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ANALYSIS & SUBMISSION FOR SUNSHINE COAST TIMBER SUPPLY AREA TIMBER SUPPLY REVIEW

May 1st, 2023

It's time to change the relationship we have with forests

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Introduction

A key recommendation from the 2021 report *Implementing a vision for the forests and forest dependent communities of British Columbia*, prepared by UBC Faculty of Forestry, is to:

> Review and overhaul the timber supply review process to ensure long-term harvest levels do not undermine the ability to implement effectively a paradigm-shift of forest management in BC. (p.8).

This paradigm shift is outlined the recommendations of the 2020 Old Growth Strategic Review (OGSR; Gorley & Merkel 2020), all of which the Provincial government has committed to implementing (Old Growth TAP 2021). The OGSR states that the overall system of forest management has not supported the effective implementation or achievement of the stated and legislated public objectives for old forests, and that paradigm shift in forest management is needed. In aid of this shift, the OGSR recommends engaging the full involvement of Indigenous leaders and organizations in reviewing the OGSR report, and any subsequent policy or strategy development and implementation (which qathet Old Growth fully supports[1]), as well as giving local communities and stakeholders a greater role in forest management decisions that affect them. The other central recommendation of the OGSR is to establish ecosystem health and biodiversity as overarching priorities for BC's forests, and to adopt a three-zone forest management framework[2] to guide forest planning and decision-making accordingly. The OGSR also states that this designation process should be prioritized in Timber Supply Areas (TSAs) that have already logged a high percentage of their operable land and are facing the greatest risk to ecological and economic values. The Sunshine Coast TSA is one of these areas. Analyses submitted by the Old Growth Technical Advisory Panel (2021) and qathet Old Growth's March 17 2021 report to Minister Conroy show that due to large reductions in percentage cover by old forests relative to that found historically, forests in the Sunshine Coast region of BC are in a situation of high risk to biodiversity, particularly high productivity, low elevation ecosystems (e.g. valley bottoms).

In 2023, the Province requested public submissions for the Sunshine Coast Timber Supply Area Timber Supply Review (TSR). A TSR is the process for establishing the Annual Allow Cut (AAC) in a Timber Supply Area (the AAC is the number of cubic meters that are allowed for harvest each year in a given area). This report constitutes qathet Old Growth's[3] submission to the TSR process for the Sunshine Coast Timber Supply Area, with specific attention to those landscape units within the qathet Regional District boundaries.

Relationship between Old Forests & Ecosystem Services

The OGSR states that:

> Knowing how much to maintain as forest with old trees is guided by the notion that mimicking nature is the approach that presents the least risk to biodiversity. The concept used to measure this is called "natural range of

[1] https://www.qathetoldgrowth.ca/indigenous-rights-and-title

[2] **1) Protected:** These are forests that will be largely left alone; **2) Converted:** Converted forests are those that we have already or intend to change from their natural state to intensive management areas as industrial timberlands. Conversion areas may have multiple objectives compatible with industrial timber production; and **3) Consistent:** These are forests and forest landscapes that are managed for ecosystem health and biodiversity risk by using planning and practises that result in forest landscapes that are reasonably consistent with the attributes of the original forests and forest landscapes (Gorley & Merkel 2020, p.51)

[3] qathet Old Growth was formed by concerned qathet residents, out of growing concerns within our community about the current management of our public lands. Industrial forestry practices are having a detrimental effect on our watersheds, biodiversity and investment into the local economy.

variability" (NRV). This is typically based on a description of ecosystems as they existed before major changes brought about by extensive industrial or agricultural activity. Conservation science provides us with a general risk rating, telling us that if we retain 70% or more of the natural abundance of forest with old trees the risk of species loss, compromised ecosystem services[4], and losing ecosystem resilience is low. If we retain below 30%, the risk is high. At between 30% and 70%, the risk varies by ecosystem. (Gorley & Merkel, 2020, p.31).

Table 1 shows the historic percentages of old forest that would be expected each of the forest type/ BEC unit[5] found in the Sunshine Coast region. These would be: CDFmm 40% (Price et al. 2020), CWHxm,dm,ms 70%, CWHds 60%, CWHvm 85-90%, and MHmm 90-95% (MOE 2020). It also shows the percentage of old growth forest in each BEC unit below which there is high risk of losing ecosystem services/resilience (<30% historic percentage of old forest), and above which there is low risk (>70% historic percentage of old forest).

BEC UNIT (forest type)	HISTORIC OLD GROWTH PERCENTAGE (% old forest)	Low Risk Threshold (% old forest) above which there is low risk to ecosystem services/resilience	High Risk Threshold (% old forest), below which there is high risk to ecosystem services/resilience
CDF			
mm	40	>28	<12
CWH			
xm	70	>49	<21
dm	70	>49	<21
ds	60	>42	<18
ms	70	>49	<21
vm	85-90	>61	<26
MH			
mm	90-95	>65	<28

When the ecosystem services and resilience of BC's forests are compromised by extensive loss of mature and old forest cover (relative to historic levels), the risks of drought, wildfire, floods, (UBC Faculty of Forestry 2022) and species loss (Price et al. 2020) increase. For example, extreme flood and landslide events in various parts of BC, including Smithers and Williams Lake, have highlighted the hydrological impacts of logging on downstream environmental systems, First Nations and communities, including:

- Increasing magnitude, frequency and duration of flooding, droughts and landslides[6].
- Increasing impacts on fish and aquatic habitat [7]
- Impacts on water quality in community watersheds, used for domestic water supply.[8]
- Impacts on infrastructure used for community water supply like dams and water treatment plants.
- Impacts on transportation infrastructure – road, railway, bridges, culverts etc. – and property.[9]

[4] According to the World Resources Institute: *"Natural ecosystems like forests and wetlands provide essential services to water utilities, businesses, and communities — from water flow regulation and flood control to water purification and water temperature regulation.* (cited in Gorley & Merkel 2021, p. 29).

[5] The Biogeoclimatic Ecosystem Classification (BEC) delineates ecological zones (biogeoclimatic units) by vegetation, soils, and climate, and is more commonly used in forestry and conservation. It also classifies ecosystems, within the ecological zones, based on the potential of the site at climax or mature successional stages. For descriptions of the different BEC units referred to in this report see: https://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/subzones/index.html

[6] https://www.focusonvictoria.ca/forests/110/

[7] https://www.cheknews.ca/logging-in-watersheds-among-stressors-for-declining-pacific-salmon-experts-say-932854/

[8] https://thenarwhal.ca/bc-drought-sunshine-coast-2022/

[9] https://bc.ctvnews.ca/catastrophic-economic-impact-of-b-c-floods-1.5672630

These kinds of risks will be exacerbated by climate change (see **Appendix A** for details), and are a consequence of forestry management in BC being premised on an outdated paradigm, as described in the OGSR. For example, in BC, forestry companies are not legally required to consider downstream impacts on private properties or road infrastructure, or to assess or consider cumulative effects of forest practices in most watersheds in BC (FPB 2019, 2022). The recently released Joint Professional Practice Guidelines of Engineers And Geoscientists British Columbia and Association Of British Columbia Forest Professionals (EGBCA 2020) states: "there is currently no legislation that regulates total land use planning on the basis of Watershed Units, nor is there a statutory requirement for government to allocate harvesting rights on the basis of cumulative hydrologic and geomorphic effects in individual Watershed Units." Even when licensees choose to set watershed and biodiversity related objectives (see Section 8 of the FRPA[10]) in their Forest Stewardship Plans, until recently these objectives could *only* apply to the extent that they do not "unduly reduce the supply of timber from British Columbia's forests" (FRPA 2022[11]), i.e. they could not reduce the Annual Allowable Cut.

