



Ecosystem Services Under Climate Change

The dry sub-boreal spruce biogeoclimatic zone
of the interior North-West (Nechako Plateau)



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ECOSYSTEM SERVICES

Supporting

- Maintenance of life cycles
- Maintenance of habitat for species
- Maintenance of genetic diversity

Provisioning

- Food & Fur
- Water
- Harvested wood products
- Medicinal resources

Regulating

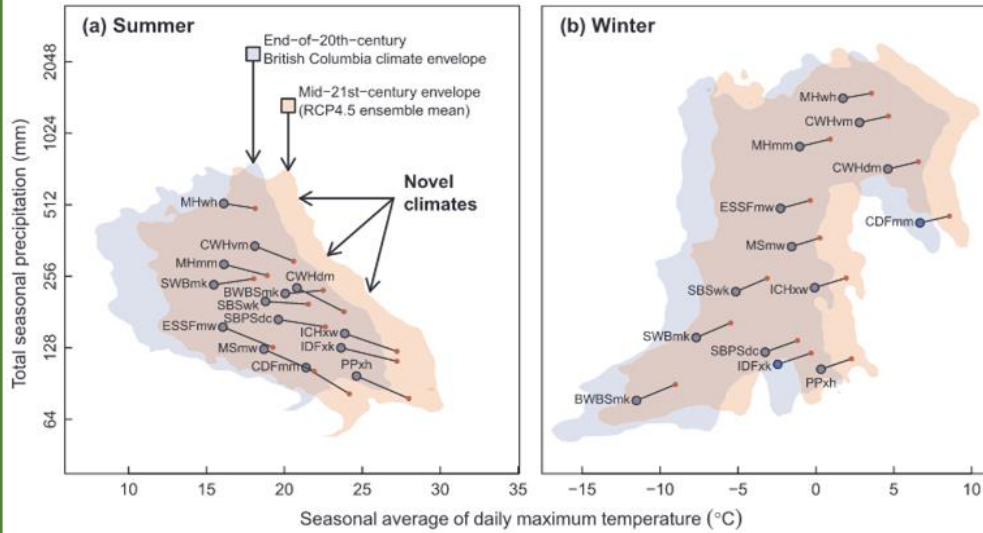
- Climate regulation
- Moderation of extreme events
- Nutrient cycling
- Biological control

Cultural

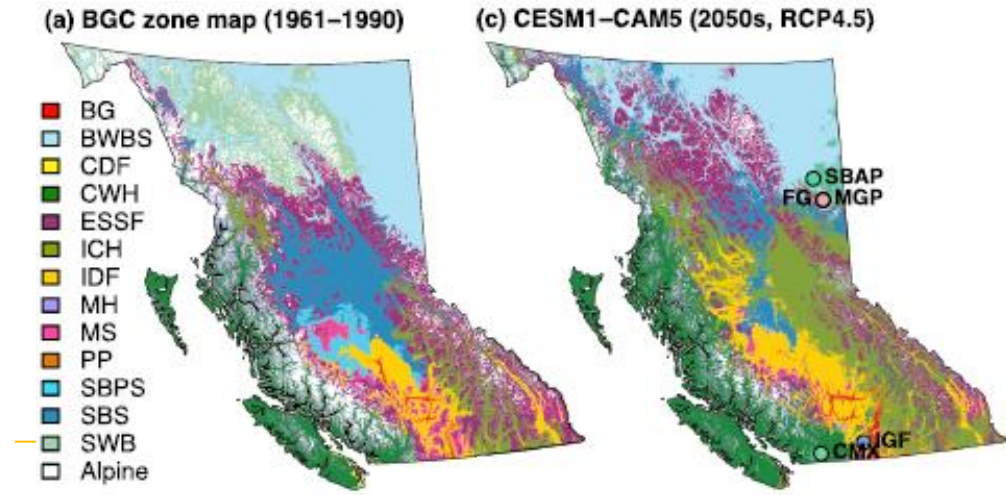
- Spiritual
- Sense of place
- Opportunities for recreation
- Cognitive development



Supporting



Projected shifts in the British Columbian temperature-precipitation envelope in winter (a) and summer (b). RCP4.5 ensemble mean projection for the 2041–2070 period. [Figure from Mahony et al. (2018)]



Projected mid-century geographic shifts in bec zones within British Columbia. (a) Mapped bec zones, (c) Biogeoclimatic projections of the 2041–2070 period (RCP4.5) for two GCMs with medium (CESM1-CAM5 regional climate sensitivity). Inset labels indicate occurrence of extra-provincial BGC zones. [Figure from MacKenzie and Mahony, 2021]

