reserves may be separated, but attempt to retain 800 acres of productive old growth in each.
5. In very large VCUs, generally larger than 10,000 acres, the allocated old growth may be mapped in separate reserves as long as each reserve has a minimum of 800 acres of productive old growth. However, larger contiguous reserves are preferred to multiple smaller reserves.
6. In very large VCUs that contain relatively little productive old growth and the computational rule requires an amount of productive old growth that exceeds 50 percent of the existing productive old growth in the VCU, map a reserve of at least 400 acres of productive old growth.
7. Where VCU boundaries do not match watershed or ecological boundaries, up to 30 percent of the allocated old growth acres in a VCU may be mapped in an adjacent VCU if the resulting reserve achieves oldgrowth reserve objectives. The resulting small reserve in both VCUs must be contiguous. Total acreage is attributed to the VCU with 70 percent of the OGR.
8. OGR boundaries should follow recognizable features that are identifiable on the ground. Features should be permanent and easily identifiable. Features may include but are not limited to streams, roads, distinctive ridges and ridge-tops, watershed boundaries, and v-notches.

OLD-GROWTH FORESTS: AN INTERNATIONAL COMPARISON OF MANAGEMENT STRATEGIES: ADDENDUM

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The term 'old growth' raises many emotions, but are these universal, and has 'old growth' always been valued? First of all, despite the occasional book such as *Old-growth forests* (Wirth et al. 2009a), the term 'old growth' is essentially a North American one, based on North American views of forests in the region. There are words in European languages, such as *gammelskog* (Swedish) or *Urwald* (German), but these don't necessarily have the same meaning as 'old growth'. The term 'old growth' was developed to describe "tracts that have escaped obvious logging or modern forestry practices within the lifespan of the existing trees" (Rackham 2006, p. 103). The concept does not necessarily refer to virgin forests, since most North American forests were utilized to some extent by Indigenous peoples and, more recently, many have been subject to efforts to prevent wildfires, changing their composition and dynamics.

Wirth et al. (2009b, p. 11) provide an insightful introduction to a discussion on old-growth forest definitions and perceptions:

> "Many of us possess an archetype of old-growth forest appearance. We expect majestic trees, small pockets of regenerating trees thriving (*sic*) to meet the sun, heaps of dead wood covered with mosses, snags spangled with cavities and bracket fungi, and rare wildlife. However, thinking twice we may realise that this archetype (1) is not a scientific definition but merely a picture, and (2) is not generic but rather describes the late stage of succession in the temperate forest biome where the great majority of ecologists live and work".

Wirth *et al*. (2009b) point out that such a vision does not reflect the nature of old forests globally, nor does it even encompass all old forests within the temperate zone. This is the source of much conflict, with scientific definitions of old growth relying on mean stand age or the presence of particular structural characteristics, but the general public having an impression more akin to that expressed in the quotation above.

In their analysis of the definition and use of the term 'old growth', Wirth *et al*. (2009c) found that there was a massive increase in the number of publications looking at 'old' forests in the English-language scientific publications in the second half of the 20th century. The number increased from an average of 9 per decade between 1940 and 1960, to 46 per decade between 1970 and 1980 and to 2,089 per decade between 1995 and 2005. They interpret this as evidence of renewed interest in old-growth forests, as well as increasing awareness of the threats that they face. Of the 18 studies of older forests published before 1960, the term 'old growth' was used only once, with the most widely used term for older forests being 'virgin forests'. In the 1970s, the term increased in use, with 39% of publications referring to old growth. In contrast, 13% referred to primeval forests and only 9% to virgin forests. In the 1995-2005 period, 62% of publications dealing with older forests referred to old growth. They attribute this increase to a number of important publications defining old growth that occurred in this period (Wells *et al*. 1998, Kneeshaw and Burton 1998, Mosseler *et al*. 2003, Gratzer *et al*. 2004). It is notable that three of these were studies from Canada, including two specifically from British Columbia.

According to the study by Wirth *et al*. (2009c), the term 'old growth' also has a regional bias. Most (80%) publications from North America referred to older forests as 'old growth', as did authors from Scandinavia, Australia, New Zealand, Chile, Argentina and Japan. This may be because of the close relationship of many of these authors with scientists in the USA. European authors, with the exception of Scandinavia, did not use the term 'old growth', with the term 'primeval' generally being preferred. However, this likely reflects the fact 91 of the 135 eastern European studies related to one site, the Bialowieža Primeval Forest. There is very little forest left in western Europe that has not been subject to significant human disturbance, although where it does occur it is often celebrated (e.g. Kälin 1997).

How did concerns about old growth start? It seems that views about old growth are intricately connected to views about the need to conserve natural habitats. It is difficult to separate the issue of old growth from more general concerns about conservation, although old growth concerns seem much more recent. Some of the earliest worries about forest conservation were more about ensuring that sufficient land was left forested and available for timber harvesting, rather than being converted to agriculture. For example, the colony of New South Wales in what is now Australia started setting aside forest areas for timber production as early as 1871-1872, and by 1882, there were 160 such reserves (Cavanaugh 2010). These areas would later be designated as state forests, managed for both timber production and scenic values. National Parks set up at this time in Australia, Canada and the USA rarely, if ever, mentioned the need to conserve late successional and old growth forests.

It is impossible to generalize across all jurisdictions, and in the following account different regions have been examined separately.

British Columbia

British Columbia has seen major changes in the ways that its forests are viewed. As elsewhere, the debate is polarized and policy initiatives aimed at forest conservation have received significant criticism (e.g. Robinson 1995). Similarly, the logging industry has come under repeated attack (e.g. Swift, 1983). Several attempts have been made to document the rise of the forest conservation movement in British Columbia, notably the study by Wilson (1998). Like the protests at Terania Creek in New South Wales, Australia, British Columbia also had an event that changed the dynamics of the public appreciation of the province's forests: the demonstrations at Clayoquot Sound in 1993 (see, for example, MacIsaac and Champagne 1994). This was the largest of a number of blockades by First Nations and environmentalists that included Meares Island, the Stein, the Carmanah, and the Walbrand (Blomley 1996). It resulted in multiple arrests, and the ensuing media coverage drew world attention.

Wilson (1998) and Hayter (2000) have described how the environmental critique of forest practices emerged in the 1970s. They argue that environmentalism was initially based locally, and was primarily related to the fear that British Columbia might be running out of wood (e.g. Marchak 1983). Attention was drawn to the implications of the reliance on the harvesting of high-volume old-growth stands to the much lower volume second-growth stands growing in their place. There was less concern expressed about the inferior quality of the second-growth, as provincial harvest calculations were based on volume.

Concerns about timber supply were added to by a prolonged economic crisis in the early 1980s. This forced many to think about the viability of alternatives to logging, especially tourism and recreation. Yet another line of pressure came from international organizations and their argument that biodiversity loss was a global crisis. The loss of rainforests was singled out for particular attention, especially by organizations such as Greenpeace Germany and a number of environmental groups and foundations in the USA. They were very concerned about the logging of old-growth rainforests, arguing that these would not be replaced once harvested.

The relatively sophisticated environmental lobby in BC was able to use alarming images of BC forest practices to its advantage, placing these in newspapers, magazines, television and the emerging internet, triggering media coverage that described Canada and particularly British Columbia as the 'Brazil of the North' or the 'Amazon of the North' (*Maclean's* 1991a, 1991b, McCrory 1993). The use of images of large-scale clearcuts was widespread (e.g. Devall 1993) and very effective, as few would contest the aesthetic appeal of an old-growth forest against an industrial clearcut. Pictures of a 140-hectare "clearcut" on Mount Paxton on northern Vancouver Island was featured in *National Geographic*, although the true and complex story behind the removal of the forest at this site was not mentioned. The conservation efforts were largely concentrated in coastal British Columbia, with the importance of other old-growth forests, especially inland rainforest old growth, only being recognized later.