Analysis

Figure 1 shows the remaining patches old growth forest in qathet Regional District (qRD), relative to BEC [12] and Landscape Units[13] (based on 2019 Provincial VRI[14] data). Most of what remains is in high elevation areas of the Mountain Hemlock (MH) zone, where forests are slow growing and likely to be ancient, or isolated to steep valley sides in the remotest northern drainages of the qRD. Little remains on the productive valley bottoms and in lower elevation forests close to the coast (less than 5%; see analysis in qathet Old Growth 2021), where 'big tree' old growth was once found.

Table 2 quantifies the remaining old forest in qRD, by BEC and Landscape Unit. Old Growth Management Area (OGMA) targets from Landscape Unit Plans[15], ecosystem-based risk thresholds for percentage old growth (as per **Table 1**), and meeting of OGSR deferral criteria 1-3 (see Gorley & Merkel 2020, p.56) are also indicated.

This analysis shows that old forest percentages are deep in the high risk 'red zone' for 24 of the 37 BEC/Landscape Unit combos in the qRD, and 20 of these (indicated in darker red) do not even meet the OGMA targets assigned in their respective Landscape Unit Plans[14] (or as per the *Order for Establishing Provincial Non-spatial Old Growth Objectives*[16], in the cases where the Landscape Unit Plans could not be found). Note that OGMA targets laid out in each of the Landscape Unit Plans[14] (and the *Order)* are all in the 'red zone' below high risk thresholds outlined in **Table 1**, indicating that they are grossly inadequate for safeguarding our forest ecosystems against the risks of drought, wildfire, floods, and species loss, especially in the face of climate change.

Only four BEC/Landscape Unit combos are in the low risk 'green zone' (three of which are in the high elevation Mountain Hemlock zone, in remote and difficult to access areas), and nine are in the 'yellow zone', which falls between the high and low risk thresholds.

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[10] https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/legislation-regulation/forest-range-practices-act

[11] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14_2004#section8.2

[12] The Biogeoclimatic Ecosystem Classification (BEC) delineates ecological zones (biogeoclimatic units) by vegetation, soils, and climate, and is more commonly used in forestry and conservation. It also classifies ecosystems, within the ecological zones, based on the potential of the site at climax or mature successional stages. For descriptions of the different BEC units referred to in this report see: https://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/subzones/index.html

[13] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/policies-guides/lup_qas.pdf

[14] Vegetation Resources Inventory https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory

[15] https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/south-coast-region-plans/sunshinecoast-lu

[16] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/biodiv-hab-mngt/bc_non-spatial_old_growth_fpc_30jun2004.pdf

The last columns of **Table 2** show that most of the remaining old forests in the qRD meet one or more of the criteria for deferrals laid out by the OGSR (meaning they are *at very high and near-term risk of irreversible biodiversity loss, p.55*), or are likely to do so because they are in high elevation areas where they are likely to be ancient (500+years old; field verification required to confirm).

The projected harvest volumes under established and current practice scenarios, as outlined in the *Sunshine Coast Timber Supply Area Timber Supply Analysis Discussion Paper* [17], show that almost all the old growth in the Timber Harvesting Land Base will be cut in the next 20 years. Cutting these remaining pockets of old forest is not consistent with government commitments to retain old growth as per the OGSR. In addition, failing to retain mature forest for recruitment toward meeting ecosystem-based risk targets for old forest by Landscape Unit is eroding the resilience of our forests, and putting the ecosystem services they provide at high risk.

Recommendations

1. **Adopt a three zone forest management framework to guide decisions before determining the AAC in the Sunshine Coast TSA**. In doing so, employ a truly meaningful engagement process, to ensure First Nations, local communities and stakeholders fully understand the implications of forest harvesting decisions on ecological resilience and ecosystem services, and have a greater role in forest management decisions that affect them.

2. **Remove old forest from the Annual Allowable Cut (AAC) calculation, or remove existing old forest from the THLB:** For the reasons outlined in qOG's March 17 2021 report submitted to Minister Conroy, retain all remaining old growth, particularly on high productivity sites, steep unstable terrain, and higher elevation sites where forest stands are likely to be ancient (i.e. >300 years old according to VRI data).

3. If item 2 is rejected, at a minimum **adhere to deferral criteria in TAP deferral report/ mapping**. This **will require verifying stands greater than 300yo in the VR**I, to confirm if they are ancient (500+yo) forests (particularly for the MH zone, where forests are often over 1000 years old). This is because forests over 300 years of age are not reliably identified by the VRI, and TAP mapping misses most of the ancient forests in qathet Regional District as a result (as outlined in qathet Old Growth's November 2021 letter to Katrine Conroy, attached in **Appendix B**)

4. **Retain mature forest for recruitment toward meeting ecosystem-based risk targets for old forest by Landscape Unit (remove from AAC calculation or THLB):** Apply ecosystem-based risk targets for old growth (as per **Table 1** and Gorley & Merkel 2020), by landscape unit and for each BEC unit within those landscape units (as per **Table 2**). Where those targets are not currently met, retain sufficient areas of mature forest for recruitment, towards meeting ecosystem-based risk targets, with >30% historic old growth as an absolute minimum target, and >70% historic old growth as a target in landscape units that support community water supply, fish habitat/spawning, and biodiversity conservation. Retention areas should be prioritized as outlined below:

    a) Use non-stationary hydrological modelling and attribution science (as per Alila et al. 2008; Yu & Alila 2019) to **select specific recruitment/retention targets to reduce flooding and drought risks** in watersheds with important downstream values, for domestic water supply, infrastructure (culverts, roads, bridges, properties) and salmon/fish spawning.

    b) **Prioritize retention and recruitment in hydrologically sensitive areas**, particularly in community drinking water watersheds and watersheds that support salmon spawning. Mature and old forest should be retained to preserve the following features, and as per the Great Bear Rainforest Land Use Order[18]:
        - Flood plains, including high bank floodplains / fluvial and glaciofluvial sediments
        - Forested swamps

[17] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/39ts_pdp_2023.pdf
[18] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/timber-pricing/coast-timber-pricing/maps-and-graphics/great_bear_rainforest_order_-_jan_21_2016.pdf

- Active fluvial units
- Upland streams (with unique features or moderate or higher risk of sediment transport)
- Steep, unstable terrain
- Karst landscapes
- Fen and Marsh wetlands
- Cirques and wetlands in Mountain Hemlock Zone (as per Klinka & Chourmouzis 2001)
- Forests in rain-on-snow elevation (ROS) bands

c) Prioritize retention and recruitment in areas important to biodiversity conservation, including:
   - High site index (productive) forests
   - All Marbled Murrelet Habitat identified in the Marbled Murrelet Order[19]
   - 100% of Class 1 Grizzly Bear habitat
   - All habitat elements important for species at risk (including Critical Habitat), ungulate winter range, and regionally important wildlife (including bear dens, with a min 50m buffers around grizzly bear dens)
   - Red and blue listed ecosystems and plant communities
   - Wildlife trees and coarse woody debris
   - Provide connection between protected areas or other ecologically significant areas

5. **Generate maps and models of the above for review** by local community and First Nations, prior to finalizing the TSR, to allow for more meaningful engagement and input by First Nations and local stakeholders.