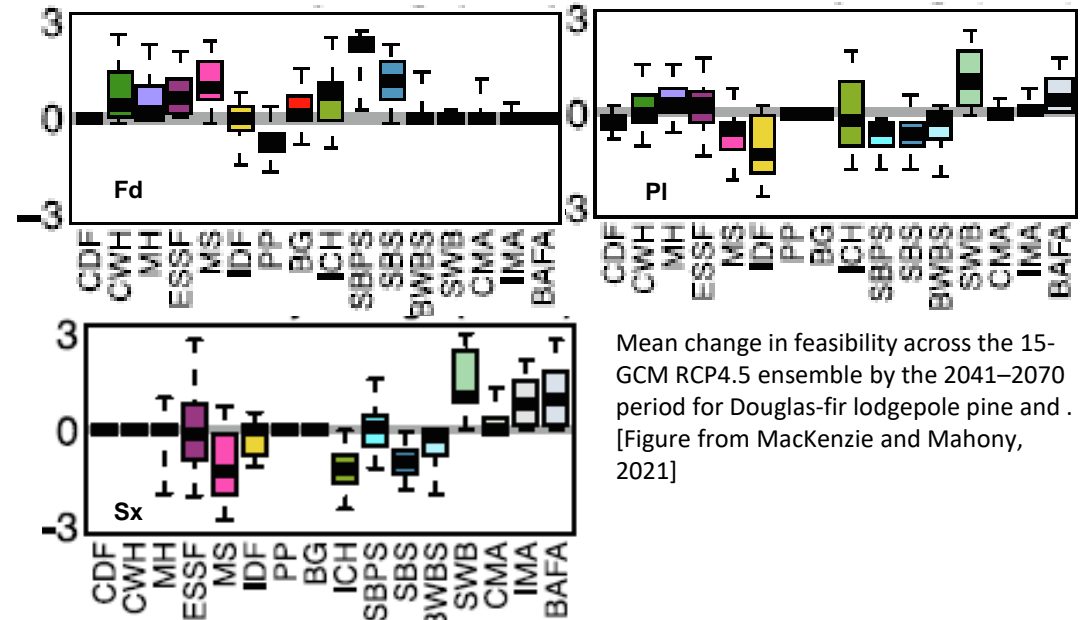
Mahony et al. (2018):

No novel ecosystems

MacKenzie and Mahony (2021):

Expansion of Fd-Douglas-fir

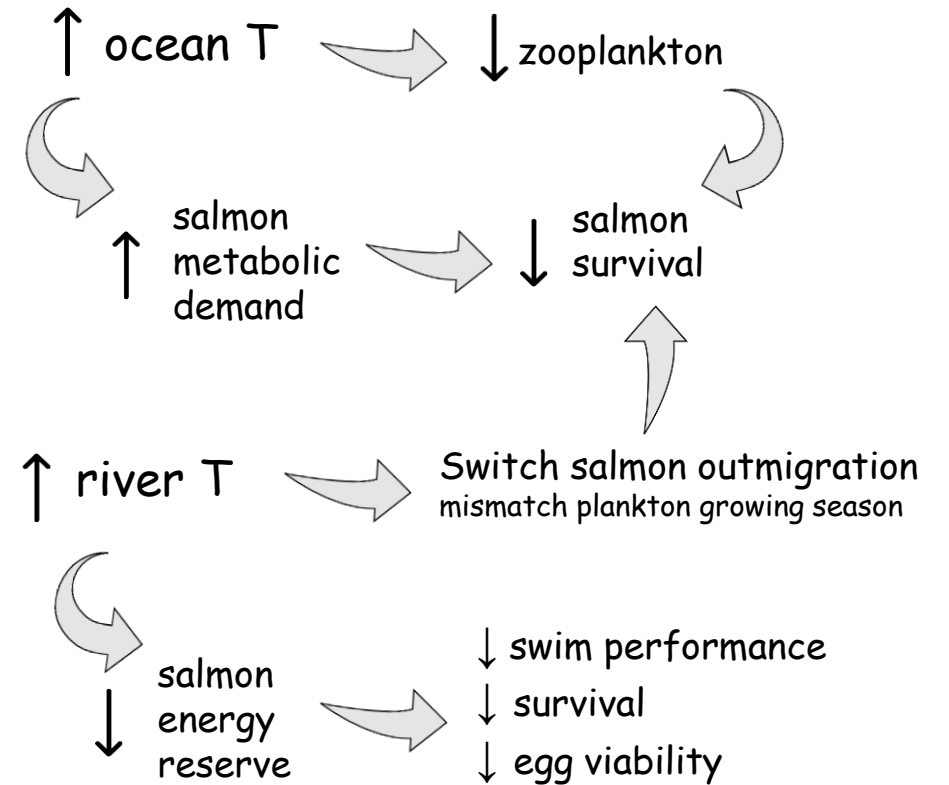
**Retreat of PI-lodgepole pine
Sx-interior spruce**



Mean change in feasibility across the 15-GCM RCP4.5 ensemble by the 2041–2070 period for Douglas-fir lodgepole pine and interior spruce. [Figure from MacKenzie and Mahony, 2021]

Provisioning

- Food & Fur
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Grant et al. 2019. State of Canadian Pacific Salmon: Responses to Changing Climate and Habitats. Can. Tech. Rep. Fish. Aquat. Sci. 3332. ix+ 50p.