British Columbia has made some attempts to develop a more consensus-based approach than see in the USA, which has relied largely on the federal government and the courts (Hoberg 2000). One such attempt, established in late 1989, was the Old-Growth Strategy Committee. This Committee had a mandate to develop a strategy for the preservation of old growth. It made its recommendations directly to cabinet in 1992, and its mandate was later incorporated under the Protected Areas Strategy. Another was the Vancouver Island roundtable of the Commission on Resources and the Environment, which recommended additional protection to forest areas on Vancouver Island.

A major step forward was taken with the declaration of the Great Bear Rainforest, which resulted in the protection of a substantial proportion of the old-growth forests on the central coast of British Columbia. However, much of this area is relatively inaccessible to the majority of the public. Instead, they are more likely to encounter old growth in areas such as Vancouver Island. Here continued felling of old growth in areas such as the Nahmint Valley has caused outrage amongst environmental groups, especially as it appears from government documents that not all required practices were properly followed (Ancient Forest Alliance 2019, Lavoie 2019). Some public complaints about old-growth harvesting have been followed up by the BC Forest Practices Board (e.g. Forest Practices Board 2011), and the Board has made many recommendations made, including to the Old Growth Strategic Review.

Within British Columbia, the frequent exclusion of environmental groups from forest policy discussions has resulted in alternative approaches being adopted. In particular, they have cultivated a strong constituency in major urban centres, especially in the Lower Mainland and southern Vancouver Island. The fragmented nature of the environmental lobby in the province has resulted in numerous small-scale protests, although occasionally some have

come together to mount advertising campaigns outside the Province. These have been countered by strong advertising campaigns by the Province of British Columbia, drawing attention to major improvements in forest practices and drawing attention to the extent to which old-growth forests, as defined by the Province, have been protected.

While much attention in the period 1970-2010 focused on coastal old-growth forests in British Columbia, there has been growing concern about the fate of inland old-growth forests, particularly in the "interior wet belt". Information about these has grown rapidly over the past 20 years (e.g. Stevenson *et al*. 2011). These forests have been found to contain unique floras (DellaSala *et al*. 2011), particularly amongst their lichens. The lichen floras of old-growth inland rainforests are particularly rich, with new species continuing to be discovered (e.g. Spribille *et al*. 2009). However, lichens generally don't catch the public interest, or that of politicians, whereas another inhabitant of these forests, the mountain caribou, does. In the past, the mountain caribou populations moved through old-growth forests from high elevations to valley bottoms. With the loss of many valley bottom forests, they are now largely restricted to higher elevations, where in winter they are dependent on hair lichens such as horsehair lichens (*Bryoria* spp.) and witch's hair lichens (*Alectoria* spp.), which in turn are closely associated with forests that are at least 100 years old (Edwards *et al*. 1960, Goward, 1998, 2003, Rominger *et al*. 1996). Mountain caribou have become an important a conservation icon for these forests, just as the spotted owl did for Pacific Northwest forests (see for example Yaffee 1994).

As in the USA, Australia and elsewhere, British Columbia has seen its share of well-illustrated publications aimed at providing information to the general public while at the same time encouraging a more conservation-oriented mindset. Some relate to the forest ecosystem (e.g. Mackenzie 1995, McAllister and McAllister 1997, McAllister 2014), others are more about particular organisms, such as bears (McAllister and Read 2010a, or wolves (McAllister 2007, McAllister and Read 2010b). An unusual variant of such books was one produced by the Western Canada Wilderness Committee that presented a variety of artists' impressions of a threatened old-growth forest at Carmanah (Western Canada Wilderness Committee 1989).

There have also been well-illustrated books celebrating the history of logging (e.g. Gould 1975, Drushka 1992, Mackie 2000). One publication used time-lapse photographs to show how forests grow back after clearcuts (Working Forest Project 1995), emphasizing that when forests are cut, they are quickly replanted so that a second-growth forest develops. While successfully demonstrating that clearcuts can be reforested, the publications missed the point that second-growth forests cannot replace old-growth forests, at least over the timescales envisaged by most forestry operations.

The two themes well illustrate the dichotomy that has developed between loggers and environmentalists, a theme also very apparent in the US Pacific Northwest and analyzed in detail by Satterfield (2002).

USA

In the USA, eastern old-growth forests have been the subject of popular works such as Maloof (2016) and more technical studies, such as Davis (1996) and Barton and Keeton

(2019). However, it is the western USA that some of the biggest controversies over the logging of old-growth have occurred, possibly because much of the eastern forest was liquidated before the rise of environmental consciousness in the USA.

One of the most rancorous of the debates surrounding the conservation of old-growth forests occurred in the Pacific Northwest of the USA, and ultimately involved the intervention of President Clinton. The background to this debate is provided by the Forest Ecosystem Management Assessment Team (1993), and is reproduced here:

> "Timber cutting and other operations on lands managed by the U.S. Department of Agriculture, Forest Service and the U.S. Department of the Interior, Bureau of Land Management, have been brought virtually to a halt by federal court orders for several reasons. Foremost has been the failure of the agencies to produce plans that satisfy the requirements of several laws including the National Forest Management Act of 1976, the Endangered Species Act of 1979, and the National Environmental Policy Act of 1969. Shortcomings have included delays in meeting court-imposed time schedules, inadequate environmental impact statements, and numerous proposed management actions (e.g., timber sale proposals) that resulted in "jeopardy opinions" from the U.S. Department of the Interior, Fish and Wildlife Service.
>
> This series of events (Thomas *et al*. 1993: 32-45) can be dated back at least to 1972 when scientists first suspected that at least one sub-species (the northern spotted owl) might be closely associated with the habitat conditions most frequently found in old-growth forests.
>
> Over the period 1972 to 1993, the issue evolved from a question of dealing with a single species, now considered by the Fish and Wildlife Service to be threatened, to dealing with several such species simultaneously within the same ecosystem, to considering the effects of broadscale management plans on all species associated with old-growth or late-successional forests. This latter consideration – and the evolving concerns with "sustainable forestry", "multiple-use", "threatened and endangered species", "retention of biodiversity", "landscape ecology", and other concepts – led the Bureau of Land Management, the Forest Service, and political leaders to embrace the concept of ecosystem management." (pages II-1 and II-2).

Forest Ecosystem Management Assessment Team (1993) went on to say:

> "Shortly after World War II and subsequent to the invention of the gas-powered chain saw and improvements in transportation, logging began in earnest on federal lands in the Pacific Northwest. European methods of forest management were gradually adopted on most federal and private lands, including techniques such as clearcutting, removal of logs and snags, slash burning, thinning, and planting of single species stands on cutover areas. The assumption was that forests managed in this manner could be cut and regrown at relatively short intervals (e.g., 40-80 years) without negatively

affecting other resources such as water quality, fish, soils, or terrestrial animals.

As a result of over a century of logging and fire control, the forests of the Pacific Northwest presently consist of a highly fragmented mosaic of recent clearcuts, thinned stands and young plantations interspersed with uncut natural stands. The natural stands that remain range from 1,000-year-old or older forests of large trees to relatively young, even-aged stands that have regenerated following wildfires. Because wildfires and windstorms often killed only part of the trees in a stand, natural stands are frequently characterized by uneven-aged mixtures of trees that survived a catastrophic event and younger trees that filled in the understory after the event. Where many large old trees remain in the overstory, these stands are usually referred to as "old growth" or "ancient forests". Where only scattered individuals or patches of large old trees remain and the majority of the stand consists of young or mature trees, stands are referred to as "mixed age" or even "young". Mixed-age stands are particularly common in some areas, such as the Oregon Coast Range, where extensive fires occurred in the 1800's. Mixed-age stands defy categorization – they are not "old growth" in the classical sense (Franklin and Spies 1991; Spies and Franklin 1991), and they are certainly not young even-aged stands. It is these mixed-age stands that have led to much of the debate over how much "old growth" or "ancient forest" is left in the Pacific Northwest.

As studies on the ecology of late-successional forests began to proliferate in the 1970's and l980's, it gradually became apparent that a simplistic approach to forest management based on high-yield, short-rotation forestry was not going to adequately protect the considerable biodiversity that was present in late-successional forests and their associated aquatic ecosystems. The northern spotted owl was the first species to receive recognition in this regard followed closely by the marbled murrelet, anadromous fish, and the recognition that a wide variety of species are closely associated with old forests (Thomas *et al*. 1993). More recently, ecologists, foresters, and the public have begun to recognize that the old forests that remain in the Pacific Northwest may be unique ecosystems that developed under climatic and disturbance regimes that may never be duplicated.