[19] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/biodiv-hab-mngt/mamu/mamu_luor_2dec2021.pdf

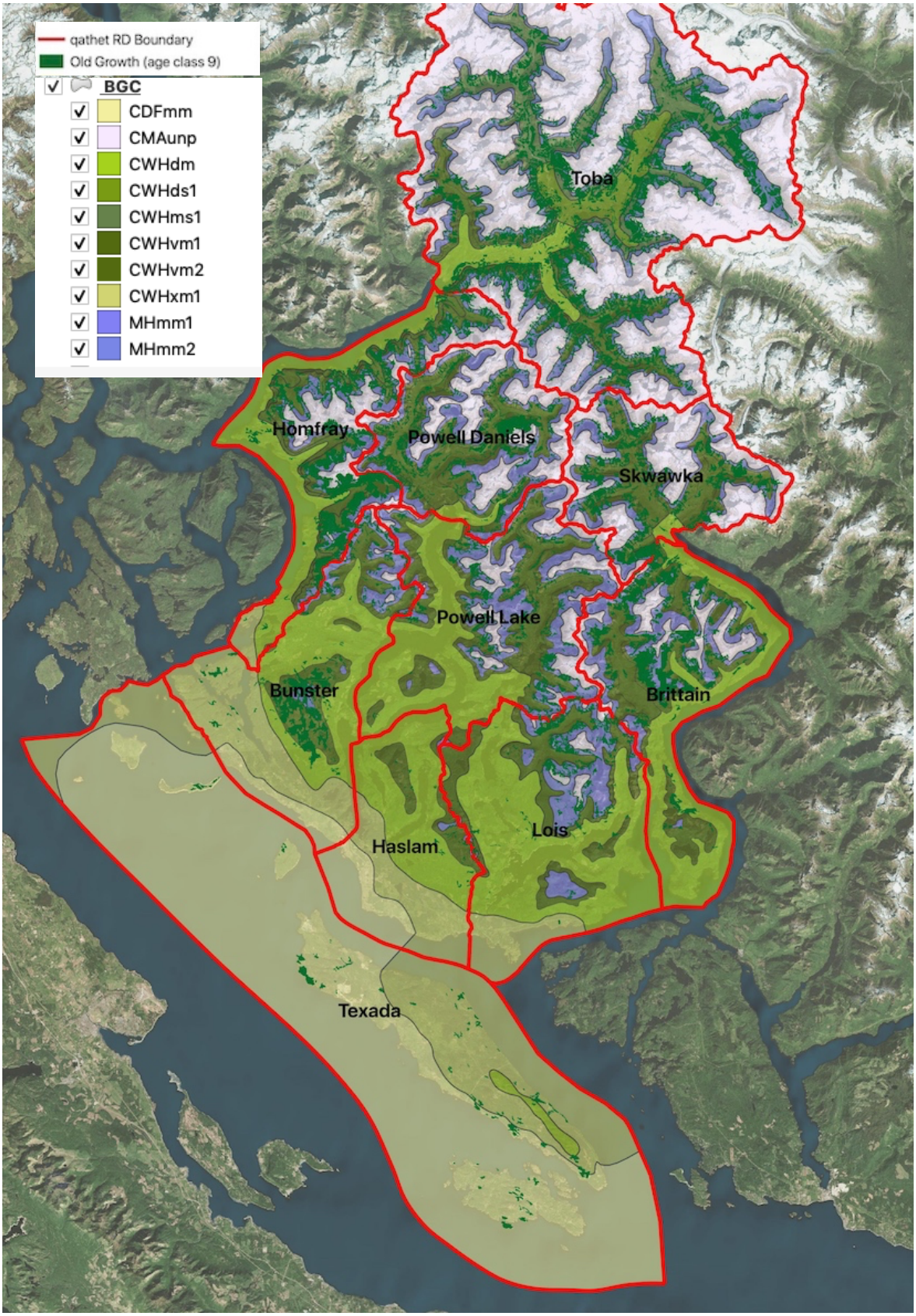

Figure 1. Remaining old forest in the qathet Regional District, relative BEC and Landscape Units.

Table 2: Remaining old forest in qathet Regional District, by BEC & Landscape Unit (based on 2019 VRI data). OGMA targets from Landscape Unit Plans, ecosystem-based risk thresholds for percentage old growth (as per Table 1), and meeting of OGSR deferral criteria 1-3 are also indicated.

LANDSCAPE & BEC UNITS	BIODIVERSITY EMPHASIS	Age Class 9 (ha)	TOTAL FOREST (ha)	OG Remaining (2019)	LUP OGMA Targets (%)	ECOSYSTEM-BASED RISK THRESHOLDS		OGSR DEFERRAL CRITERIA***		
						LOW RISK % OG*	HIGH RISK % OG**	1	2	3
Brittain	**Intermediate**	**7239.9**	**36952.5**	**19.6**						
CWH		**3821.6**	**25425.0**							
dm		501.9	11175.0	4.5	9.0	>49	<21	Y	Y	
vm		3319.7	14250.0	23.3	13.0	>61	<26			likely
MH		**2981.6**	**8435.0**							
mm		2981.6	8435.0	35.3	19.0	>65	<28			highly likely
Bunster	**Intermediate**	**4408.4**	**38780.4**	**11.4**						
CDF			**2084.1**							
mm			2084.1	0.0	9.0	>28	<12	Y	Y	
CWH		**3045.7**	**33186.3**							
xm		300.9	11399.0	2.6	9.0	>49	<21	Y	Y	
dm		386.4	13723.3	2.8	9.0	>49	<21	Y	Y	
vm		2358.4	8064.0	29.2	13.0	>61	<26			likely
MH		**1345.3**	**3197.5**	**42.1**						
mm		1345.3	3197.5	42.1	19.0	>65	<28			highly likely
Haslam	**Low**	**232.3**	**18603.6**	**1.2**						
CDF			**1137.1**							
mm			1137.1	0.0	not found	>28	<12	Y	Y	
CWH		**204.3**	**17158.5**							
xm			4611.5	0.0	not found	>49	<21	Y	Y	
dm		110.6	9842.6	1.1	not found	>49	<21	Y	Y	
vm		93.7	2704.4	3.5	not found	>61	<26		Y	likely
MH		**28.0**	**308.0**	**9.1**						

LANDSCAPE & BEC UNITS	BIODIVERSITY EMPHASIS	Age Class 9 (ha)	TOTAL FOREST (ha)	OG Remaining (2019)	LUP OGMA Targets (%)	ECOSYSTEM-BASED RISK THRESHOLDS		OGSR DEFERRAL CRITERIA***		
						LOW RISK % OG*	HIGH RISK % OG**	1	2	3
Homfray	**Intermediate**	**10140.4**	**27200.7**	**37.3**						
CMA		**713.2**	**877.4**							
unp		713.2	877.4	81.3						
CWH		**4096.4**	**19229.9**							
xm		7.7	898.9	0.9	9.0	>49	<21	Y	Y	
dm		625.4	7987.8	7.8	9.0	>49	<21	Y	Y	
vm		3463.3	10343.1	33.5	13.0	>61	<26			likely
MH		**5330.8**	**7093.5**							
mm		5330.8	7093.5	75.2	19.0	>65	<28			highly likely
Powell Daniels	**Intermediate**	**5637.8**	**12348.9**	**45.7**						
CWH		**4051.7**	**10597.3**	**38.2**						
dm		36.6	763.3	4.8	9.0	>49	<21	Y	Y	
vm		4015.2	9834.0	40.8	13.0	>61	<26			likely
MH		**1412.7**	**1578.3**	**89.5**						
mm		1412.7	1578.3	89.5	19.0	>65	<28			highly likely
Powell Lake	**Low**	**4088.0**	**26696.0**	**15.3**						
CWH		**1660.2**	**21763.5**							
dm		18.3	9618.1	0.2	9.0	>49	<21	Y	Y	
vm		1641.8	12145.4	13.5	13.0	>61	<26			likely
MH		**2254.0**	**4694.0**							
mm		2254.0	4694.0	48.0	19.0	>65	<28			highly likely
Skwawka	**High**	**6232.1**	**12452.9**	**50.0**						
CWH		**3619.6**	**9178.0**							
dm		33.3	703.5	4.7	13.0	>49	<21	Y	Y	
vm		3586.3	8474.5	42.3	18.0	>61	<26			likely
MH		**2249.4**	**2765.1**							

