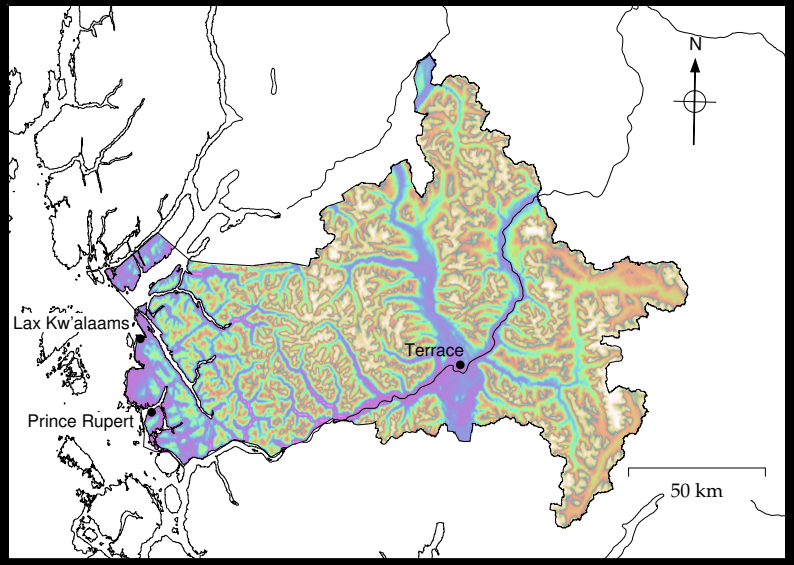
Climate Change Adaptation Planning for the Skeena Region of British Columbia, Canada:

A combined biophysical modelling, social science, and community engagement approach



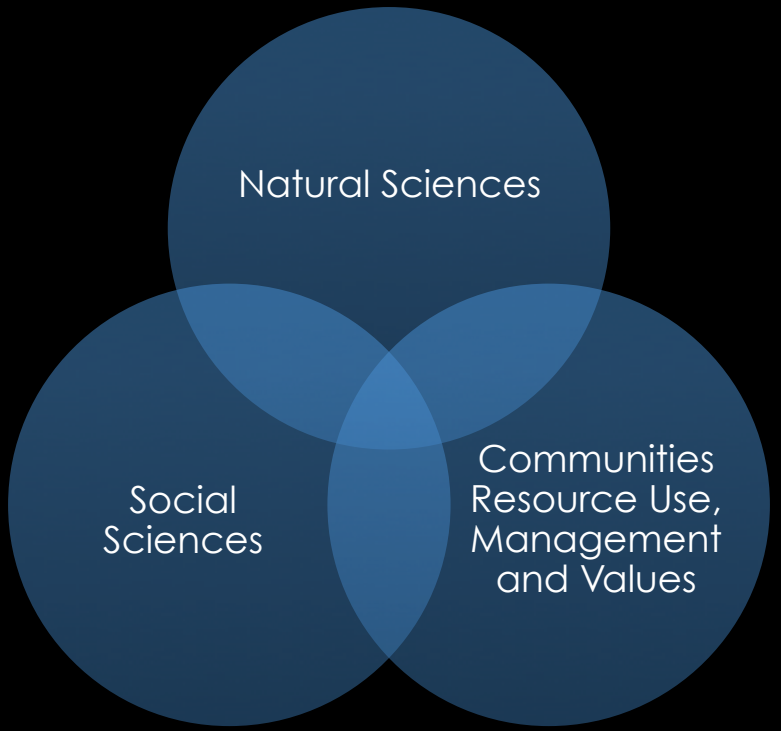
Joe R Melton[1, 5], Jed O Kaplan[1, 5], Ralph Matthews[2], Robin Sydneysmith[2], Jordan Tesluk[2], Georgia Piggot[2], Donald C Robinson[3], Dirk Brinkman[4], Dave Marmorek[3], Stewart Cohen[6], Katie McPherson[4]

1. ENAC IIE, ARVE Group, Lausanne, Switzerland.
2. Sociology, University of British Columbia, Vancouver, BC, Canada.
3. ESSA Technologies Ltd., Vancouver, BC, Canada.
4. Brinkman and Associates Reforestation Ltd., Vancouver, BC, Canada.
5. Earth and Ocean Sciences, University of Victoria, Victoria, BC, Canada.
6. Adaptation & Impacts Research Section (AIRS), Environment Canada, Vancouver , BC, Canada.