Changes in public perceptions and expectations concerning management on federal lands in the Pacific Northwest and elsewhere have led to a gradual increase in protection of unique ecosystems and species, increased concern with riparian areas, and experimentation with methods of "new forestry" designed to retain some of the structural features found in old forests and thereby more closely imitate natural disturbance regimes. As these changes have occurred, harvest rates of timber on federal lands have declined, and considerable controversy has ensued. The Forest Ecosystem Management Assessment Team was formed to develop and evaluate possible management options for resolving this issue." (pages II-2 and II-3).

The degree of polarization between those for and those against logging old growth in western Oregon has been examined in depth by Satterfield (2002). This study is unusual in that she conducted it from an ethnographic perspective, looking at both sides. She attempted to determine the extent to which the dispute was cultural, rather than driven by legal, scientific and land-managerial perspectives. She concluded that the differences between loggers and environmentalists were "profound, morally rooted, and ethically challenging" (p. 160). She goes on to explain that:

> "… loggers see themselves as members of historically rooted land-based communities whose experiential knowledge of the forest is sound and wise but who have nonetheless been cast unfairly as violent antagonists and treated without respect, despite their wood-producing contribution to society. Conversely, many ancient-forest activists lean towards, and derive insights from, cultural arrangements that they imagine as resembling Aboriginal practices. They are wary of, though they also endorse, a science that stands metaphorically for nature as mystical, complex, enchanting, and vulnerable to disruption (Yearley 1993); and some are creatively resistant to emotional norms that interfere with a deeper bond between the human and biotic worlds". (pp. 160-161).

The reference to environmentalists imagining their desired practices being similar to those of Indigenous people is interesting. Certainly, at points, environmental groups and Indigenous people in the US Pacific Northwest and in British Columbia have formed alliances when blockading particular logging operations, and there are some suggested intellectual affinities (e.g. as expressed in Suzuki and Knudtson 1993). However, environmental groups and Indigenous peoples do not always agree, and there has been resentment amongst some Indigenous peoples of the appropriation of aspects of their culture and their economic future by some environmentalists (e.g. Willems-Braun 1997). In Alaska, one Native Corporation in particular has been responsible for large-scale logging of old growth in the Tongass National Forest (see below).

The debate over old-growth forests in the Pacific Northwest has generated a plethora of publications, some aimed at specialist readerships, others aimed at the general public. As an important industry, logging has received the attention of historians looking at how the industry developed over time, either in the North America generally (e.g. Cox 2010), or in the Pacific Northwest and British Columbia (e.g. Rajala 1998, Hayter 2000, Brock 2015). Some books were clearly intended to sway public opinion. For example, the cover of Norse (1990) *Ancient forests of the Pacific Northwest* contains the subtext 'The grandeur, complexity, diversity and impending destruction of a fragile and vital ecosystem'. Similarly, and more provocatively, the inside cover of Lien (1991) *Olympic battleground: The power politics of timber preservation* describes the book as:

> "A provocative chronicle of intrigue, political chicanery, and citizen activism, this first account of the struggle to create and preserve the Olympic National Park in Washington State provides an eye-opening history of forestry in the Pacific Northwest from 1890 to our time. *Olympic Battleground* offers a searing critique of the U.S. Forest Service, a National Park Service in need of drastic restructuring and redirection, and forest policy in general. Interwoven

> are more than 100 pivotal struggles – many continuing today – which have pitted the park's advocates against those who would exploit the protected lands and timber of one of the world's greatest old growth conifer forests".

Many of the publications written about the forests of the west refer to battles (e.g. Dietrich 1992) and wars (e.g. Widick 2009), and *Clearcut*, a 1971 book by Nancy Wood is one of the Sierra Club "Battlebooks". In so doing, clearcutting was elevated to the same scale of environmental issue as energy, oilspills and mercury in the environment. The disputes in the Pacific Northwest and British Columbia are frequently referred to as the "War in the Woods" – with some justification given the violence that occurred on occasion. Others try and adopt a more objective view, explaining the natural history of old-growth forests in accessible text (e.g. Maser 1989) or featuring the natural history of the forest in beautifully illustrated publications (e.g. Kelly and Braasch 1988, Middleton 1992, Kirk 1992, Ketchum and Ketchum 1994, Kirk and Mauzy 1996). There are also a number of illustrated books presenting the perspective of the loggers, many featuring the photographs of Darius Kinsey taken in the 1890s and 1900s.

Elsewhere on the Pacific Coast, the value of even small patches of old growth forest have been recognized. For example, Zielinski and Gellman (1999) found that small areas of old-growth redwood (*Sequoia sempervirens*) growing in a matrix of younger regrowth stands were critical for some species of bats. Major confrontations occurred over the conservation of redwoods in California, such as over first the creation and then the extension of the Redwood National Park (Harris 1995, Speece 2017). They have also been the subject of a fictional novel, *The giants' last tear* (Powers 2014).

Concerns in Alaska have generally pitted environmentalists against resources users. There has been strong political support for the maintenance of a forestry industry in areas such as the Tongass (Soderberg and DuRette 1988), but the actions of some of the forestry companies have resulted in considerable public opposition. Durbin (1999) provides an account of how concerns over the actions of two of the major forestry companies operating in the Tongass led to a national campaign to try and achieve what was viewed as a more sustainable approach to forest management. Some pressure for conservation was already occurring, with the Alaska National Interest Lands Conservation Act 1980 leading to the protection of some key locations, such as Admiralty Island. This Act also mandated large logging subsidies and unsustainable rates of logging in the 1980s; these activities were curtailed by the Tongass Timber Reform Act of 1990. A major turning point in public opinion was the ruling on March 5, 1981, by U.S. District Judge Barbara Rothstein in favour of Reid Brothers Logging Co. in its antitrust suit against Ketchikan Pulp Company and Alaska Lumber and Pulp initiated distrust in the two companies. When the initial ruling was followed by her findings that the companies had engaged in collusion, conspiracy and lying, and her award of triple damages (totaling nearly $1.5 million) set in motion, the activities in the Tongass came under national scrutiny.

While the role of the industrial companies involved in the Tongass have been examined in detail, others were also involved. The Alaska Native Claims Settlement Act, signed into force in December 1971, resulted in the transfer of 162,000 km^2 of land to 12 Alaska Native Regional Corporations and over 200 Native village corporations. The village corporations received title to the surface estate of ca. 89,000 km^2, selected from 25 township withdrawal

areas surrounding each village. The 12 regional corporations received the mineral rights for the 89,000 km^2 as well as the surface and sub-surface title to an additional 65,000 km^2. The Alaska Native Regional Corporation in the Tongass area was Sealaska Corporation. It was responsible for logging large areas of old growth, including a now renowned clearcut on Long Island.

As elsewhere, environmental pressure groups singled potentially iconic species that might symbolize the plight of the old-growth forest. Considerable attention was placed on the Alexander Archipelago Wolf (*Canis lupus* ssp. *ligoni*), a subspecies of the grey wolf. Attempts to have it listed under the Endangered Species Act failed, with the US Fish and Wildlife Service determining in January 2016 that listing was not warranted. This is the same subspecies of grey wolf that has been celebrated in coastal British Columbia, and used an icon there of old-growth coastal forests (e.g. McAllister and Read 2010b).