LANDSCAPE & BEC UNITS	BIODIVERSITY EMPHASIS	Age Class 9 (ha)	TOTAL FOREST (ha)	OG Remaining (2019)	LUP OGMA Targets (%)	ECOSYSTEM-BASED RISK THRESHOLDS		OGSR DEFERRAL CRITERIA***		
						LOW RISK % OG*	HIGH RISK % OG**	1	2	3
mm		2249.4	2765.1	81.4	28.0	>65	<28			highly likely
Texada	**Low**	**1647.5**	**37090.8**	**4.4**						
CDF		1080.5	19068.7							
mm		1080.5	19068.7	5.7	not found	>28	<12	Y	Y	
CWH		567.0	18022.1							
xm		546.5	16325.8	3.3	not found	>49	<21	Y	Y	
dm		20.5	1696.3	1.2	not found	>49	<21	Y	Y	highly likely
Toba	**High**	**24841.8**	**42982.4**	**57.8**						
CWH		**12941.6**	**27780.4**							
dm		903.9	5022.9	18.0	not found	>49	<21	Y		
ds		1531.3	5592.5	27.4	not found	>42	<18			possible
ms		5662.2	9216.6	61.4	not found	>49	<21			possible
vm		4844.2	7948.3	60.9	not found	>61	<26			likely
MH		**9535.3**	**12162.6**							
mm		9535.3	12162.6	78.4	not found	>65	<28			highly likely
Lois	**Low**	**2786.4**	**41770.3**	**6.7**						
CWH		**858**	**33305**							
xm1		10.1	1627.5	0.6	9.0	>49	<21	Y	Y	
dm		213.9	22222.3	1.0	9.0	>49	<21	Y	Y	
vm2		643.8	11083.1	5.8	13.0	>61	<26		Y	likely
MH		**1768.4**	**6540.2**							
mm		1768.4	6540.2	27.0	19.0	>65	<28			highly likely
GRAND TOTALS		**67254.6**	**294878.6**	**22.8**						

* Threshold % of old forest (by BEC unit) needed to ensure low risk to ecosystem function & resilience, as per OGSR (p.31), and Price et al. (2020) and (MOE 2020)

** Threshold % of old forest (by BEC unit) below which there is high risk of losing ecosystem function & resilience, as per OGSR (p.31), and Price et al. (2020) and (MOE 2020)

*** OGSR Deferral Criteria

1. Any BEC variant with less than 10% old forest remaining today.
2. Old forest in any BEC – Landscape Unit combination that has less than 10% old forest today.
3. Ancient forests (e.g., forests >500 years on the coast). Field verification is required, as VRI has no ages classes above 250 yo, and VRI ages are rarely projected beyond 360y. See **Appendix B**.
4. Areas with a high potential to contribute towards larger ecosystem resilience. (NOT EVALUATED IN THIS TABLE)
5. Areas with a Site Index of >20m (i.e. productive sites able to grow large trees). (NOT EVALUATED IN THIS TABLE)

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APPENDIX A
Climate Change Considerations[20]

The effects of climate change are increasingly compounding watershed pressures from human activity. Summers are becoming dryer and hotter with more frequent heat waves and increased year-to-year variability compared to historical levels. Winters will likely become increasingly warmer and wetter. Large and frequent winter rainstorms and large decreases in snowfall are expected (Little 2012). These changes in precipitation and temperature will have significant implications for hydrology and aquatic ecosystems (**Table A-1**).

Table A-1. Projected climate related changes in winter weather, storm impacts and streamflow in BC (source: Price & Daust 2013, citing others).

Winter	Summer	Storms and their impacts	Streamflow
Temp ↑	Temp ↑	Frequency & magnitude ↑	Snowmelt → hybrid rain/snow driven
Precipitation ↑	Precipitation ↓ ↑	Landslides ↑	Rain on snow events ↑
Rainfall ↑	Evaporative demand ↑	Avalanche ↑	Earlier freshet
Snowfall ↓	Plant transpiration ↑	Erosion ↑	Peak flow ↑ ↓
Snowpack ↓	Moisture deficits ↑	Sedimentation ↑	Summer low flow ↓
Snowline ↑ & north	Stream/lake temp ↑	Big log jams ↑	Low flow period ↑
Extreme weather ↑	Risk to salmon ↑	Channel stability ↓	Perennial stream → intermittent*
		Log supply (long term) ↓	

*where snowmelt not stored in ground water

The following is a summary of some of the predicted climate change impacts on coastal aquatic ecosystems (adapted from: Pike et al. 2010, Klassen & Hopkins 2016, and Price & Daust 2013 citing others).

1. **Increased evaporation:** Increased evaporation, due in part to increased air temperature, will reduce the water available in streams, lakes and reservoirs, decrease survival and growth of existing vegetation in drier areas (e.g. the CDFmm and CWHxm zones), with a big increase in fire severity and frequency in the Georgia Basin. Modeling predicts that water deficit will increase from 20 – 60% depending on location and climate scenario.

2. **Altered vegetation composition affecting water interception:** Vegetation intercepts precipitation and draws moisture from the soil through transpiration. Projected future climates will lead to changed productivity, changed dominant species. As vegetation communities shift to reflect climate, water interception, evaporation and transpiration will change.

3. **Increased water temperature:** Water temperature in streams and lakes will increase with implications to aquatic ecology. Salmon species are tolerant to particular temperature windows. Increased water temperature has consequences for sensitive populations, including increased disease, altered growth and development, thermal barriers to migration, and altered species distribution. Small changes in water temperature will likely result in distribution shifts and loss of salmonids in areas already near their limit (see **Table A-2)** for details).

4. **Increased frequency and magnitude of storms:** Increased wind and precipitation will likely increase windthrow, flooding and landslides. Associated increases in erosion and landslide-derived log jams will destabilise channels and change the temporal input of woody structure, affecting stream ecology, hydroriparian function and fish populations.

5. **Decreased snow accumulation and accelerated snowmelt:** Less water will be stored overwinter for release in spring to groundwater or streams, changing the streamflow regime. The central and northern coasts, and high-elevation sites on the south coast, are projected to have the biggest declines.

[20] This summary is adapted from the Tla'amin Nation Watershed Protection Plan (2021). https://www.tlaaminnation.com/tlaamin-watershed-protection-plan/

6. **Altered timing and magnitude of streamflows:** The impacts of climate change will vary with watershed hydrological regimes. Watersheds with rain-dominated regimes (with peak flows in winter and low flows in summer) will likely reflect projected changes in precipitation. For example, increased storms will lead to increased storm-related peak flows in winter, and drier summers will lead to more low-flow days. As snow decreases and rain increases in winter, hybrid rain and snow dominated watersheds (with peak flows in winter and spring and low flows in summer) may shift to rain-dominated regimes with more frequent winter peak flows. Larger and more frequent winter peak flows will be exacerbated by more frequent of rain-on-snow events, particularly in the shallow snowpack zone between 300 and 800m elevation.

7. **Altered timing and magnitude spring peak flows in hybrid rain and snow dominated watersheds:** As snow decreases and rain increases in winter, hybrid rain and snow dominated watersheds may shift to a rain-dominated regime with more frequent winter peak flows. Coastal watersheds with hybrid regimes often have 4-5m deep snowpacks above 1000m. Deep snowpacks can store a large amount of rain, dampening wateshed response to large midwinter rain events. If these snowpacks no longer form or are very shallow, and as winds and temperature increase, large midwinter snowfall events will become large rain or melt events, thereby increasing frequency of peak/flooding flows through the winter. With less snow, spring freshet will also be smaller and earlier, and summer low flows be lower and longer. Groundwater storage will also be decreased.