Project Purpose

- Form basis for local decision makers to develop a plan for the development of forests and river systems in the Skeena regions that:
  - Accounts for projected future climate change
  - Accounts for the 'values' identified by local communities
  - Is consistent with the changes and future that local community residents identify

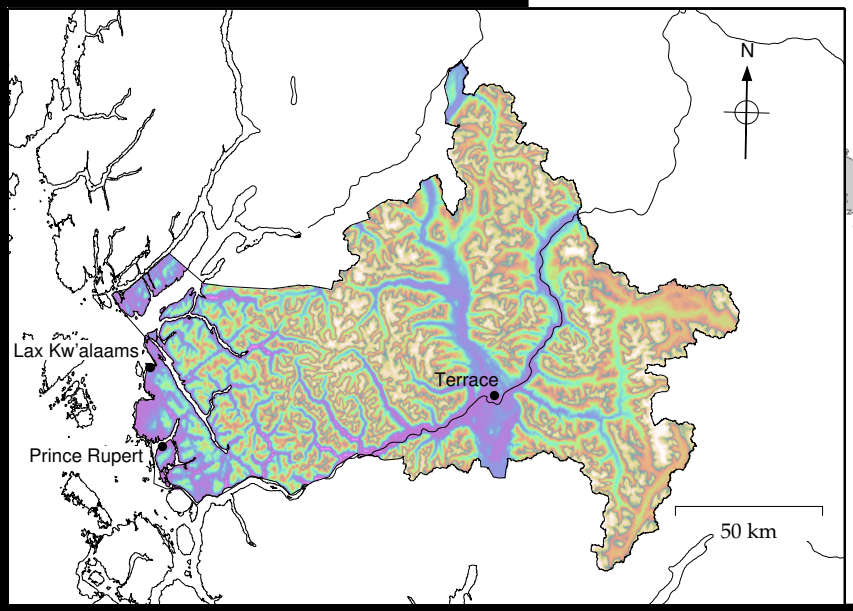
Intersection and integration of three knowledge types

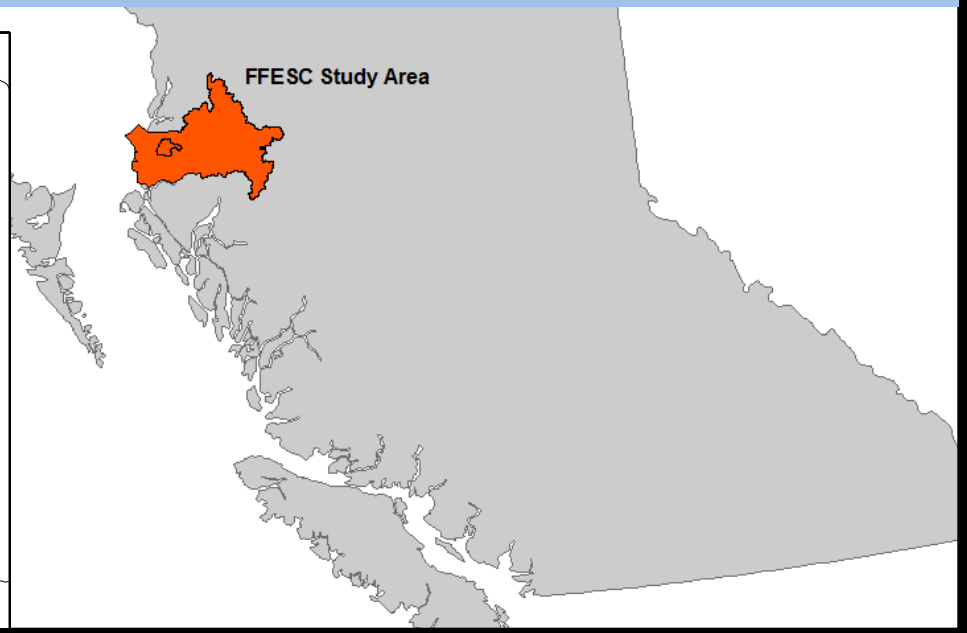


Study Overview

Main Steps:

1. Interviews in local communities with stakeholders
2. Gather information about projected climate changes to region
   - Modelling of future vegetation changes
   - Watershed monitoring
3. Community workshops to present modelling results and promote discussion on building adaptive capacity