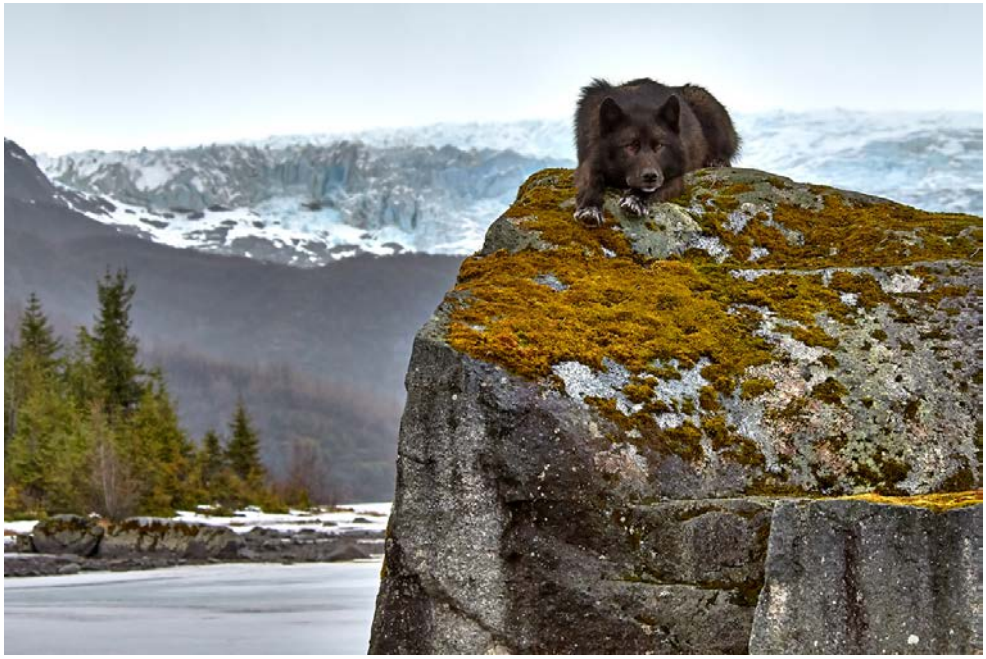

Fig. xx. The Alexander Archipelago wolf. Photo copyright Kim Elton. (Permission to use this photo is pending).

Other issues have come to dominate the debate about forests in the American west since the Northwest Forest Plan was established. In particular, the Healthy Forests Initiative announced by George W. Bush in August 2002, and the subsequent Healthy Forests Restoration Act, has resulted in major policy changes and regulatory reform. In particular, it reduced the extent of environmental analysis of proposed actions, the ability to make administrative appeals and the possibility of turning to litigation (Vaughn and Cortner 2005). This legislation is particularly important for the forests of the inland west, an area that has seen in its own controversies over the logging of old growth (e.g. Langston 1995).

Europe

In Europe, feelings towards completely natural forests have historically been quite varied. In England, the 'Wildwood' was often views as a place of danger, harbouring outlaws and dangerous animals such as wolves. The older the trees, the more the forest was associated with mythical creatures, and there are long-standing Pagan traditions associated with the forest (Porteous 1928). In many cases, Pagan traditions were carried forward to more recent times, and it has been speculated that one mythical occupant of English forests, Herne the Hunter, was actually the continuation of *Cernunnos*, the Celtic horned god, or a more recent manifestation of the Norse god *Odin*. This in part reflects the complex social history of England, where successive waves of colonists, each with their own mythologies, arrived and co-opted traditional magical sites.

Many mythological ideas had no place in 18th century Europe, with the gradual ascent of science, systematic descriptions and the attempts to establish 'order'. Wirth *et al*. (2009b) cite the work of the Comte de Buffon, who in his multi-volume book *Histoire Naturelle*, wrote:

> "There, a desolate tract of land lies, a sad and sullen region, never used as a man's abode. Its mountains are covered with forests, dark and dense. Trees without bark and without tops, stand bent or half-broken, withered by age. Others, far more than those first ones, lie down full length, only to decay on those heaps of wood already rotten and to suffocate the seedlings that were about to come through. Nature seems to be worn out here; earth – heaped with the ruins of what she brought forth – carries piles of debris, instead of her flowery green, and holds trees loaded with parasitic plants, poisonous fungi and mosses, and those impure fruits of rottenness".

At this time, concepts of beauty were very much aligned with order, symmetry and geometric arrangements, and this would have been reflected in the royal gardens in France, where the Comte worked (Gaier 1989). Natural forests were seen as untidy, messy, and places of disease, although the 'dangerous' animals that had previously occupied them had either already been extirpated or were in the process of extirpation. Most such forest had already been lost, with a few exceptions that had been preserved as royal hunting forests (e.g., Bialowieža in Poland) or which were in particularly inaccessible locations. Most forests were highly managed, often with destructive practices such as overgrazing, over-extraction of wood and litter raking. This formed the background for the emergence of 'scientific forestry', with Heinrich Cotta being credited as one of the early pioneers in the discipline (Cotta 1817). The European tradition of forestry is exemplified by textbooks such as Mayer and Ott (1991) and Mayer (1992). Since the 1980s, there has been increasing interest in trying to emulate old growth characteristics (e.g. Otto 1994, Scherzinger 1996). This is being done by modifying silvicultural practices, particularly through the use of continuous cover silvicultural systems.

While forestry was emerging as a scientific discipline, there was also an emerging romanticism in the early 19th century that attached much greater value to nature. This emerged from the 18th century work of individuals such as William Kent and Capability Brown, who rejected the very formal garden and landscape designs that had been

previously favoured. It resulted in a move away from the regular patterns favoured in the 17th century towards a more natural, but still artificial, landscape.

In the United Kingdom, ideas about 'old growth' have been heavily influenced by ideas and experiences associated with ancient woodlands. Such woodlands are not natural: they are characterized by long and intense use. They are defined as areas that have been woodland since at least 1600. Much of the work on woodlands as a feature of the cultural landscape came from the work of Oliver Rackham, an academic at Cambridge University (e.g. Rackham 1986, 1990).

Through the 20th century, tensions between conservation bodies and Forestry Commission escalated. These tensions led to a conference organized jointly by the Forestry Commission and the Institute of Chartered Foresters, and it was this that led to the establishment of a Broadleaves Policy (Nail 2008). In 1985, the Forestry Commission announced its new policy in favour of broadleaves, reversing the stance it had taken for the previous 60 years. The policy resulted in grants and special measures to support ancient semi-natural woodland to ensure that their area was not further reduced, as well supporting the establishment of new broad-leaved woodlands and the replacement of some conifer planting with broadleaves (Forestry Commission 1985a, 1985b). The guidelines for managing broadleaved woodland issued in 1985 have been revised and updated (Harmer *et al*. 2010) and there are also special guidelines for managing ancient woodland (Forestry Commission 2010). Books aimed at the general public have appeared, such as those designed to educate the public about the different types of woodland habitats found in the United Kingdom (e.g. Lake *et al*. 2015). The changes in policy have produced real results. In the mid-1980s, the Forestry Commission in England was planting 25,000–30,000 ha a year, 95% of which consisted of conifers. By the late 1990s, it was planting about 5,000 ha a year, 80% of which were with broadleaves.

The change in policy also required that ancient semi-natural woodlands be protected. An inventory of ancient woodlands was established by a government body, the Nature Conservancy Council, in 1981, and management grants for these woodlands were introduced in 1992. These were supported by new legislation, the 1985 Wildlife and Countryside (Amendment) Act that introduced the requirement for management for multiple objectives by the Forestry Commission. The Act specified that:

> "In discharging their functions under the Forestry Acts of 1967 to 1979 the Commissioners shall, so far as may be consistent with the proper discharge of their functions, endeavor to achieve a reasonable balance between:
>
> - The development of afforestation, the management of forests and the production and supply of timber, and
> - The conservation and enhancement of natural beauty and the conservation of flora, fauna and geological or physiographical features of special interest" (cited in Miller 1995, p. 68).

Australia

In Australia, many concerns have surrounded the rapid change in the Australian environment since European colonization (e.g., Beale and Fray 1990; White 1997). A watershed moment seems to have occurred in the 1960s when the Minister of Lands of the state of Victoria (Sir William McDonald) announced a rural settlement scheme for the Little Desert in the northwest part of the state. A sophisticated campaign against the scheme ensued, and it was eventually abandoned (Robin 1998). A number of popular books have been produced that emphasize native forests, such as *Woodlands: A disappearing landscape* (Lindenmayer *et al*. 2005) and *Life in the tall eucalypt forests* (Lindenmayer and Beaton 2000). While being a series of different issues (e.g. salinization, forest clearance, loss of native fauna), there has been some focus on forests. Many of the publications use the same terminology as used in North America, describing the 'battles' (e.g. Buckman 2008) and 'wars' (e.g. Turvey 2006, Ajani 2007). It is also interesting that the term 'old growth' is increasingly being used in Australia.