Table A-2. Projected climate change impacts on fish in the South Coast Region (adapted from: Klassen & Hopkins 2016).

Feature	Projected Impacts on Fish
Increased stream water temperature	• Increased incidence and severity of disease in some salmonid species. • Changed behaviour (e.g., movement to higher elevations to remain within suitable thermal envelopes). • In cool areas, productivity might increase. • Decreased incubation and freshwater residence time could impact prey availability or result in a thermal mismatch between freshwater and marine environments leading to decreased survival of juveniles. • Decreased dissolved oxygen could decrease carrying capacity for fish.
Increased lake water temperature	• Warming could decrease critical nearshore habitat and feeding opportunities. • Salmonid thermal niche will change as cold-water habitat shrinks or shifts into deeper water. • Introduced warm-water species (e.g. smallmouth and largemouth bass, yellow perch, common carp) may increase.
Low summer flows	• Cumulative effects of development and increased summer drought will exacerbate naturally low flows in many small coho and trout-rearing streams.
Peak flows	• Changed timing of peak flows could lead to a mismatch between hydrological regime and migration and spawning. • Changed timing or magnitude of peak flows could lead to fewer migrating smolts, decreased speed of migration or increased predation.
Winter flooding	• Low elevation habitat could experience increased sediment deposition thereby decreasing spawning habitat and reducing egg survival.
Isolated populations	• Changed climate poses risks to isolated peripheral fish populations (e.g. headwater stocks of cutthroat trout and Dolly Varden) that may have disproportionate conservation value. • Increased fire intensity and extent could impact habitat and kill fish, with potentially high impacts in isolated populations.
Marine changes	• Changes in sea level, estuarine hydrological regimes, and storm surges might impact salmonids.

References:

Klassen, H. and K. Hopkins (2016). *Adapting natural resource management to climate change in the West and South Coast Regions: Considerations for practitioners and Government staff*. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/coasten160222.pdf

Price, K. and D. Daust (2013). *Adapting to Climate Change: Hydrology and Aquatic Ecosystems.* https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/applied-science/2b_va_hydrology-finalaug30-2013.pdf

Pike, R. G., Bennett, K. E., Redding, T. E., Werner, A. T., & Spittlehouse, D. L. (2010*). Climate change effects on watershed processes in British Columbia.* https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66/Lmh66_ch19.pdf

APPENDIX B
Concerns regarding Provincial mapping of priority old growth harvest deferral areas

From: qathet Old Growth
jkmay@shaw.ca

To: Honourable Katrine Conroy
Minister of Forests, Lands, Natural Resource Operations and Rural Development

November , 2021

re: concerns regarding Provincial mapping of priority old growth harvest deferral areas

Dear Minister Conroy,

Qathet Old Growth (qOG) was pleased to hear the BC Government's November 2nd announcement on its intent to pursue "priority deferral" of 2.6 million hectares of old growth forest. It is also pleased with the release of the Old Growth Technical Advisory Panel's report on priority deferrals and associated maps.

While qOG applauds many aspects of the Technical Advisory Panel's (TAP) report and mapping, we have significant concerns regarding their Map 4: Ancient Forest[21] (depicted for qathet Regional District in **Figure 1**), and how this mapping skews their proposed priority harvest deferral areas (depicted for qathet Regional District in **Figure 2**). Priority harvest deferral areas were derived by combining TAP's Prioritized Big-tree Old Growth (Map 3), Remnant Old Ecosystems (Map 4) and Ancient Forests (Map 5) (to view, refer to this interactive website).

Our concerns relate to inherent deficiencies in the Provincial Vegetation Resource Inventory (VRI), whereby age class data does not discriminate between old (250+ yo) and ancient (400+ yo) forests[22], and ages assigned to old growth stands are unreliable and often underestimated (therefore requiring on the ground identification using tree core analysis[23]). Our review of the spatial data for qathet Regional District (qRD) indicates that these deficiencies have likely resulted in a significant underestimation of extent of ancient forest occurring in qRD, with far fewer priority deferral areas (**Figure 2**) being identified by TAP as a result.

For reasons outlined in **Box 1** below, we believe that **Figure 3** is a more accurate representation[24] of the likely extent of ancient forest in the qRD, **and that these areas should be included in TAP's priority deferral areas mapping** (as illustrated in **Figure 4**), unless otherwise ruled out by groundtruthing via tree core analysis.
In qRD the stakes are high in this regard, as most old growth logging is currently taking place in higher elevation remnant forests that are more likely to be ancient (most of the lower elevation, easily accessed forest having already been logged). This is exemplified by the attached report which documents trees between 800 and 1200 years old felled in a recent WFP cutblock on Mount Freda; the VRI assigned age for this stand was 351 years (see article in *Powell River Living*[25]).

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[21] According to the Old Growth Strategic Review, ancient (400+ year old) forests have ancient genetic material and are repositories of biota and processes we may not even know or understand. This makes them an extremely important buffer against species extinction, climate change, and lost future opportunities. These "ancient forests" are globally unique, rare, and contain species as yet undiscovered, and many of these ecosystems and old forests are non-renewable within any reasonable time frame. Many of these irreplaceable forests are in the timber harvesting land base and are subject to logging,

[22] Holt R., Price, K., Kremsater, L., MacKinnon, A., and K. Lertzman (2008). *Defining old growth and recovering old growth on the coast: discussion of options.* Report prepared for the Ecosystem Based Management Working Group .

[23] Old Growth Technical Advisory Panel (2021). *Priority Deferral Areas: An Ecological Approach*.

[24] by including stands with a reasonable likelihood of being ancient: **i.e.** higher elevation big-tree Old Growth assigned as 300+ years old by the VRI.

[25] *Millenia-old cedars felled on Mount Freda (May 2021)*

Figure 5 shows that a number of old growth stands within proposed WFP cutblocks fall outside TAP's currently proposed priority deferral areas. **qOG believes there is a significant probability that these stands are actually ancient, and that at a minimum groundtruthing of the ages of these stands (and those in cutblocks proposed by other licensees) is urgently required.**

qOG respectfully asks that you **address these concerns about underrepresentation and mislabelling of ancient forests prior to finalizing priority deferral areas for qRD**, and provide the public and First Nations with a methodology detailing how this will be done given the absence of reliable spatial data, e.g. through the precautionary application of surrogate data (such as we did in generating **Figure 2**), and through comprehensive groundtruthing via tree core analysis.