ARVE

Environment Canada | Environnement Canada

BRINKMAN FOREST LTD

Coast Tsimshian Resources LP

UBC

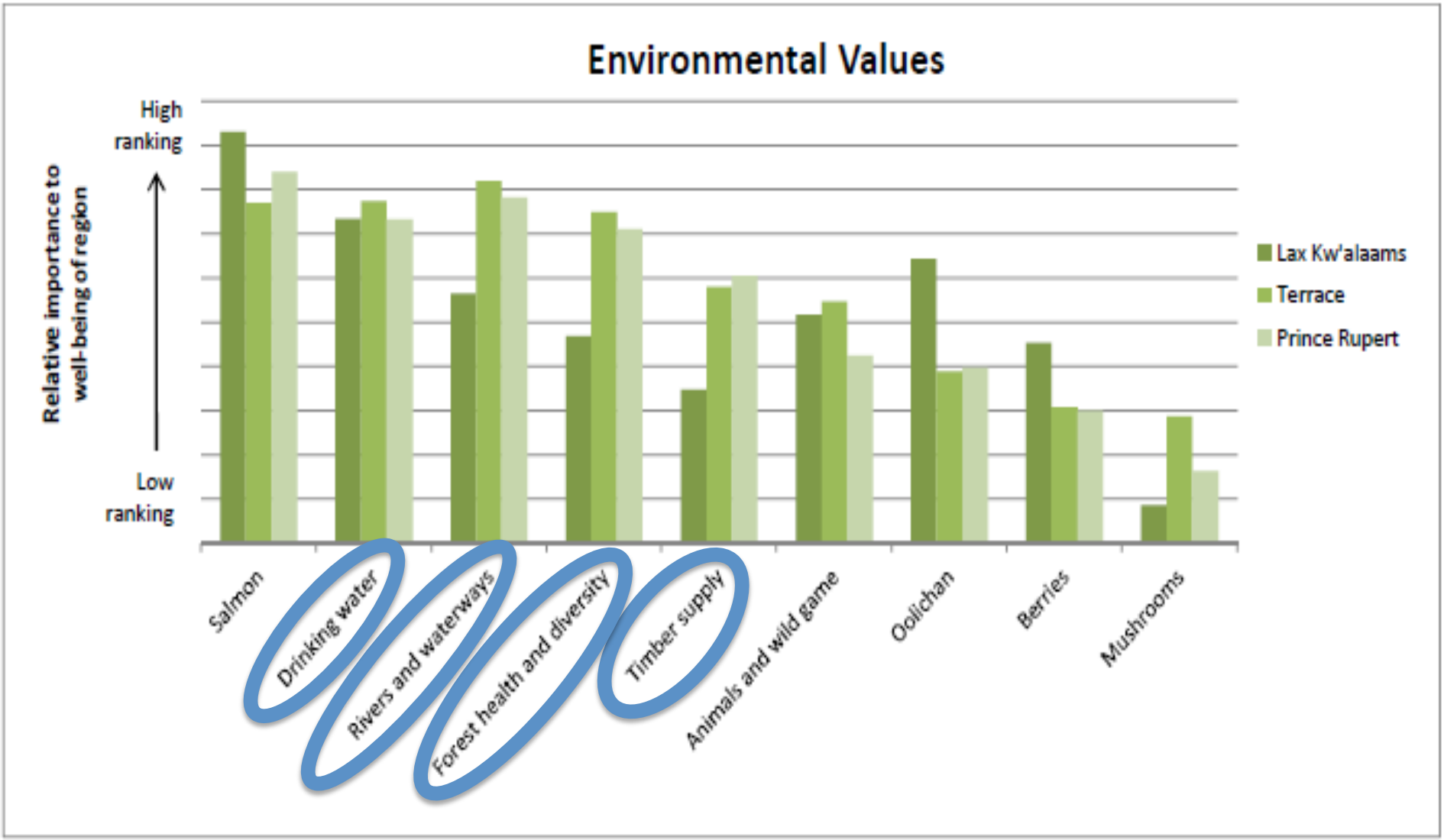
Social science approach

- Interviews in Prince Rupert, Lax Kw'alaams, and Terrace
- 50 interviews in each community
- Purposive sample focused on people in key positions of leadership and resource management
- 1-3 hours for each interview

Public Sector	**66**
Private Sector	**51**
Retired	**26**
Non-government organization	**6**

Community leader	**5**
Councillor	**16**
High level manager	**6**
Mid-level manager	**26**
Small operation manager	**13**
Administrator	**13**
Sole proprietor	**13**
Resource worker	**20**
Other worker	**9**
Elder	**12**
Retired	**16**

Valued Resources Across 3 Communities



Visions of the Future

Do you think that the future is most likely to be determined by what goes on within the community and by the actions of local leaders (internal),

OR

do you think the future will be determined more by external factors that may be largely outside local control (external)?