Some of the campaigns led by politicians appear to have had significant impacts. In particular, Bob Brown, who held a seat for the Green Party in Tasmania's House of Assembly before being elected to the Australian Senate, became a focal point for eco-activism in Tasmania (see, for example, Brown 2004). His efforts drew international attention, and in 1987 he was recognized with a United Nations Environment Program Global 500 Award. This was followed by the 1990 Goldman Environmental Prize.

The preservation of forests was not a priority in the establishment of Australia's national parks between the 1880s and 1960s (Cavanaugh 2010). This changed in the 1970s, when scientific evidence mounted about the uniqueness of Australia's rainforests, previously considered to be an invasive element from the Indo-Malayan floral region. There was a growing recognition of their uniqueness and, at the same time, a growing recognition of their loss to agriculture and logging. This resulted in a series of campaigns to protect rainforests from development including at the Border Ranges, Terania Creek, Washpool, Werrikimbe and the Nightcap Range.

Initially, the pressure to have forests put aside was based on lobbying, as in the case of the Border Ranges. This met with limited success and tactics changed at Terania Creek. This is a small watershed at the base if the Nightcap Range, near Lismore in New South Wales. Road-building to provide access into the basin started on 16 August 1979, but was unexpectedly opposed on the ground by local protestors (Cohen 1997). Some of the protestors obstructed the logging peacefully, others resorted to sabotage, and 41 arrests were made. The ensuing media drew major attention to the attempts to preserve rainforests in the area. There had been no forest protest in Australia up to this point that used the types of direct action adopted at Terania Creek, and it set the scene for many future antagonistic conflicts in the forest. It resulted in an independent inquiry that last 18 months, and which was used by environmental groups to emphasize the importance and uniqueness of Australia's rainforests. The inquiry itself was conducted under adversarial conditions, with considerable amounts of evidence being deemed irrelevant at the request of the NSW Forestry Commission. The inquiry found in favour of continued logging, but this finding was not accepted by the Government. Protestors returned to the Nightcap Range three years later,

trying to block logging developments in the Griers Scrub and then at Goorgarna Road in the Mt Nardi area. They were hampered by the remoteness of the area and new legislation allowing the holding and arrest of protestors for trespass. The Forestry Commission started logging in the area without an Environmental Impact Statement, but was then subject to several stop-work orders by the Land and Environment Court.

The situation in New South Wales was complicated by the very different opinions held within the New South Wales government. On the one hand Forestry Commission NSW was a strong advocate on rainforest logging, and was responsible for opening areas up for development. On the other hand, the NSW National Parks and Wildlife Service (NPWS) argued in policy papers from 1979 onwards that all publicly-owned rainforest should be protected from logging and placed into reservations. The NPWS started inventorying all remaining rainforest areas at the level of the vegetation community and individual species (Cavanaugh 2010). This information was eventually published in Floyd (1990).

Another factor that came into play at this time was the introduction of the NSW Environmental Planning and Assessment Act 1979, which required that environmental impact assessments be undertaken prior to any logging and roading. Until its introduction, the need for such assessments had been decided on a case by case basis by the NSW State Pollution Control Commission. With its passing, conservation groups could use legal means to aid their campaigns, and they did so successfully in the cases of proposed logging in the Forbes Valley (Prineas v Forestry Commission) and the Nightcap Range (Kivi v Forestry Commission). The Department of Environment and Planning also started making use of the Act, forcing an inquiry into proposed logging in the Washpool.

Cavanaugh (2010) describes how the Forestry Commission NSW adopted a 'siege mentality' during this period, refusing to accept the need for a politically acceptable compromise. While it won the legal case for logging in Terania Creek, it then voluntarily protected it as a flora reserve. It was heavily criticized for its uncooperative attitude towards independent attempts to quantify the extent of the resource, and for its failure to assess properly the resource remaining in previously logged rainforest and moist hardwood forests. As a result, it lost the confidence of both the government and the general public, and its underlying philosophy and land management practices were increasingly questioned. As stated by Cavanaugh (2010):

> "It was revealed that the Commission had become 'a captive of the industry it was set up to control' (Prineas and Elenius 1981, p. 15) and had not effectively resisted industry demands for more timber than the forest will grow, so much so that native forests were being over-cut and the current supply of native timber was going to decline (Hammond, 1980)." (p.268)

Release of financial documents revealed that the Forestry Commission had accrued deficits, with roading costs for timber extraction being a major expense that were not being recouped through stumpage payments.

The New South Wales government, meanwhile, had been monitoring the situation closely. The Cabinet decided in late 1979 that a state-wide policy on the future of the rainforest was needed as it was concerned that confrontations such as the one at Terania Creek might re-

occur. While the Forestry Commission had a plan to phase out rainforest logging, this appeared to coincide with the area of rainforest (Cavanaugh 2010), with only one area of rainforest on the north coast surviving into the mid 1990s. This reduced the credibility of the 'jobs-or-conservation' argument: the jobs would ultimately all be lost as the resource diminished. Eventually, in October 1982, the Cabinet decided on a policy involving the conservation of 89,500 ha of state forests as national parks, nature reserves and flora reserves. This decision created the Nightcap National park, Mt. Hyland Nature Reserve, Murray Scrub Flora Reserve and the Cambridge Plateau Flora Reserve. Large additions were also made to existing national parks, including Border Ranges national park, Dorrigo National Park, New England National Park, Werrikimbe National Park and Mt. Seaview Nature Reserve. Known as the Rainforest decision, it protected in national parks 43.8% of the mapped areas of rainforest on public land. The protection was not equally divided amongst all rainforest formations, with a preponderance of areas that might best be considered old growth being protected. Cavanaugh (2010, p. 273) cites Alex Floyd's description of these as 'towering figs, yellow carabeens and booyongs', as well as 'ageless Antarctic beeches', adjectives that could be used of many old-growth areas meeting the public's concept of old growth.

The moves by the NSW government coincided with rising global concerns about the loos of rainforests. There was a widespread feeling that Australia should not be seen as leading rainforest destruction, and conservation of the nation's rainforests was added to the election manifesto of the Australian Labour Party, which won the 1983 Federal election.

New Zealand

The West Coast of New Zealand is a highly scenic area, and tourism has been a major industry since the early 20th century. In the early 20th century, there was a growing realization that many endemic species, particularly birds, were being threatened by loss of habitat and competition with or predation by introduced species. This led to the creation of organizations such as the Native Bird Protection Society (founded 1923). This was later renamed (in 1935) the Royal Forest and Bird Protection Society of New Zealand, and is today known simply as Forest & Bird. By the 1970s, the Royal Forest and Bird Protection Society of New Zealand was the only conservation organization in New Zealand, and so was at the forefront of campaigns against a proposal put forward by the New Zealand Government in October 1971 proposed to harvest large areas of native (old-growth) South Island lowland beech forest, with half the cleared area to be converted to exotic radiata pine.

The threat to native forests prompted the formation of new environmental groups, including the Beech Forest Action Committee (later the Native Forest Action Committee, the Maruia Society and then the Ecologic Foundation. On 4 July 1975, the Royal Forest and Bird Protection Society of New Zealand and the Beech Forest Action Committee started the Maruia Declaration, a public petition that demanded an end to native forest logging and legal recognition of native forests. The petition was presented to Parliament in 1977, carrying 341,160 signatures. It repeated and expanded on previous recommendations made in 1937 that protected forests be established and that commercial forestry be compelled to manage the forests as a perpetual crop without interfering with their scenic value. The Declaration contained six principles that became the basis for a continuing public campaign against natural forest logging:

- Native forests, wherever they remain, need recognition and protection in law.
- The wholesale burning of indigenous forests and wildlife has no place in a civilized society.
- The logging of virgin forests should be phased out by 1978.
- Our remaining publicly owned native forests should be placed in the hands of an organization that has a clear and undivided responsibility to protect them.
- To reduce commercial pressures on native forests, the growing of fine quality exotic and native timbers on land not presently forested should be given encouragement.
- It is prudent to be conservative in our consumption of these forest products, especially newsprint and packaging paper, which make heavy demands on our precious resources of land, energy and water.