Yours truly,

Janet May

Attached:
GIS Analysis of Forest Cover in the qathet Regional District (2021)
Mount Freda, Powell River Living (Jan 2021)

cc :
Hegus John Hackett, Tla'amin Nation, john.hackett@tn-bc.ca
hiwus Henry Warren Paull , shíshálh Nation, wpaull@shishalh.com
Nicholas Simons, MLA Powell River- Sunshine Coast Nicholas.Simons.MLA@leg.bc.ca
Diane Nicholls, Chief Forester, Resource Stewardship Division, Diane.Nicholls@gov.bc.ca
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Wendy Hamod, South Coast Natural Resource Region, wendy.hamod@gov.bc.ca
Derek Lefler, Sunshine Coast Natural Resource District Manager, Derek.Lefler@gov.bc.ca
Rachel Holt, Technical Advisory Panel, rachel@veridianecological.ca
Patrick Brabazon, qathet Regional District, pbrabazon@qathet.ca
Mayor Dave Formosa, City of Powell River, dformosa@powellriver.ca

Box 1. Reasons for concern about TAP's ancient forest and priority deferral area mapping in qathet Regional District:

1. In qathet Regional District, most of the remaining Big Tree Old Growth) is located in wetter and higher elevation areas (i.e. the CWHvm and MHmm biogeoclimatic subzones) due to extensive historic logging in lower elevations, coastal areas, and along valley bottoms.
2. Because wetter and higher elevation coastal forests naturally experience only low levels of disturbance (e.g. fire), historically these forests would have been 85-95% old growth (as per **Table 1 in** our March 2021 report to the Minister). Fire-return intervals in these types of forests have been estimated at between 700 and 6000 years, and as a result some forests are many thousands of years old[2]. For example, the Caren Range Forest of the lower Sunshine Coast is known to have 1250 year old Hemlock and 1824 year old Yellow Cedar, and may be the oldest known closed canopy forest in the world[3].
3. Consequently, in qRD the ages of many remaining big tree old growth stands in the CWHvm and MHmm BEC subzones of would be expected to be ancient (400+ years old), particularly those stands in the MHmm subzone, where trees are slow growing and small for their age (and hence are often many hundreds of years old before reaching a harvestable size). This is depicted by **Figure 3**, in which we highlight higher elevation big tree stands in the CWHvm and MHmm zones labelled as 300+ years old in the VRI, which we believe are likely to actually exceed 400 years of age.
4. In comparison, the Technical Advisory Panel's mapping of ancient forest[4] (**Figure 1**), shows only a handful of ancient forest stands in the qathet Regional District, with none being labelled as greater than 557 years old.
5. Empirically we know there are mislabelled ancient stands in qRD, including stands that are greater than 557 years old. Tree ring counts on a selection of stumps in a recent WFP cutblock in the MHmm zone of Mount Freda (in the qRD) found trees between 800 and 1200 years old (see attached report, and Powell River Living Article[5]). However, the VRI assigned age for the stand was only 351 years, illustrating the limitations of using existing provincial forest cover data to identify ancient forest attributes. We are certain many more ancient forest stands will be revealed by further groundtruthing efforts.

Lertzman, K., D. Gavin, D. Hallet, L. Brubaker, D. Lepofsky and R. Mathewes. 2002**.** Long-term fire regime estimated from soil charcoal in coastal temperate rainforests. *Conservation Ecology* 6(2): 5. http://www.consecol.org/vol6/iss2/art5

[2] Price, K., R.F. Holt and D. Daust (2020). *BC's Old Growth Forest: A Last Stand for Biodiversity.*

[3] Jones, P. (2003). *Caren Range Ancient Forest.* Paper submitted to the XKK World Forestry Congress, 2003, Quebec City, Canada. https://www.fao.org/3/XII/0081-B1.htm

[4] Which was based on Province of BC 2010. BC Land Management Handbook #25. Structural stage 7b. NDT 1, 2 and 4 for less frequent disturbance .

[5] *Millenia-old cedars felled on Mount Freda (May 2021)*

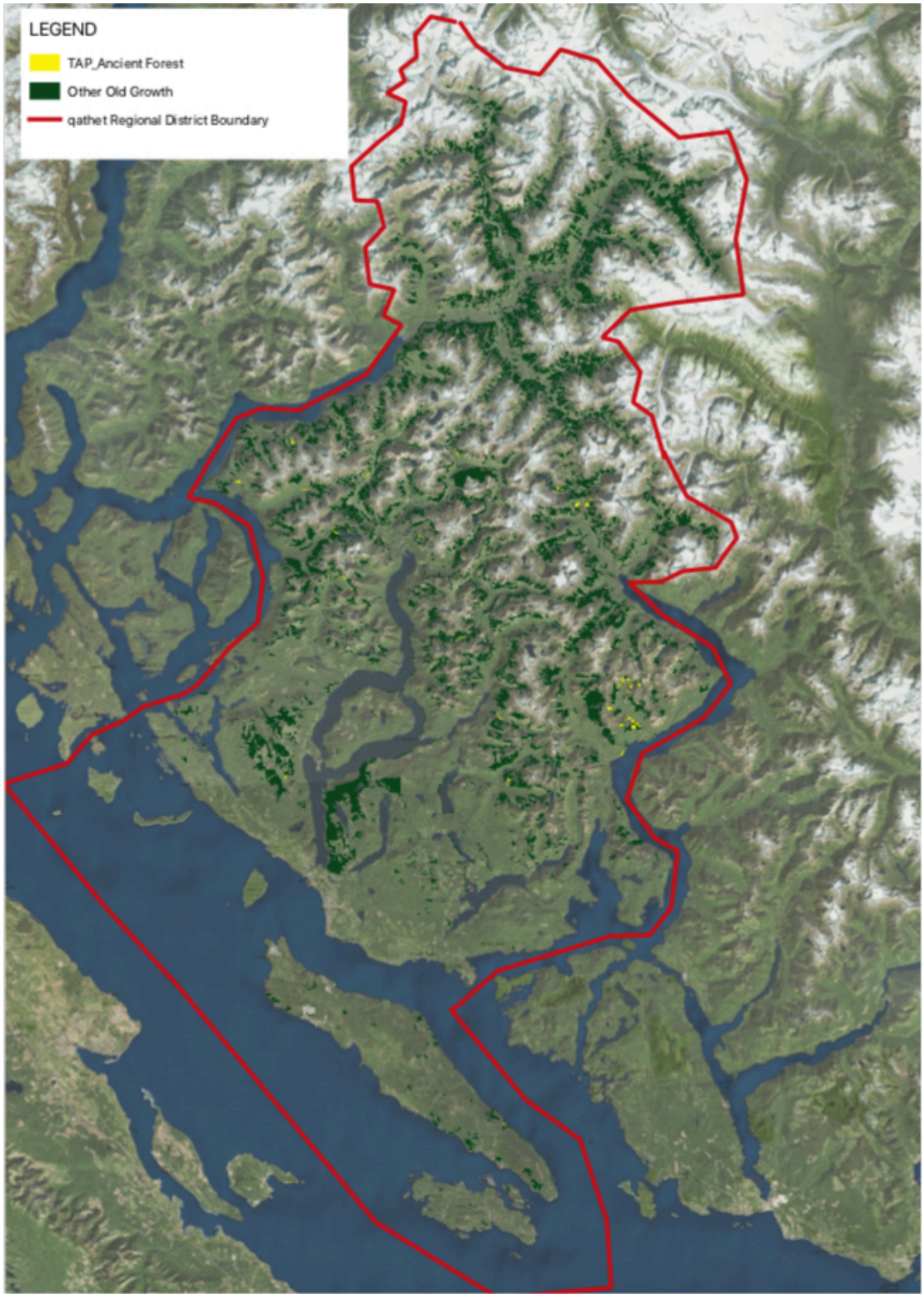

Figure 1. Technical Advisory Panel mapping showing only a handful of of ancient forest stands (400+ years old) in qathet Regional District.

