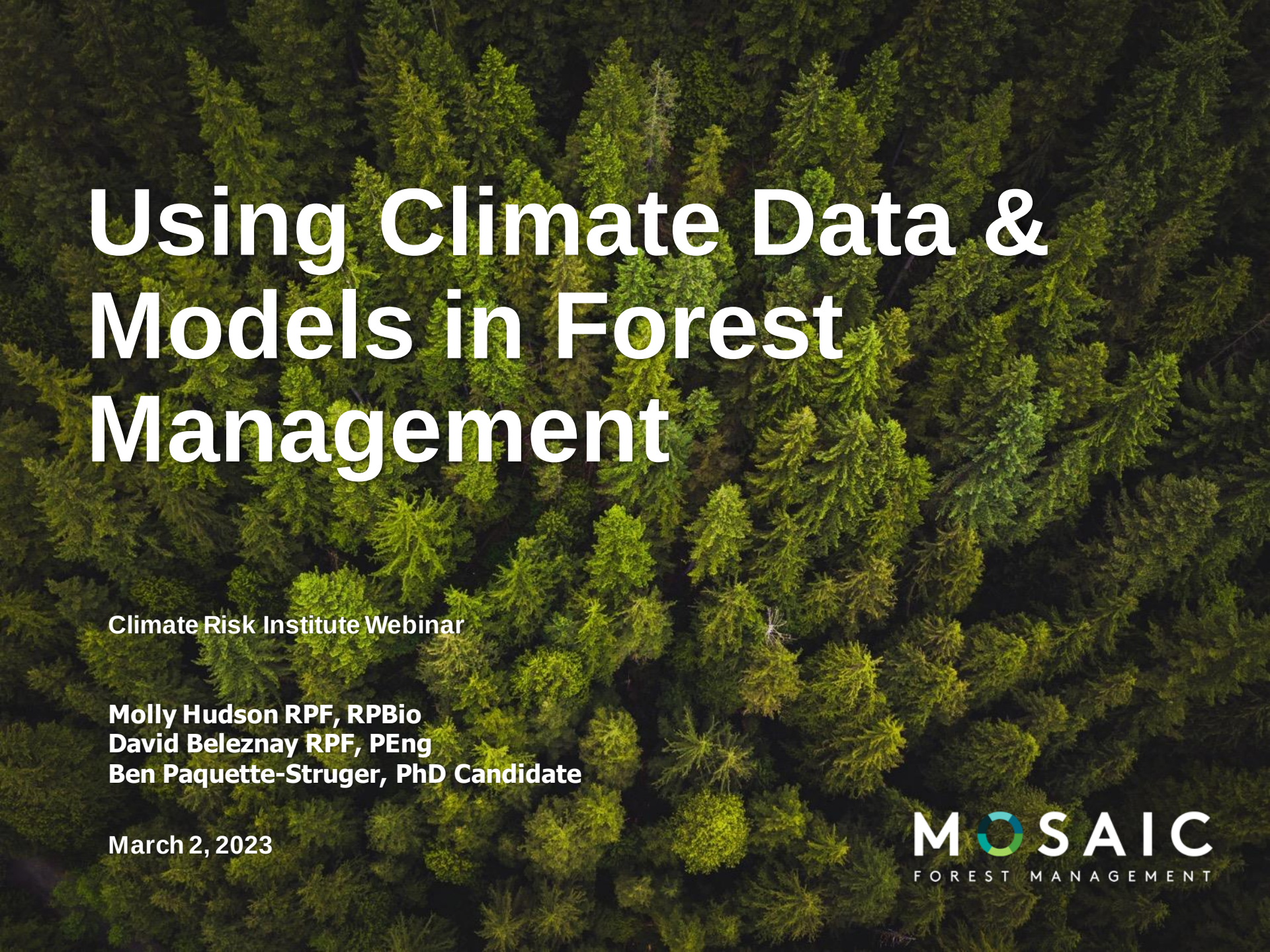


Using Climate Data & Models in Forest Management

Climate Risk Institute Webinar

Molly Hudson RPF, RPBio
David Beleznay RPF, PEng
Ben Paquette-Struger, PhD Candidate

March 2, 2023

MOSAIC FOREST MANAGEMENT

Outline

- ✓ Company introduction
- ✓ Context: why invest in climate planning?
- ✓ Mosaic approach overview
- ✓ Adaptation focus: Climate data and modelling
- ✓ Mitigation focus: Carbon storage

Introduction to Mosaic

Canada's **largest private timberland** producer, over 2000 people employed in our operations

We are responsible for **forest planning, operations and product sales**

Our owners are BC and federal **pension funds**

We have **private managed forest lands** – predominantly **second growth**

We also manage multiple **public licenses** on public lands.

SFI®, PEFC, ISO14001 certified

Context

MOSAIC FOREST MANAGEMENT

Global

COP27 SHARM EL-SHEIKH EGYPT 2022

2020 UN BIODIVERSITY CONFERENCE
COP 15 - CP/MOP10 - NP/MOP4
Ecological Civilization-Building a Shared Future for All Life on Earth
KUNMING – MONTREAL
7 – 19 DECEMBER 2022

National & Provincial

Canada

cleanBC
our nature. our power. our future.