Further concerns were raised over the concerns about the felling of native forests by Japanese timber companies for the woodchip industry during the 1980s. The concerns were occurring at the same time as the Labour Government (centre right) was dismantling New Zealand's welfare state and re-regulating the economy to compete globally. The conflict between conservation and old-growth harvesting eventually led to an agreement, the West Coast Accord. This was signed on 6 November 1986 between government, industry and environmental organisations. The major focus of the Accord was for the sustainable yield of timber from the indigenous forests on the West Coast. 79% of the remaining West Coast forest lands were protected, 8% were to be available for sustainable management, and 15% would remain in private ownership. The parties agreed that all unsustainable harvesting would end by 2000. Under the terms of the agreement, the area of indigenous forest allocated to harvesting was supposed to have sufficient beech and beech/podocarp forest to have a sustained yield, initially set at ca. 150,000 m^3 annually in order to sustain the timber industry. North and South Westland were to reach a long-term sustained yield of 140,000 m^3 by 1994 and the Buller area was to reach 17,200 m^3 by 2006. On private land, forest could be felled to increase pasture area on a farm, but the wood could only be sold if the owners had an approved sustainable management plan.

The Accord provided protection for specific areas of native forest for their natural values. Some areas had already been set aside in the 1970s, but they were not representative of the range of forest types in the region (West Coast Forests Working Party 1986). The Accord sought to protect ecologically diverse areas, especially lowland vegetation types not already represented in the reserve system. 'Indigenous production zones' were also established that allowed the continued clearfelling of podocarp forests, the sustainable management of *rimu* forests and the development of logging in beech forests.

Memon and Wilson (2008) argue that a major difficulty within the report existed over differing interpretations of the term 'sustainable forestry'. Some believed that it had a bio-centric meaning, whereas others interpreted it from an economic (specifically jobs in the timber industry) perspective. The former included the Secretary for Environment, West Coast local authorities and some environmental groups. Those in favour of the latter approach included the West Coast Timber Association, the Westland Timber Workers' Union and some local authorities. Considerable faith was placed by central and local government politicians in the contested science of sustainable harvesting (Memon and Wilson 2008).

Fig. xx. Old-growth Red Beech forest, New Zealand.

The government reorganisation of the mid 1980s involved a restructuring of the forest administration scheme, including dissolving the New Zealand Forest Service in 1987. The Department of Conservation assumed responsibility for the management of almost all remaining state-owned native forests, while the state-owned Forestry Corporation assumed responsibility for all state-owned plantations of exotic trees. Under the Conservation Act 1987, all state-owned native forests were to have non-timber management goals. Further developments occurred with the passing of the Resource Management Act (RMA) 1991 and the Forest Amendment Act 1993, both of which provided mechanisms to deal with the adverse environmental impacts of logging native forest on private land. Administration of the RMA was devolved to local government.

In the 1990s, logging of native forests had been confined to communally-owned Maori land, land owned by non-Maori farmers and state-owned native forests on the West Coast. The state-owned forests were managed by a state-owned company called Timberlands West Coast Ltd. The West Coast had been singled out for special attention because the economy there was so resource-dependent. However, as indicated above, it was scheduled for a gradual reduction in the logging of native forests.

Throughout this period, there was friction between two major groups. The first consisted of local government and the sawmilling industry, which came together in a group known as West Coast Resource Interests. The second was a group of 'deep green' environmental groups, led by an organization called Native Forest Action. The first group concentrated, via the courts, on persuading central government to keep local sawmills open by ensuring the Timberland

West Coast Ltd. Maintained timber supplies to mills. The environmental group concentrated on developing a political constituency in major cities aimed at achieving 100% protection of lowland native forests on state-owned land.

The Accord ran into difficulties in the 1990s with the court proceedings against West Coast Timberlands being unsuccessful. However, it seems to have been a proposal by Timberlands to develop a sustained yield beech harvesting programme that triggered the greatest opposition (from Native Forest Action as well as concerned scientists). The concerns were about the potential impacts on the ecological integrity and biodiversity of the beech forests. The beech scheme was supported by the Parliamentary Commissioner for the Environment, the New Zealand Institute of Forestry and some scientists, and received formal approval in principle from the government in 1998. Timberlands West Coast Ltd. mounted a very aggressive public relations campaign to try and save the beech scheme in the vent that a Labour government was elected in the 1999 election that was subsequently heavily criticized (Hager and Burton 2002). The Labour party had actually committed in their election manifesto to terminate the Accord.

The Labour Party won the election, and the Labour Alliance coalition government promptly changed Timberland West Coast's statement of corporate intent to exclude beech logging, thereby preventing the company from seeking planning permission for its beech logging operations. The West Coast Accord was cancelled on 15 May 2000 by the Forests (West Coast Accord) Act 2000. A new accord was agreed to in 2001, with the objectives being to:

- define those areas where it is inappropriate to establish plantation forestry
- recognize the important heritage values of New Zealand's remaining natural indigenous forests and the need for their protection and conservation
- acknowledge that the existing area of natural indigenous forest in New Zealand should be maintained and enhanced
- recognize that commercial plantation forests of either introduced or indigenous species are an essential source of perpetually renewable fibre and energy offering an alternative to the depletion of natural forests
- acknowledge the mutual benefits emanating from an accord between New Zealand commercial forestry enterprises and conservation groups and the example that this unique accord can provide for the international community.

The 2001 Accord did not exclude all harvesting of old-growth forests. However, one of the instruments of the accord stated: "The parties support the production management and harvest of naturally occurring indigenous forest only where such activity is conducted on a sustainable basis and principally for the production of added value solid wood products in New Zealand. A "sustainable basis" is considered to be a rate and method of tree extraction that does not exceed the replenishment so that the forest ecosystem in the area under consideration is maintained in perpetuity". On March 31 2002, all logging was halted on forests in public ownership, and the forests were reclassified for conservation purposes.

The saw-milling industry contested the 2000 decision in the courts, arguing that they had been encouraged to invest based on promises of a future supply of beech timber, and that ending the Accord breached contracts and expropriated property rights without

compensation. The Courts rejected these arguments, ruling that the state cannot be stopped from exercising legitimate power, even if this causes some injustice to some individuals (Memon and Wilson 2008).

According to Memon and Wilson (2008, p. 759), their work on the way that the New Zealand government was able to shut down the logging of old-growth forests on the west coast of New Zealand:

> "… challenge critics of the role of the state as the overriding agent of authority in society in shaping environmental policy (e.g. Young, 1994; Stoker, 1998; Durant et al., 2004). Rather, and in line with recent analyses by Wilson & Bryant (1997), Bryant & Bailey (1997) and Bryant (2005), it confirms the pivotal role of both the state in pluralist democracies as a powerful actor in shaping indigenous forest allocation policies and of certain non-state actors (in particular 'deep green' environmental groups) who, at times, may share common objectives with the state. Therefore, the findings are in line with recent debates on devolution, 'hybrid neo-liberalism', and the reconfiguration of actor spaces in forestry in other temperate latitude forests (e.g. McCarthy, 2005, 2006; Wilson, 2006), and demonstrate that solutions to controversial environmental and socio-economic problems can, in some instances, only be successfully tackled by government acting as an 'objective' collective public entity and based on an institutional structure of authority and accountability (Young, 1994; Johnston, 1996; Gleeson & Low, 2001)."

These findings have considerable implications for the interventions of governments in complex environmental issues.

International concerns

Internationally, there has been very little attention paid to old-growth forests in the multiple political processes that have been underway for the past 50 years (Freibauer 2009). Most of these processes have proved remarkably ineffective for the simple reason that mo international body has the power to determine the way a country chooses to utilize its resources. In addition, most policy has aimed at helping developing countries reduce deforestation and forest degradation, with very little attention being paid to old-growth forest issues in more developed countries. A few environmental organizations have tried to draw attention to certain issues: the work of the World Resources Institute on frontier forests comes to mind. There have also been efforts by international certification bodies, notably the Forest Stewardship Council, to affect management practices associated with old-growth forests, and these have had some impacts.