	Internal (%)	External (%)	Both (%)
Lax Kw'alaams	37 (74)	12 (24)	1 (2)
Terrace	9 (19)	35 (73)	4 (8)
Prince Rupert	12 (24)	31 (62)	7 (14)
TOTAL	58 (39)	78 (53)	12 (8)

Vegetation Simulations

Climate, CO_2 concentration, soil texture, species parameters, (tree harvesting)

Input

LPJ-GUESS Dynamic Vegetation Model

Output

Forest composition, carbon pools and fluxes, disturbance (fire) regime, hydrology,…

19 Modelled Tree Species

Model parameterized tree species for the Skeena region of British Columbia

Sitka Spruce
Picea sitchensis
(Ss)

Lodgepole Pine
Pinus contorta
(Pl)

Western Yew
Taxus brevifolia
(Tw)

Trembling Aspen
Populus tremuloides
(At)

Western Hemlock
Tsuga heterophylla
(Hw)

Engelmann Spruce
Picea engelmannii
(Se)

Mountain Hemlock
Tsuga mertensiana
(Hm)

Douglas Fir
Pseudotsuga menziesii
(Fd)

Paper Birch
Betula papyrifera
(Ep)

Amabalis Fir
Abies amabalis
(Ba)

Black Cottonwood
Populus trichocarpa
(Act)

Subalpine Fir
Abies lasiocarpa
(Bl)

Whitebark Pine
Pinus albicaulis
(Pa)

Bitter Cherry
Prunus emarginata
(Vb)

Western Red Cedar
Thuja plicata
(Cw)

Red Alder
Alnus rubra
(Dr)

Yellow Cedar
Chamaecyparis nootkatensis
(Yc)

White Spuce
Picea glauca
(Sw)

Mountain Alder
Alnus tenuifolia
(Xc1)

[1]http://www.for.gov.bc.ca/hfp/silviculture/Compendium/ and http://www.pennine.demon.co.uk/Arboretum/Alte.htm (Oct 12 2010)