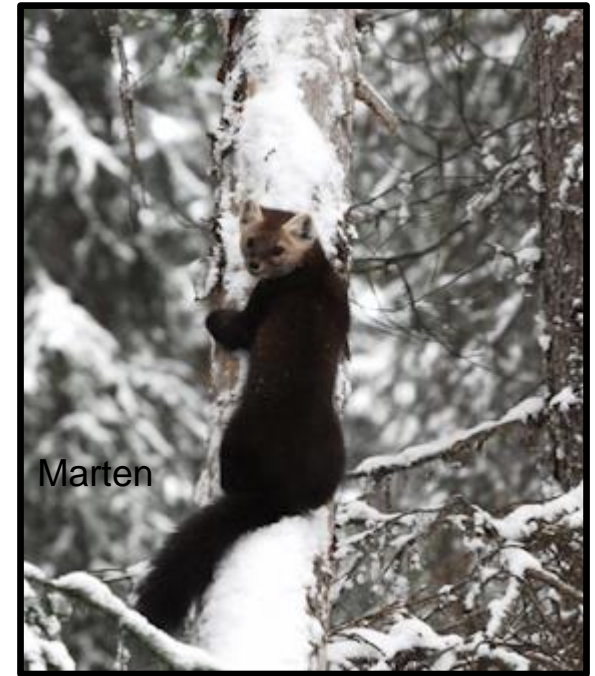
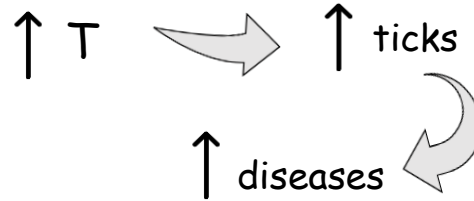
2016. Climate Change Vulnerability of BC's Fish and Wildlife: First Approximation

Provisioning

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Generalist: uses multiple habitats



Riparian specialist:

- needs wetlands/riparian habitat for cooling as well as preferred forage
- uses forest for cover

Sensitive to heat

Drying of wetland poses potential habitat loss

Old forest specialist:

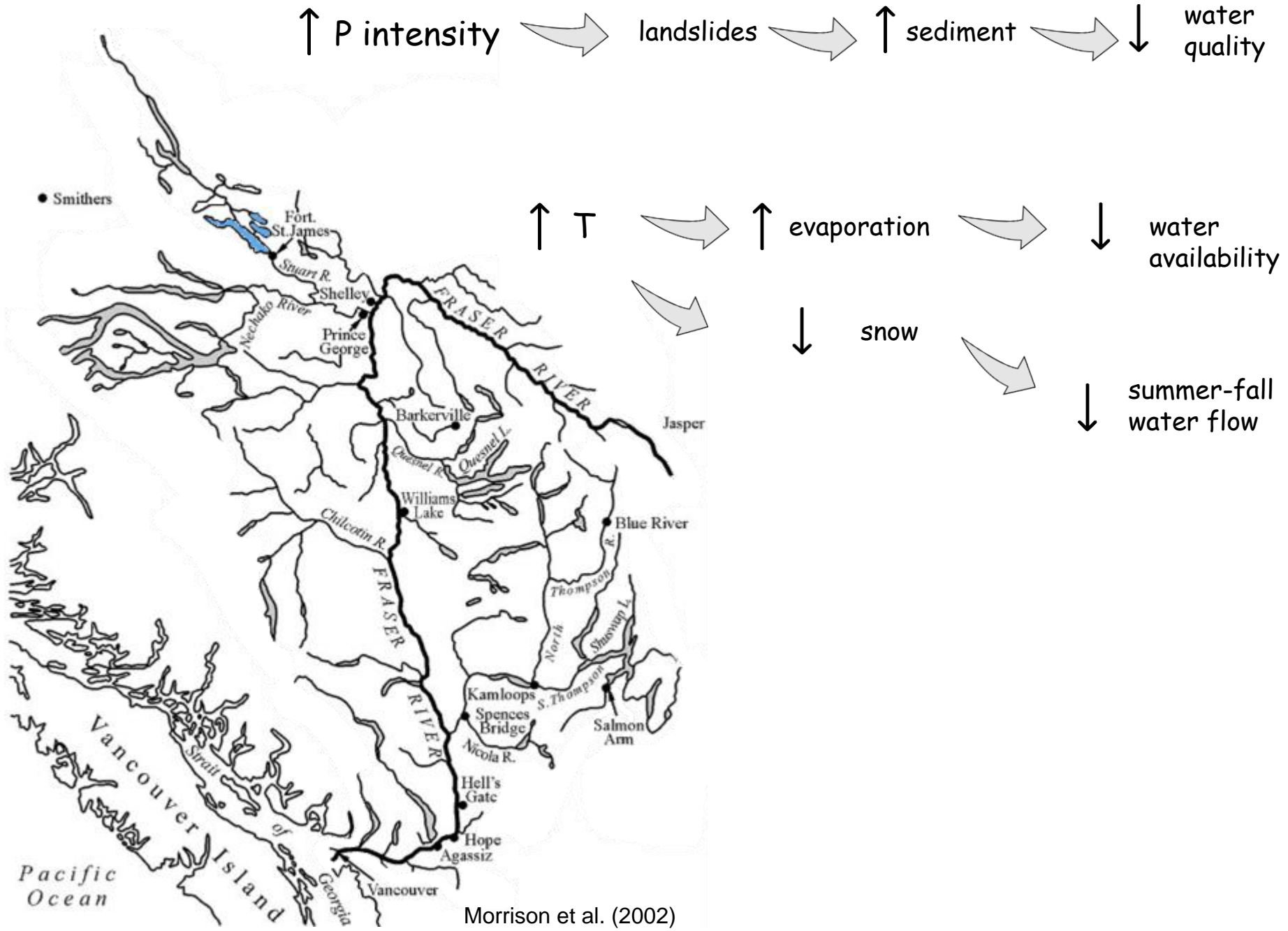
- needs mature forest with downed wood structure (subnivean habitat)
- Dependent on snowpack