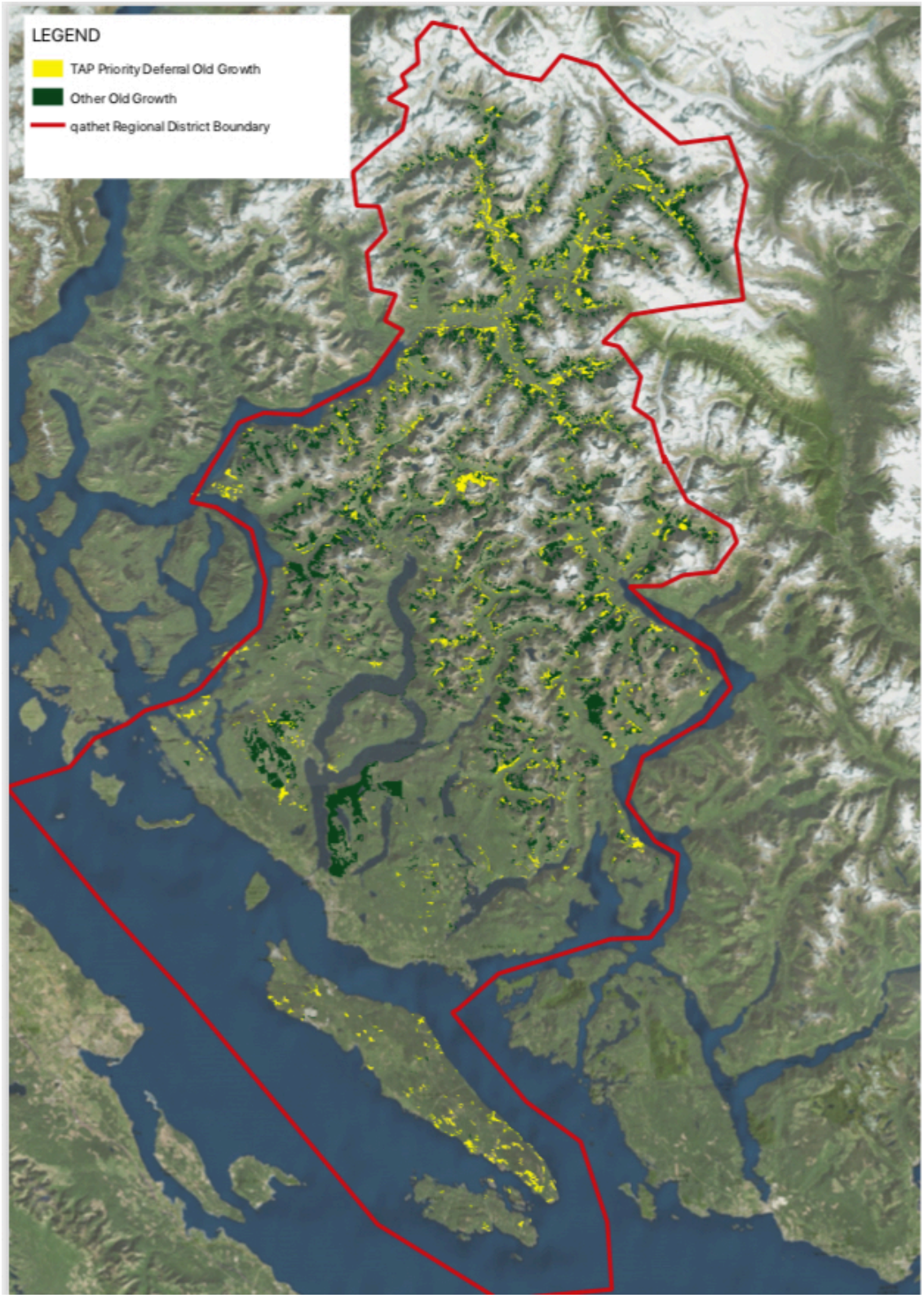

Figure 2. Priority old growth deferral areas for qathet Regional District, as mapped by the Technical Advisory Panel, based in part on the ancient forest mapping shown in Figure 1.

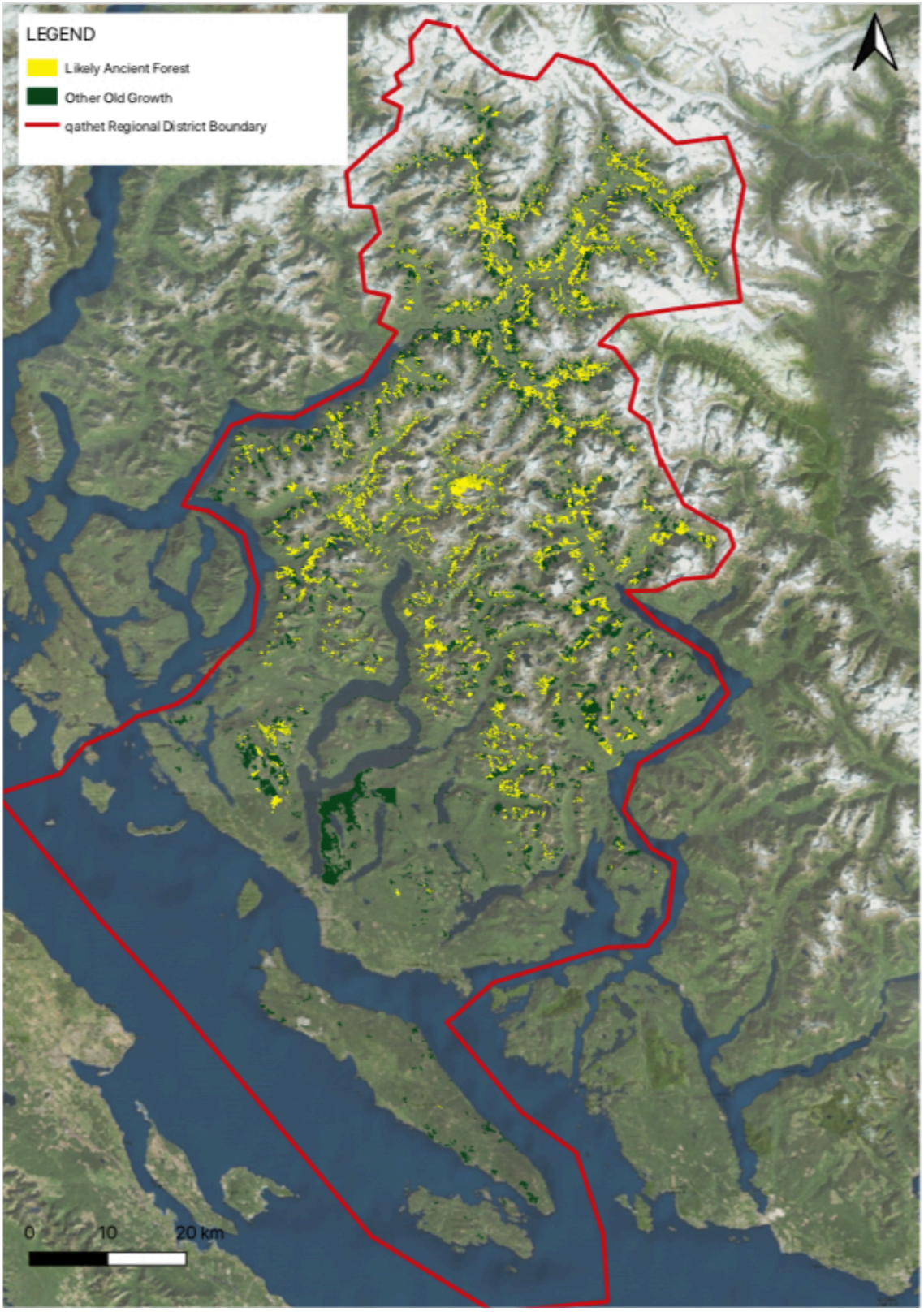

Figure 3. qOG's estimation of a more likely extent of ancient forest in qathet Regional District, as per reasons outlined in Box 1.