+ Grass

ARVE

Environment Canada | Environnement Canada

BRINKMAN FOREST LTD

Coast Tsimshian Resources LP

UBC

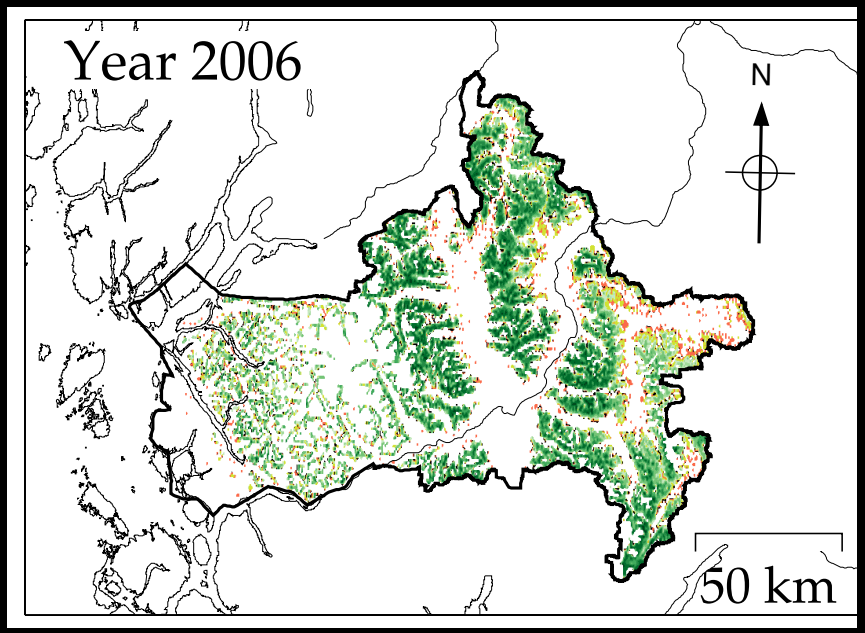
Climate Scenarios

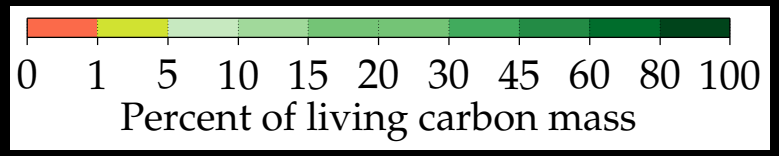
Time period	Emissions / Model Scenario	Mean temperature change relative to the 1961 – 1990 annual mean (°C)	Mean precipitation change relative to the 1961 – 1990 annual total (%)
2020s (2010-2039)	CGCM3-A2	+2.0	+11.5
	HADCM3-B1	+1.0	+10.4
	HADGEM-A1B	+1.4	+0.3
2050s (2040-2069)	CGCM3-A2	+2.7	+16.0
	HADCM3-B1	+1.7	+17.2
	HADGEM-A1B	+3.3	+3.6
2080s (2070-2099)	CGCM3-A2	+4.1	+23.3
	HADCM3-B1	+2.3	+22.4
	HADGEM-A1B	+4.9	+7.0

Warmer & wetter = CGCM3-A2
Warm & wetter = HADCM3-B1
Warmest & wet = HADGEM-A1B

Mountain Hemlock

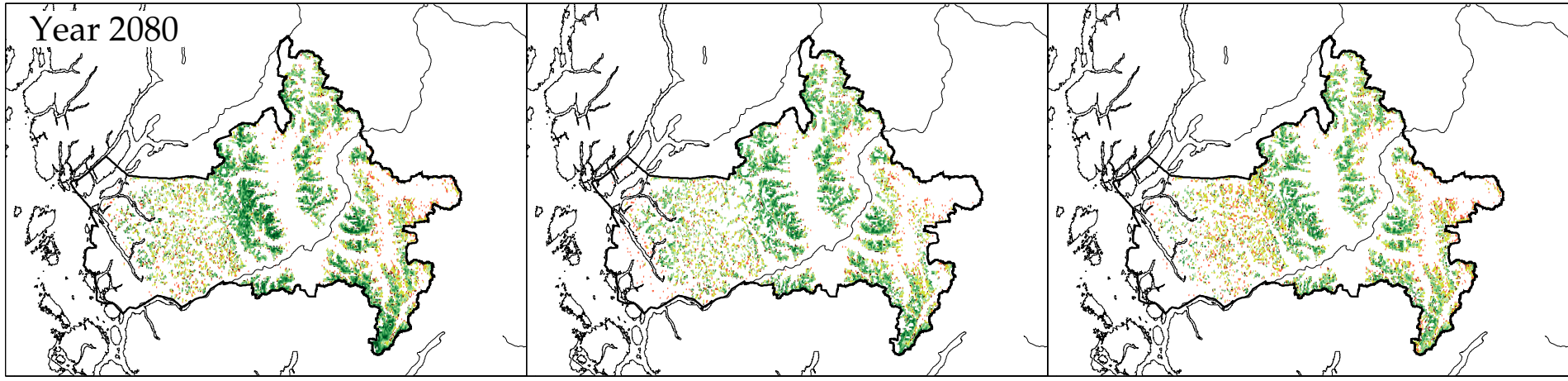
Tsuga mertensiana





Potential natural vegetation

CGCM3–A2 (warmer & wetter) HADCM3–B1 (warm & wetter) HADGEM–A1B (warmest & wet)