Vulnerable to changes in disturbance regime and warmer temperatures



Provisioning

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Provisioning



News Release



For Immediate Release

May 20, 2020

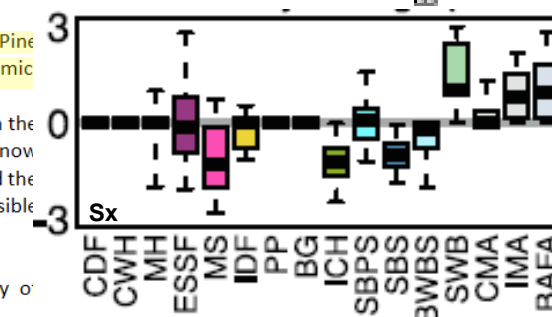
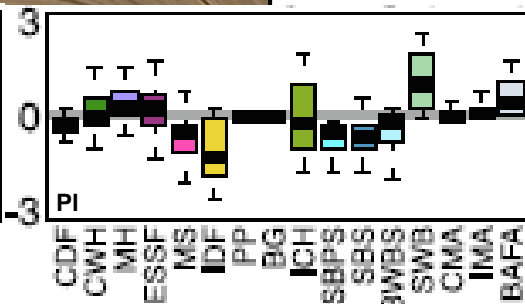
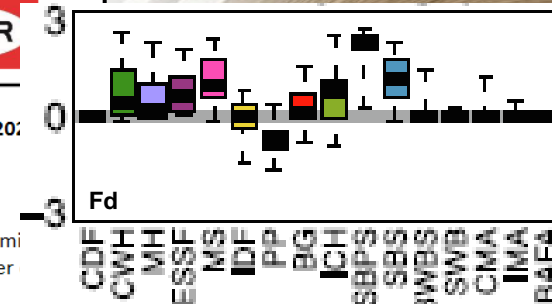
Canfor to Permanently Close Isle Pierre Mill

Vancouver, BC — Canfor Corporation (TSX:CFP) announced today it will be closing its Isle Pierre sawmill which is located near Prince George, British Columbia. The closure will take effect in the third quarter 2020 following an orderly wind down of operations.

The closure is a result of an insufficient supply of economically viable timber following the Mountain Pine Beetle epidemic, coupled with the major global economic downturn as a result of the COVID-19 pandemic

“Unfortunately, the ongoing economic devastation caused by the COVID-19 pandemic has resulted in the urgent need for Canfor to make this difficult decision,” said Don Kayne, President and CEO. “We know today’s announcement will have a significant impact on our employees, contractors, their families and the local communities, which we deeply regret. We will work hard to redeploy as many employees as possible to other opportunities throughout the company.”

Based on the current one-shift operation, Isle Pierre sawmill has an annual production capacity of approximately 120 million board feet.