Patterns in the adoption of old growth as a valued element of forests

As shown in this section, it is very difficult to draw generalizations about the factors that led to the identification of old growth as something to be protected rather than liquidated. However, in all the jurisdictions that were studied as part of this report, old growth has become something that is widely valued, although there also remain groups that see old growth differently, essentially as a resource to be developed. In most cases, it is possible to

identify a growing trend in environmental awareness through the 20th century, accelerating in the 1980s and 1990s into the 21st century. Much of this seems to have come through education: the general public is more aware of environmental issues thanks to the written and visual media. Initially this consisted of well-illustrated books, bit more recently, television and online videos (not reviewed in this study) are likely to have played a major role in raising environmental consciousness. Television series like Sir David Attenborough's *Life on Earth* have undoubtedly had an impact, as have many other series.

Campaigns by environmental groups have also helped both raise awareness and swung public opinion in favour of preserving old growth. Court actions brought about as a result of cases brought by environmental groups have been successful in stopping old-growth logging in some areas, and have been particularly effective in the USA. The campaigns by environmental groups have benefited when they have attracted extensive and prolonged media coverage: the protests at Terania Creek in Australia and Clayoquot Sound in British Columbia are good examples of this. While physical confrontations in the forest draw a lot of media attention, a variety of other techniques have been used, especially campaigns in overseas markets for old-growth forest products. Some markets (e.g. Europe) are more easily influenced by such campaigns than others (e.g. China). This seems, for example, to have influence opinion in British Columbia, and certainly provoked a major counter-campaign by the government/industry.

In several cases, the strongest advocates for the liquidation of old growth have been government forest services or state-owned companies. Environmental organizations and some scientists have been quick to exploit mistakes by such organizations, whether it be examples of violations of their own rules, below-cost timber sales or the use of flawed science. Most governments have generally had considerable difficulty finding the elusive (and possibly non-existent) line that meets the needs of all stakeholders and, as a result have failed to manage old growth effectively.

A small group of scientists seem to have played a very large role in developing our knowledge of old growth, and have also been important advocates of the preservation of old growth. They include Jerry Franklin and Tom Spiess in the USA, David Lindenmayer in Australia, Per Angelstam in Sweden and Oliver Rackham in England, although Oliver Rackham's work focused more on ancient woodlands than old growth *per se*. Scientific panels and working groups have also been effective in influencing both government and public opinion. Examples include the Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee (ANZECC: Australia and New Zealand Environment and Conservation Council; MCFFA: Ministerial Council of Forestry, Fisheries and Aquaculture) in Australia, the Forest Ecosystem Management Assessment Team in the Pacific Northwest and the Clayoquot Sound Scientific Panel in British Columbia. Obtaining consensus from multiple scientists clearly adds credibility to policy and management decisions concerning old growth.

Monitoring the success of old-growth polices

Many jurisdictions around the world have committed to detailed forest monitoring, although in practice many default on the requirements. Many of the jurisdictions examined in this report are part of the Montréal Process (https://www.montrealprocess.org/), which

has a set of criteria and indicators to guide reporting. However, as Chandran and Innes (2014) have discussed, very few countries are adhering to the guidelines, with only a few of the members publishing regular state of the forest reports.

Reporting of old-growth forests under the Montreal process should come under Criterion 1, *Conservation of Biological Diversity*. There are three indicators under the theme of ecosystem diversity, namely:

> 1.1.a Area and percent of forest by forest ecosystem type, successional stage, age class, and forest ownership or tenure
>
> 1.1.b Area and percent of forest in protected areas by forest ecosystem type, and by age class or successional stage
>
> 1.1.c. Fragmentation of forests

In theory, this should enable the area of old-growth forests in each jurisdiction to be tracked over time. British Columbia last published a 'State of the Forests' report in 2010, before moving to an online format in 2012. The current reporting (available at https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/reporting/environmental-reporting-bc/previous-reports-indicators) does not include any reporting on the area of old-growth forest in British Columbia. Similarly, national reports do specify the area of old-growth forest.

In Australia, the federal government has been publishing 'State of the Forest' reports every five years (1998, 2003, 2008, 2013, 2018). This includes Indicator 1.1b Area of forest, by growth stage. Four classes of growth stage are recognized: regeneration (<20 years since disturbance), regrowth (20-80 years since disturbance), mature (80 or more years since disturbance), and senescent (various ages after 80 years since disturbance, with irregular crowns forming). The categories can be applied to even-aged forests, but are less applicable to mixed age forests, such as some drier eucalypt forests, rainforests and open acacia woodlands.

Growth stage information was collected in 1995-2000 as part of the Comprehensive Regional Assessments completed in 11 forested regions of five states in preparation of the regional Forest Agreements. The information covered 15.4 million ha of the forest area of Australia. It has not been updated since then, except for Tasmania.

Old-growth forests are not defined on the basis of time since disturbance, and are instead defined by stand structure and ecological features. They comprise a subset of areas of mature and senescent forest (Pitman et al. 1996, Davey 2018). Old-growth forests were mapped in the same areas and at the same time as the growth stage information in 1995-2000, with 5 million ha being identified in the RFA regions. There has been no survey of old-growth forest since that period, although there have been occasional studies in specific localities (e.g. for jarrah (*Eucalyptus marginata*) and karri (*Eucalyptus diversicolor*) in Western Australia. Old growth is known to have diminished in the period: 413,000 ha in Victoria were lost to bushfires in 2003, 2007 and 2009, 13,000 ha in Western Australia was lost to harvesting (prior to 2001), improved mapping, bushfire and disease, 33,000 ha in

Tasmania were lost to harvesting, bushfire and conversion to plantations and agricultural land. The impact of the 2019-2020 bushfires has yet to be assessed, but is likely to be very substantial.

In the United Kingdom, the Nature Conservancy Council (and it then was) launched an Ancient Woodland Inventory project in 1981. It was continued by its successor, English Nature, in 1991, and was then integrated into the National Digital Archive of Datasets in 2001-2002. Approximately 52,000 sites have been identified, many of which are isolated and fragmented. The information is available at: https://data.gov.uk/dataset/9461f463-c363-4309-ae77-fdcd7e9df7d3/ancient-woodland-england. Following devolution, separate inventories are now maintained for England and Wales, with Natural Resources Wales being responsible for the Welsh inventory (https://naturalresources.wales/evidence-and-data/research-and-reports/ancient-woodland-inventory/?lang=en).

The most detailed plan for monitoring old-growth forests was developed under the auspices of the Northwest Forest Plan in the northwest USA (Hemstrom *et al*. 1998). This report addressed a number of questions, specifically

- How much late-successional forest is there on federal land?
- What is the pattern across the landscape?
- Is the amount of late successional and old growth (LSOG) forests on Federal land changing?
- If so, from what causes and at what rates?
- Is the Northwest Forest Plan providing for conservation and management of LSOG forests as anticipated?

The authors proposed that a monitoring report be prepared every five years describing the status and trend of LSOG forests in the Northwest Forest Plan area. They proposed that a panel of experts would review the report and provide recommendations to regional interagency executives. This has actually happened, with peer-reviewed reports being published every 5 years (e.g. Moeur et al. 2005, 2011, Davis *et al*. 2015). Other monitoring reports cover northern spotted owl habitats (Davis *et al*. 2016), northern spotted owl populations (Dugger *et al*. 2015) marbled murrelet population and habitat trends (Falxa and Raphael 2016), amongst others. A 25-year report is planned for next spring. The key findings are shared with interagency executives through the Regional Interagency Executive Committee (RIEC). Monitoring leads present findings to the Senior Managers Group and RIEC for consideration. Public outreach is also important, with public and partner webinar or meeting to share the findings.