ARVE

Environment Canada Environnement Canada

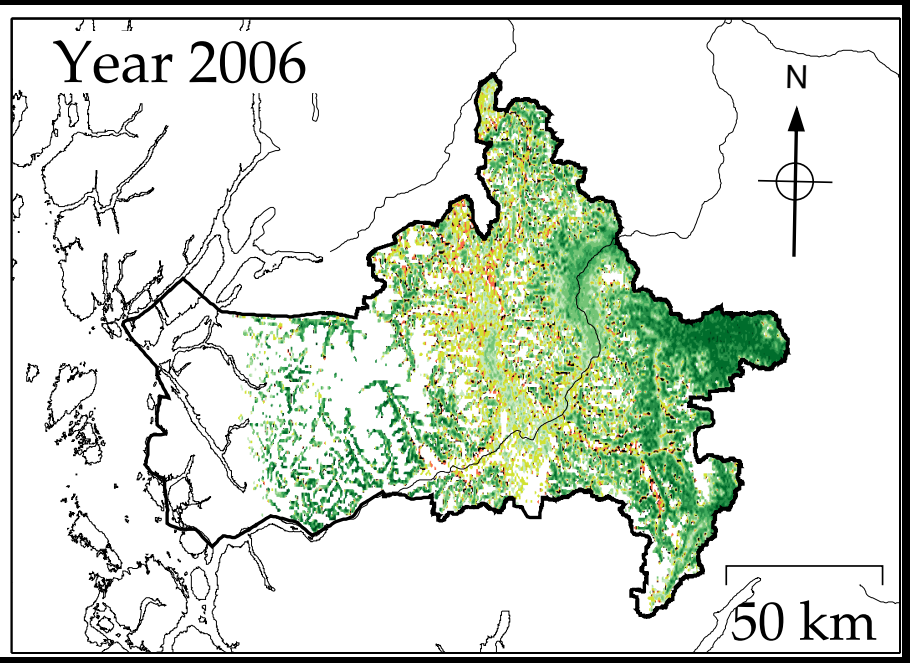
BRINKMAN FOREST LTD

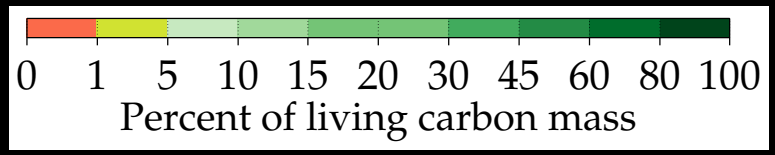
Coast Tsimshian Resources LP

UBC

Subalpine Fir

Abies lasiocarpa



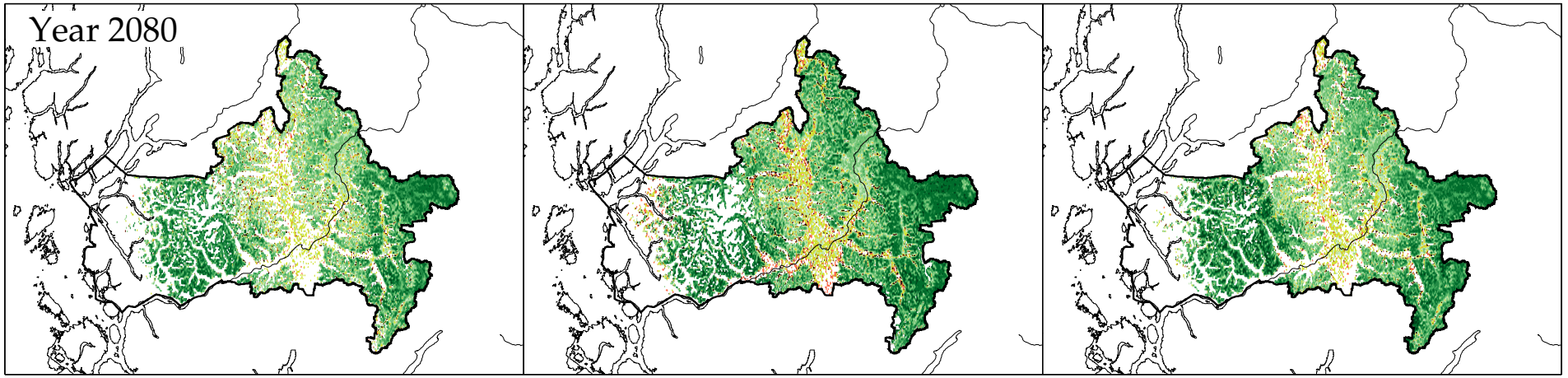


Potential natural vegetation

CGCM3–A2 (warmer & wetter)

HADCM3–B1 (warm & wetter)

HADGEM–A1B (warmest & wet)