Mean change in feasibility across the 15-GCM RCP4.5 ensemble by the 2041–2070 period for Douglas-fir lodgepole pine and . [Figure from MacKenzie and Mahony, 2021]

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Provisioning

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Specialists



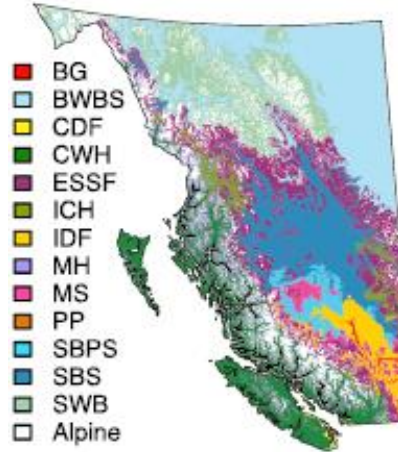
Generalist



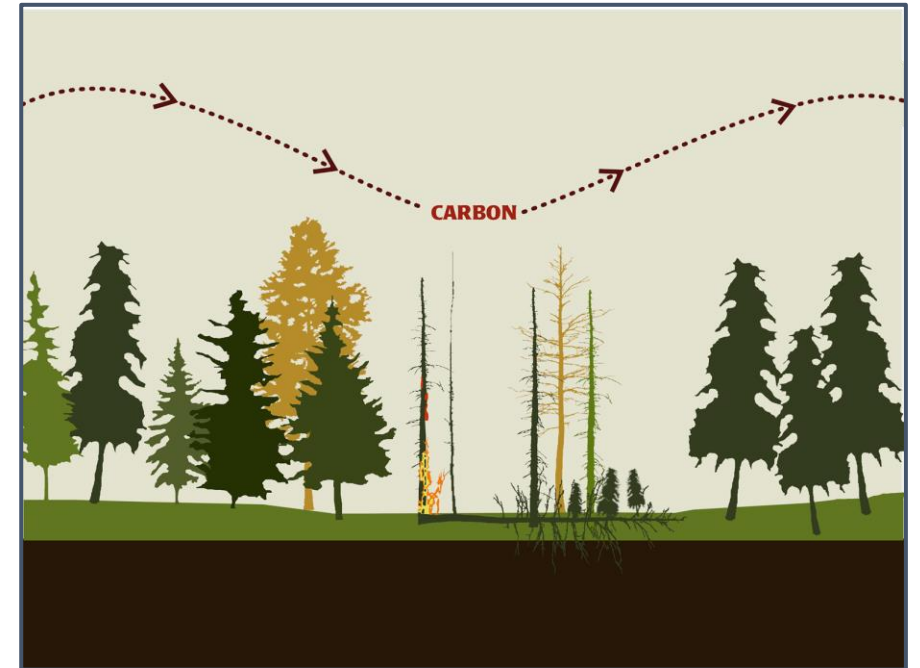
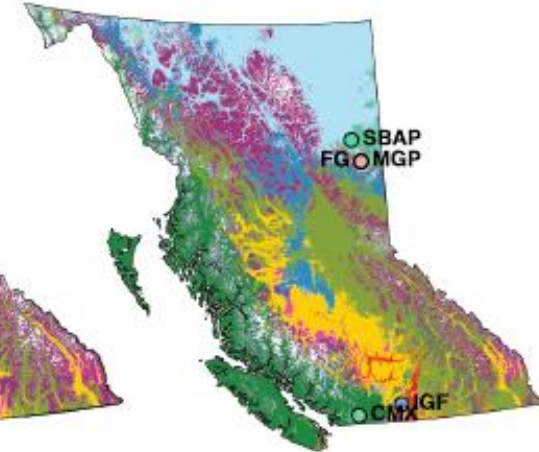
Regulating

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(a) BGC zone map (1961–1990)



(c) CESM1–CAM5 (2050s, RCP4.5)

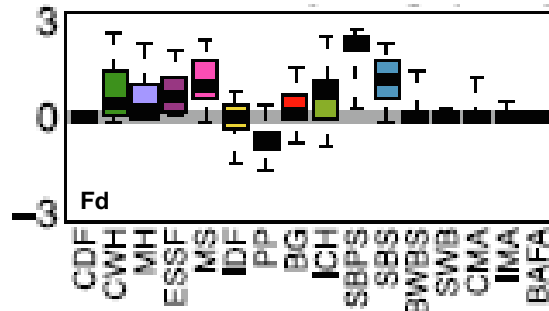


Regulating

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**A shift in species distribution might change fire regime.
towards more frequent but low severity fires?**



species	adult bark thickness	root habit	branching habit	flammability foliage	overall resistance
white spruce	thin bark	shallow	low	high	NONE
Douglas-fir	very thick	usually deep	low & dense	high	HIGH
subalpine fir	very thin	shallow	low	high	NONE
black spruce	thin	shallow	low	high	NONE
lodgepole pine	very thin	deep	high & open	medium	LOW

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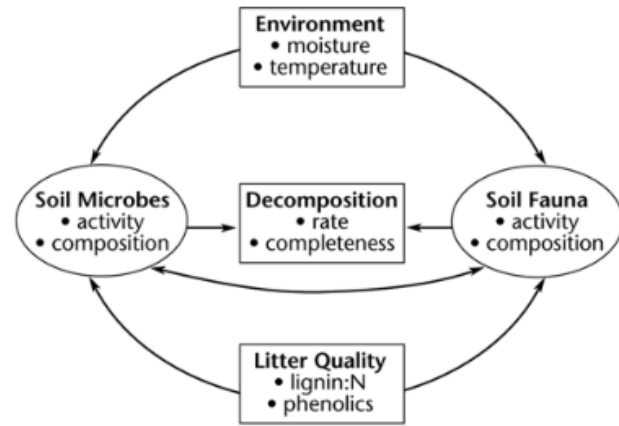


FIGURE 1. Factors that control the rate and completeness of decomposition. Source: Prescott *et al.* (2000a).