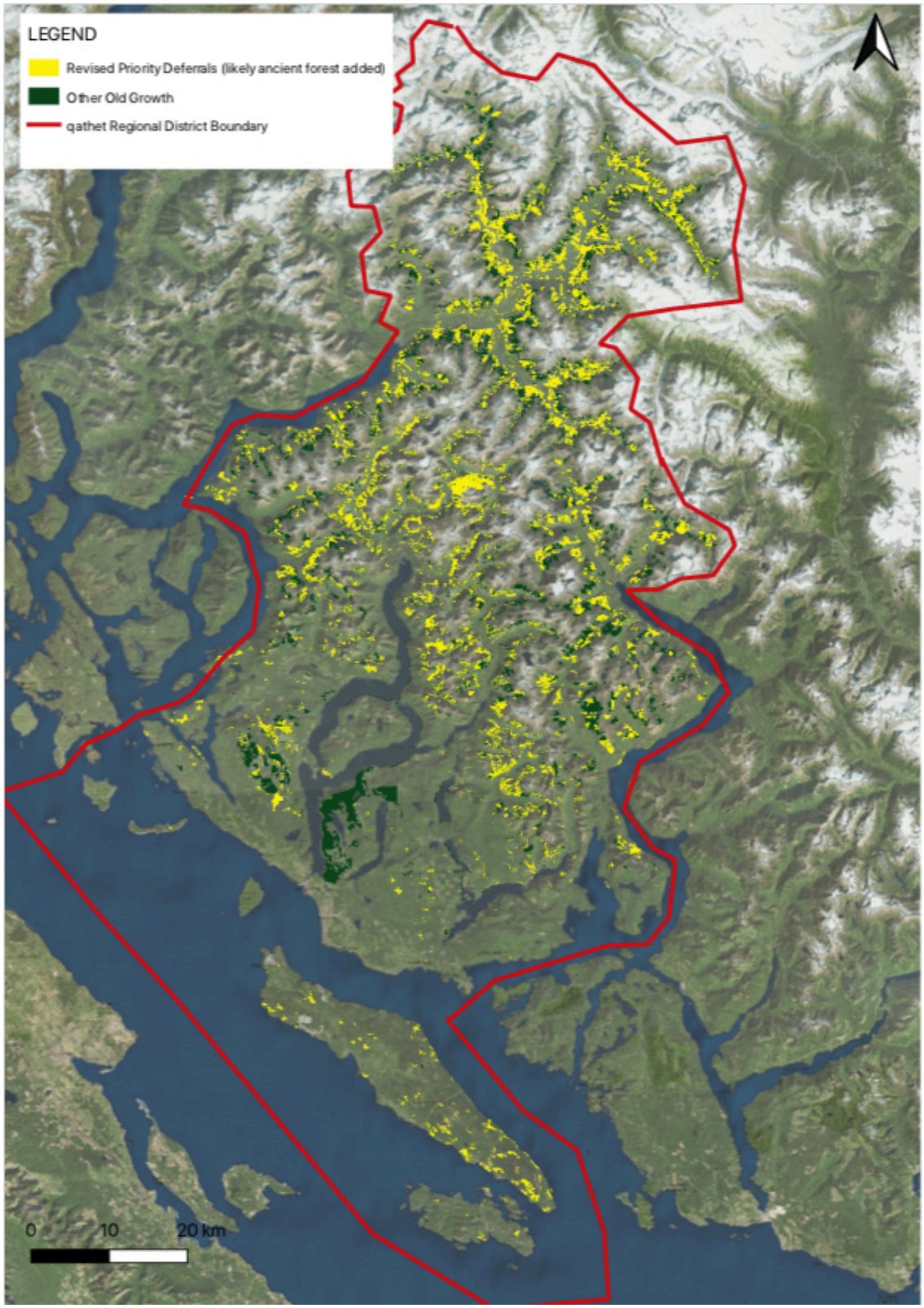

Figure 4. qOG's estimation where priority deferral areas should be located, to better incorporate stands which are likely to be ancient, but which are not captured as such in Provincial databases.

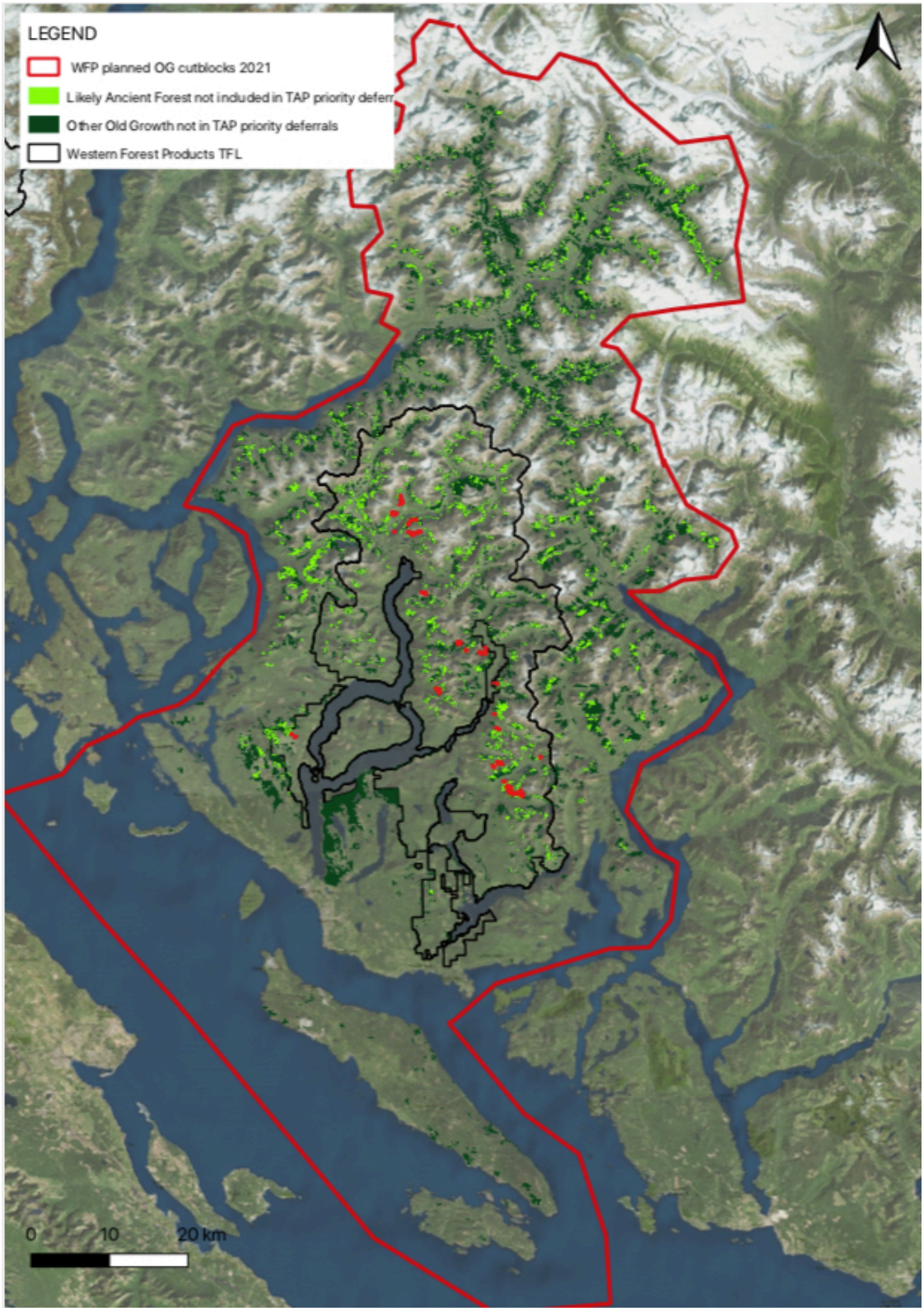

Figure 5. Old growth that falls within proposed WFP cutblocks and also falls outside the Technical Advisory Panel's proposed priority deferral areas. Stands shown in bright green have a significant likelihood of being ancient, despite not being mapped as such.