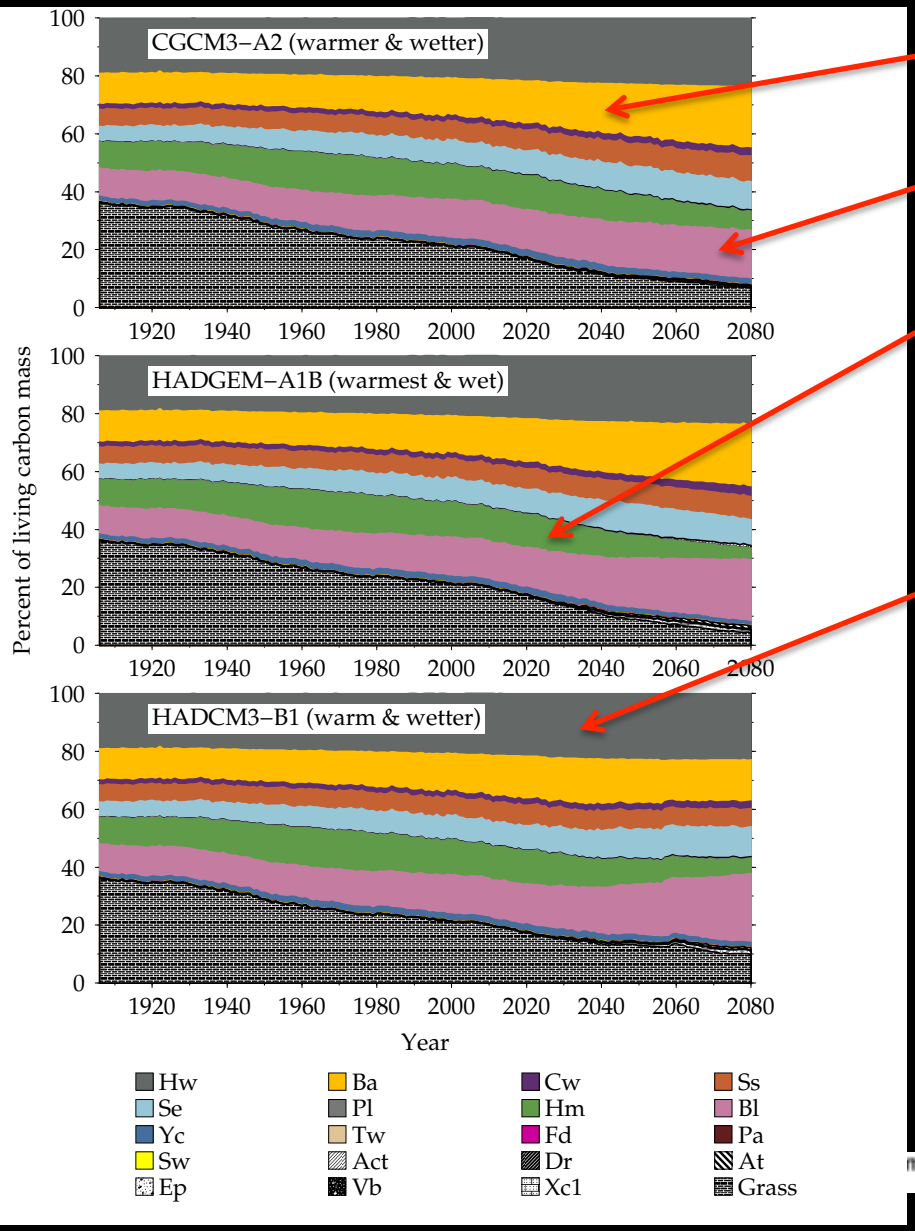


Environment Canada Environnement Canada

BRINKMAN FOREST LTD

Coast Tsimshian Resources LP

Species Composition Changes Across Study Area



- Pacific Silver (Amabalis) Fir and Subalpine fir expand into higher elevations
- Mountain Hemlock is out competed as its range is encroached on
- Coastal Western Hemlock continues as a dominant species
- Grasslands decline due to:
  - Afforestation of alpine tundra due to warming temperatures
  - Denser forests in the valleys