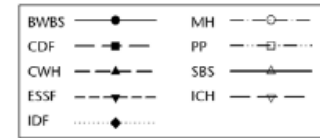
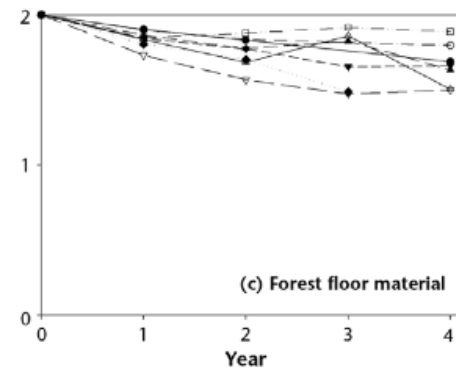
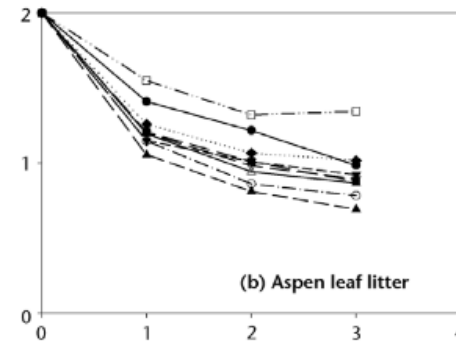
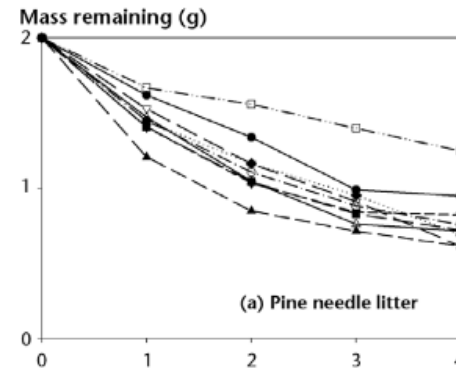
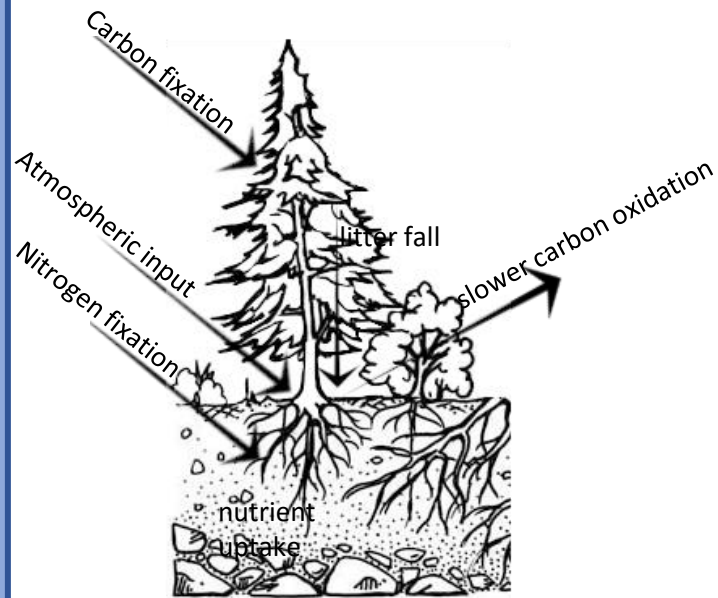
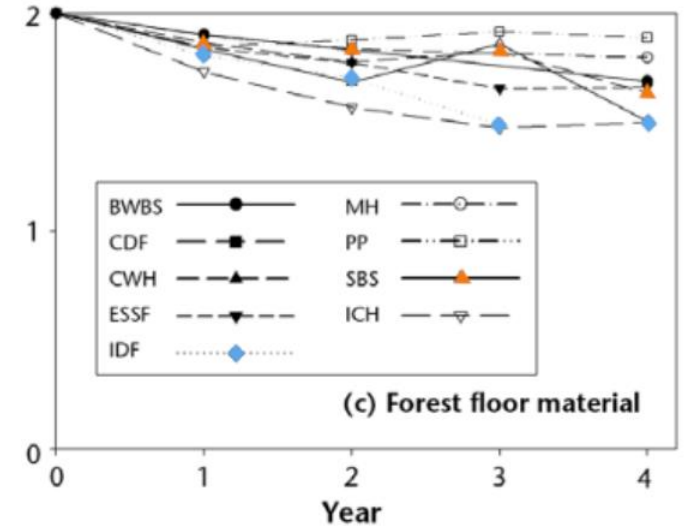