The monitoring team has developed maps using several definitions, although two are now being used to assess changes in the forest. The first relates to forests older than 80 years (OGSI-80) that are considered to have a structure similar to mature, late-successional and old-growth forests in the region. The second relates to forests older than 200 years (OGSI-200) that represents forests that have progressed past maturation and have developed the structures commonly found in the later stages of succession and which are associated with the old-growth stage. The OGSI refers to an Old Growth Structure Index developed by Spies and Franklin (1988) that uses (1) density of large live trees, (2) diversity of live tree size

classes, (3) density of large snags, and (4) percentage of cover of down woody material. The methodology is explained in detail by Davis *et al*. (2015).

Their work showed there has been a small decrease (2.8-2.9%) in the amount of older forests on federal lands managed under the Northwest Forest Plan (NWFP). Gross losses included 4.2-5.4% due to wildfire, 1.2-1.3% due to timber harvest and 0.7-0.9% due to insects and other causes. These have been partly compensated by recruitment into the two age classes. Decadal gross losses of about 5% per decade as a result of timber harvesting and wildfire were expected. Wildfire losses were as expected, whereas losses due to timber harvesting were lower than expected. Wildfire losses were not evenly distributed, meaning that some portions of the landscape are losing older forest faster than others.

A valid monitoring programme might also start to fill in some of the gaps in our knowledge about late-successional and old-growth forests. It might also help determine the differences in value between "young" and "old" old growth. We have made little progress since Lertzman et al. (1997, p. 375) commented:

> "We have just begun to understand the dynamics within late-successional ecosystems. Forests are routinely labeled old-growth whether they are 200 or 1000 years old, yet we know that substantial structural and compositional change occurs between these ages. Relatively little is known about changes in soil biology that occur late in succession, for instance, or about changes in the forest canopy structure and canopy biodiversity. Some general ideas have been proposed about the dynamics of late-successional forests vary across landscapes and over the temperate rain forest region as a whole, but the details of this variation have not been described. The role of late-successional remnants in the recovery of disturbed landscapes is a problem of obvious importance, but one about which we know almost nothing".

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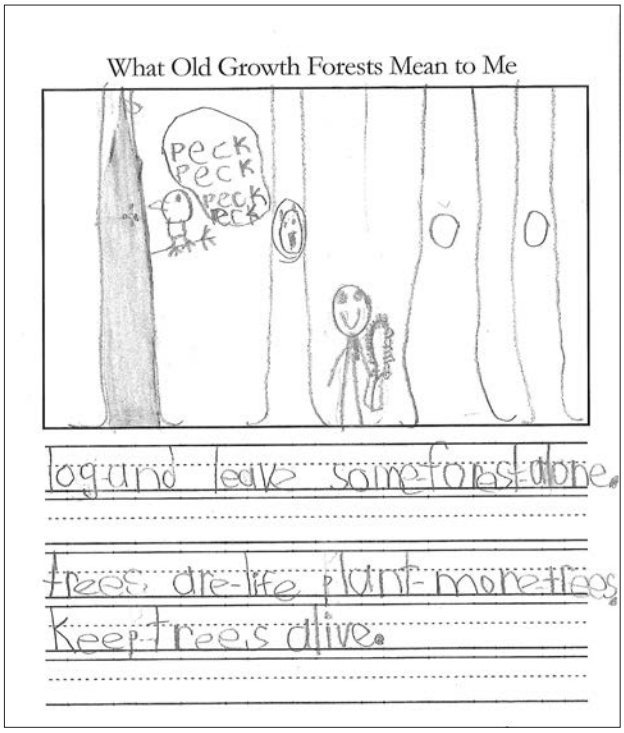

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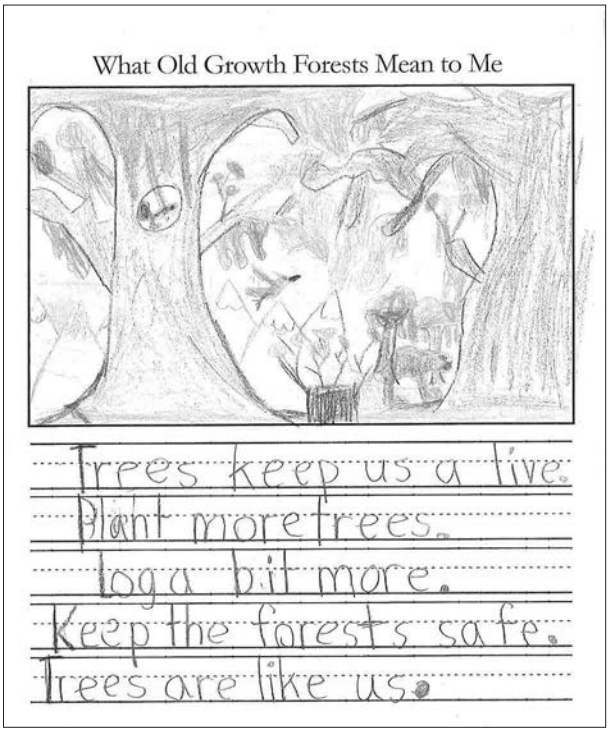

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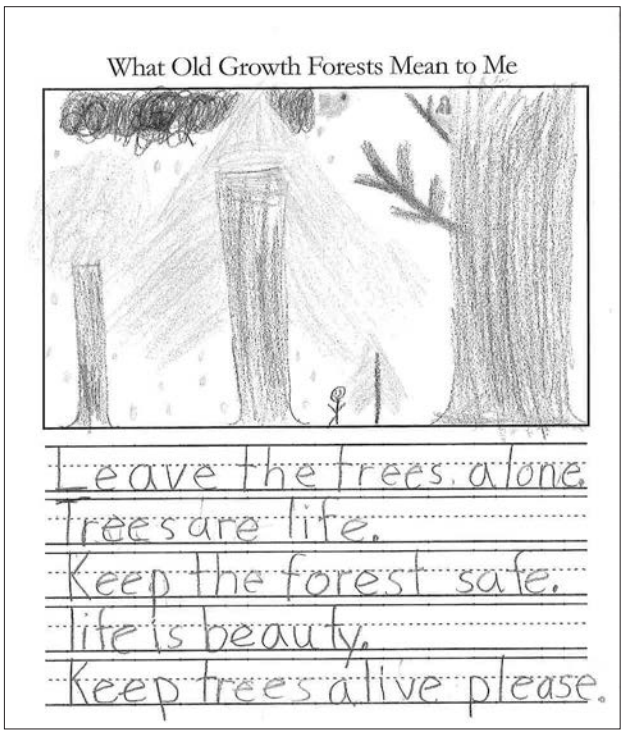

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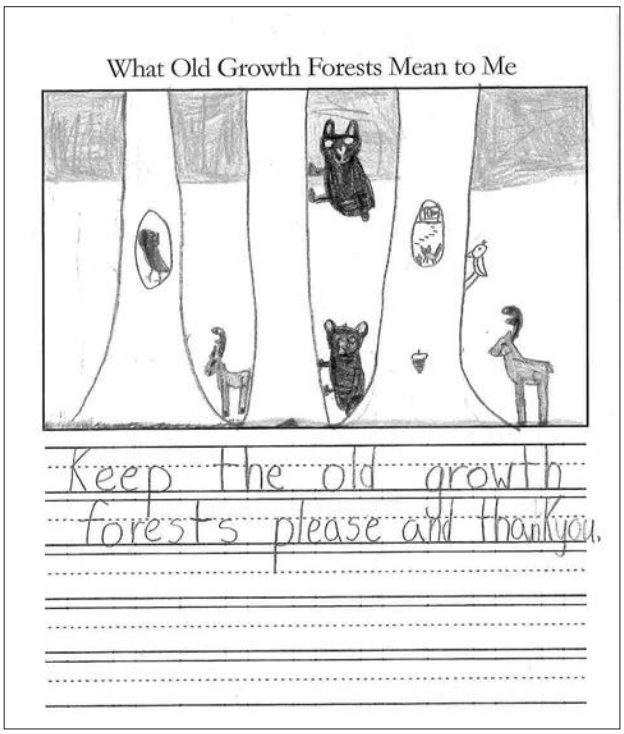

- Addison

Old dry pine forest in the Interior.
Photo by Al Gorley