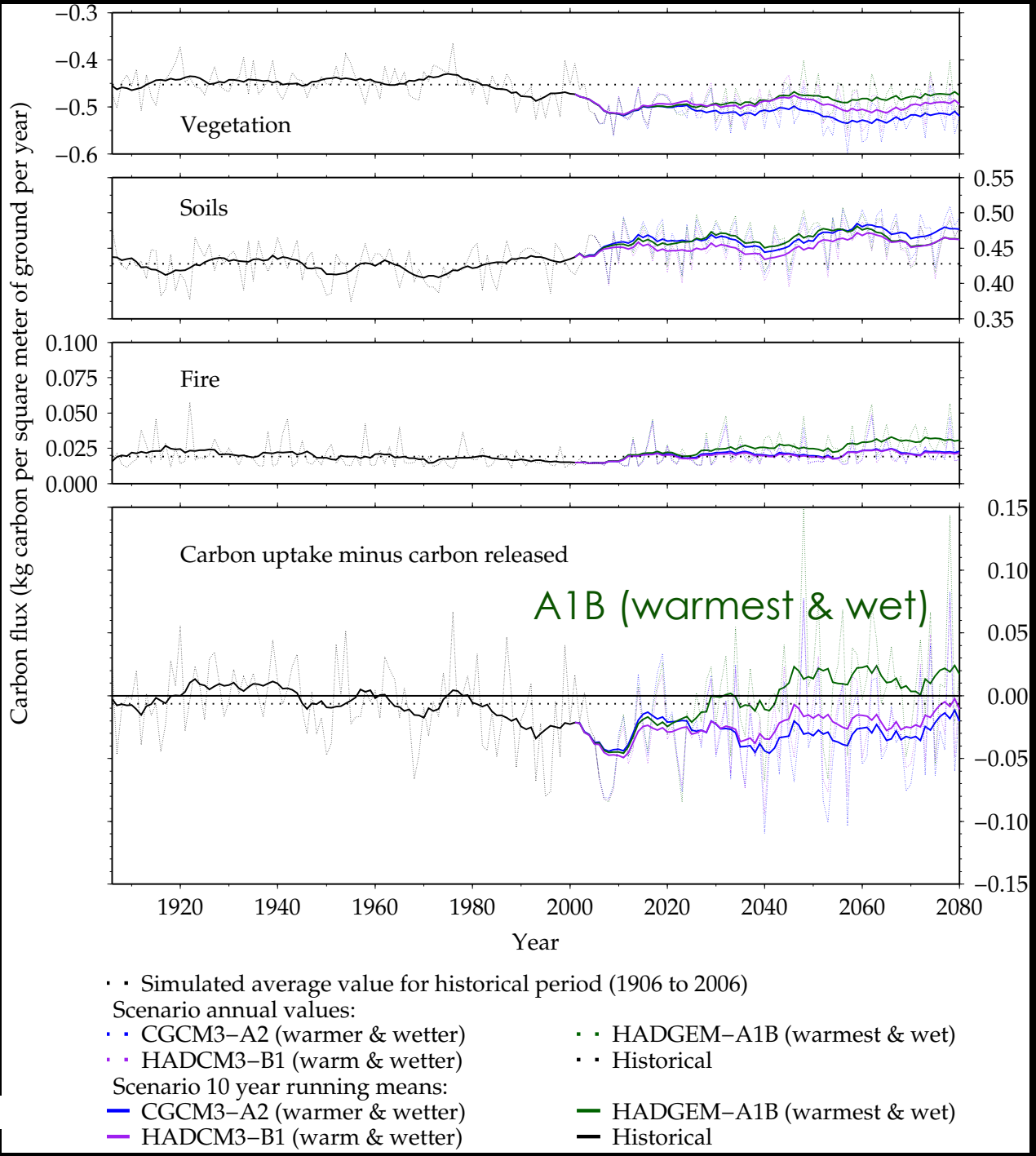
BRINKMAN FOREST LTD

Coast Tsimshian Resources LP

UBC

Carbon Fluxes

- Vegetation
  - CO_2 fertilization and greater warmth = enhanced C uptake
- Soils
  - warmer temperatures = higher organic matter decomposition
- The region continues as a carbon sink until 2040 – when it may become a source, depending on the climate scenario we follow



Conclusions from Biophysical Modelling

- Future climate scenarios have a dominant influence
  - Differences between climate scenarios > between harvested and potential natural vegetation simulations
- On the scale of the study region, climate changes are a stronger influence than harvesting on carbon fluxes and surface runoff
- Future changes in runoff may be outside of historical ranges
- Right now, the region is likely a net C sink but may change to a net C source past year 2040
- **This information feeds discussions at public workshops, on now, for planning to build adaptive capacity**

Funded by the Future Forests Ecosystem Scientific Council (FFESC)
Project website: http://brinkmanforest.com/ffesc/