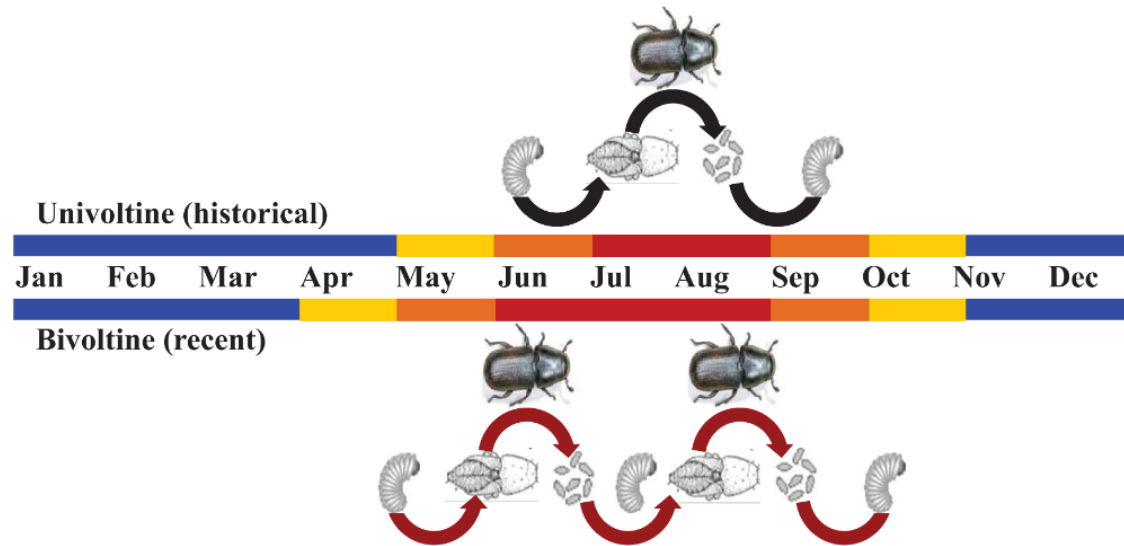
FIGURE 3. Mass loss of (a) pine needle litter, (b) aspen leaf litter, and (c) forest floor material in sites in each biogeoclimatic zone.



Slower nutrient cycling can potentially reduce tree growth

Regulating

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Mitton and Ferrenberg (2012)

Cultural

- **Spiritual**
- Sense of place
- Opportunities for recreation
- Cognitive development



Traditional Clan Names:

Beaver	Lhts'umusyoo
Frog	Lusilyoo
Caribou	Granton
Bear	Lohjeboo

Kinship

Keyohs are clan territories, which “serve as the material, cultural, and spiritual basis for sustaining human life” (Brown 2002).



spiritual well-being = human health

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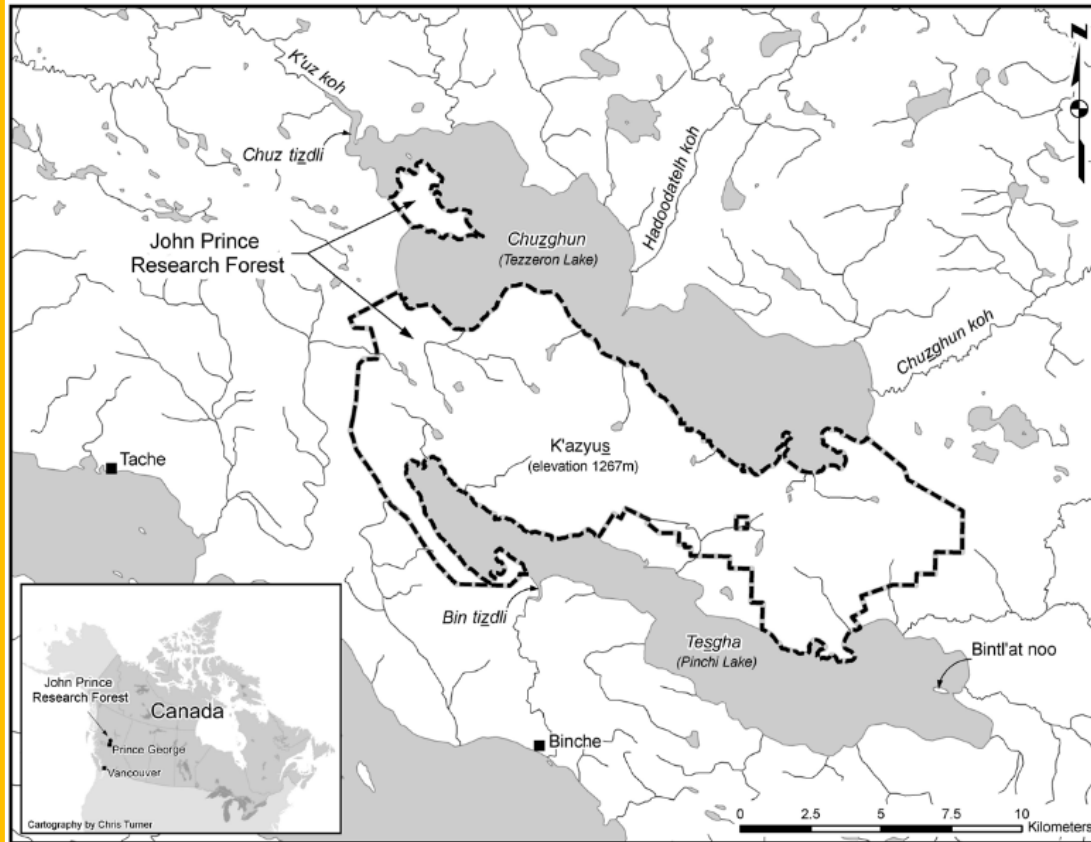


Fig. 1. Dakelh toponyms researched and their locations in the vicinity of the John Prince Research Forest, British Columbia, Canada. (From Mitton JB and Ferrenberg SM.)



Dakelh name & gloss	Official name
<p>Chuzghun “A down feathers place”(where ducks and geese moult). Also refers to the treed shoreline of the lake. <i>chuz</i> = snowflake; soft or hollow wood. -<i>ghun</i> (from <i>bunghun</i>) = lake, lake area.</p>	Tezzeron Lake
<p>Chuz tizdli The point at which the waters of Chuzghun discharge. <i>tizdli</i> = that flows out; starting to flow; flowing creek; water running out of a lake; beginning of a running river; river running out of a body of water; running water; where water runs out; flowing away from a body of water.</p>	–
<p>K’uz koh K’uz (from ‘u’k’uz) = half; parts that make a whole; half a side of fish. -<i>koh</i> (from ‘ukoh) = creek, river, stream.</p>	Kuzkwa River
<p>Hadoodatelh koh Describes the soft quality of the bed of the lake it takes its name.</p>	Hatdudat Creek
<p>Chuzghun koh</p>	Tezzeron Creek
<p>Tesgha Refers to the mossy quality of the lakebed, which is prime whitefish habitat. Also describes the lake area as a refuge or “resting area” for migrating waterfowl. <i>Tes</i> = bed; bedding. -<i>gha</i> = hairy, furry or mossy.</p>	Pinchi Lake
<p>Bin tizdli The point at which the waters of Tesgha discharge.</p>	–
<p>Bintl’at noo Island at Tesgha’s farthest end (farthest upstream end of the lake). -<i>tl’at</i> = posterior; backside (indicating backwater areas, upstream from settlements).</p>	–
<p>K’azyus -<i>yus</i> = ridge (archaic Dakelh form).</p>	Pinchi Mountain

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Snow and water sports most affected by climate change

Cultural

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JPRF RESEARCH



Use of constructed coarse woody debris corridors in a clearcut by American martens (*Martes americana*) and their prey



The role of environmental variables and sympatric meso-carnivores on the detection and occupancy of American mink during winter



Wildlife Health Indicators and Mercury Exposure: A Case Study of River Otters (*Lontra canadensis*) in Central British Columbia



An assessment of the efficacy of rub stations for detection and abundance surveys of Canada lynx (*Lynx canadensis*)



Year-round Activity Patterns of Moose (*Alces alces*) at a Natural Mineral Lick in North Central British Columbia, Canada.



Visitations by Snowshoe Hares (*Lepus americanus*) to and Possible Geophagy of Materials from an Iron-rich Excavation in North-Central British Columbia.



Paper birch (*Betula papyrifera*) shoot selection by moose (*Alces alces*) following a forest clearing experiment.



Using Wildlife Vehicle Collision Data, Expert Opinions and GPS Technology To More Accurately Predict and Mitigate Vehicular Collisions With Wildlife in Northern ...



Considerations For Natural Mineral Licks Used By Moose in Land Use Planning and Development



Improving a Field School Curriculum Using Modularized Lessons and Authentic Case-Based Learning



Assessing noninvasive hair and fecal sampling for monitoring the distribution and abundance of river otter.



Diet Content and Overlap of Sympatric Mule Deer (*Odocoileus hemionus*), Moose (*Alces alces*), and Elk (*Cervus elaphus*) During a Deep Snow Winter in North-central ...



Ecosystem Services Under Climate Change

During the workshop, I would encourage you to:

1. Value all the ecosystem services at risk
2. Consider that users might value services differently
3. Embrace collaborative efforts for climate adaptation
4. Remember, there is high uncertainty