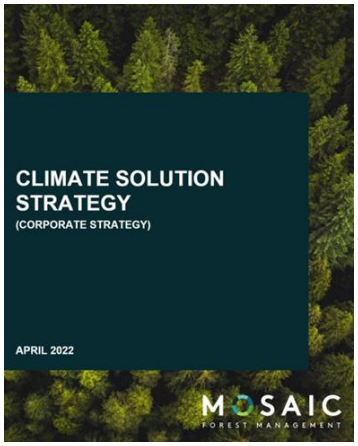
Marketplace

SUSTAINABLE FORESTRY INITIATIVE
SFI-00015

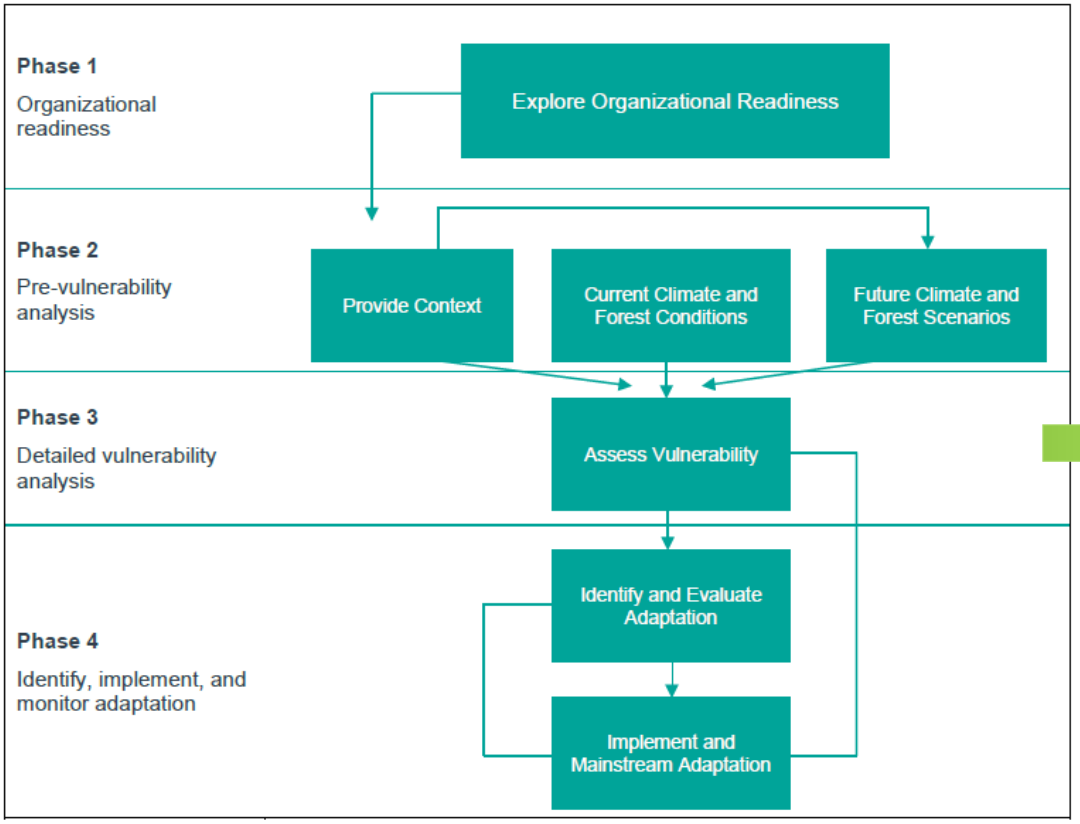
CLIMATE SMART FORESTRY

Climate Solutions Strategy

MOSAIC FOREST MANAGEMENT



CCFM: **Stages of Climate Change Adaptation**



Potential Climate Change Impact	Description	Current Vulnerability L, M, H	Future Vulnerability L, M, H	Considerations/ Challenges	Adaptive Capacity L, M, H	Adaptation Priority L, M, H	Adaptation Practices – Currently Underway	Adaptation Practices - Future Considerations (Identified Priorities in Blue)
ENVIRONMENTAL								
Extreme Weather Events	Change in average temperatures. Increase in extreme heat.	M-H	H	Adaptation Already o		H	• Watershed assessments • Water Purveyor Engagement	• Research/ monitoring ground water etc. • Consider evapotranspiration modelling

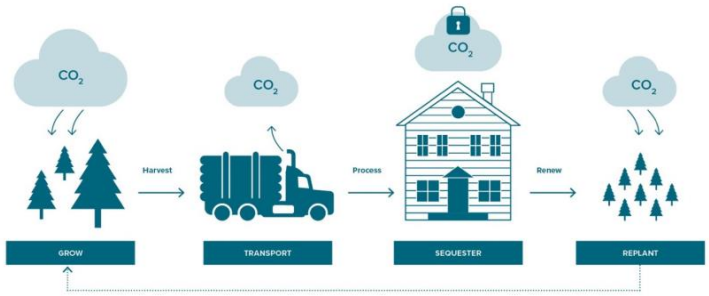
Mosaic Vulnerability Assessment

Past and ongoing work

MOSAIC FOREST MANAGEMENT

Mitigation Initiatives: Actions to reduce or remove GHG's from the atmosphere to prevent significant adverse effects

- GHG Supply Chain Footprint (scope 1, 2, and 3) and science-based targets for net zero
- Wildfire prevention (Security, partnerships, training)
- Reducing emissions (electrification, logistics, chipping)
- **Carbon storage in old forests (BigCoast) and through thinning**

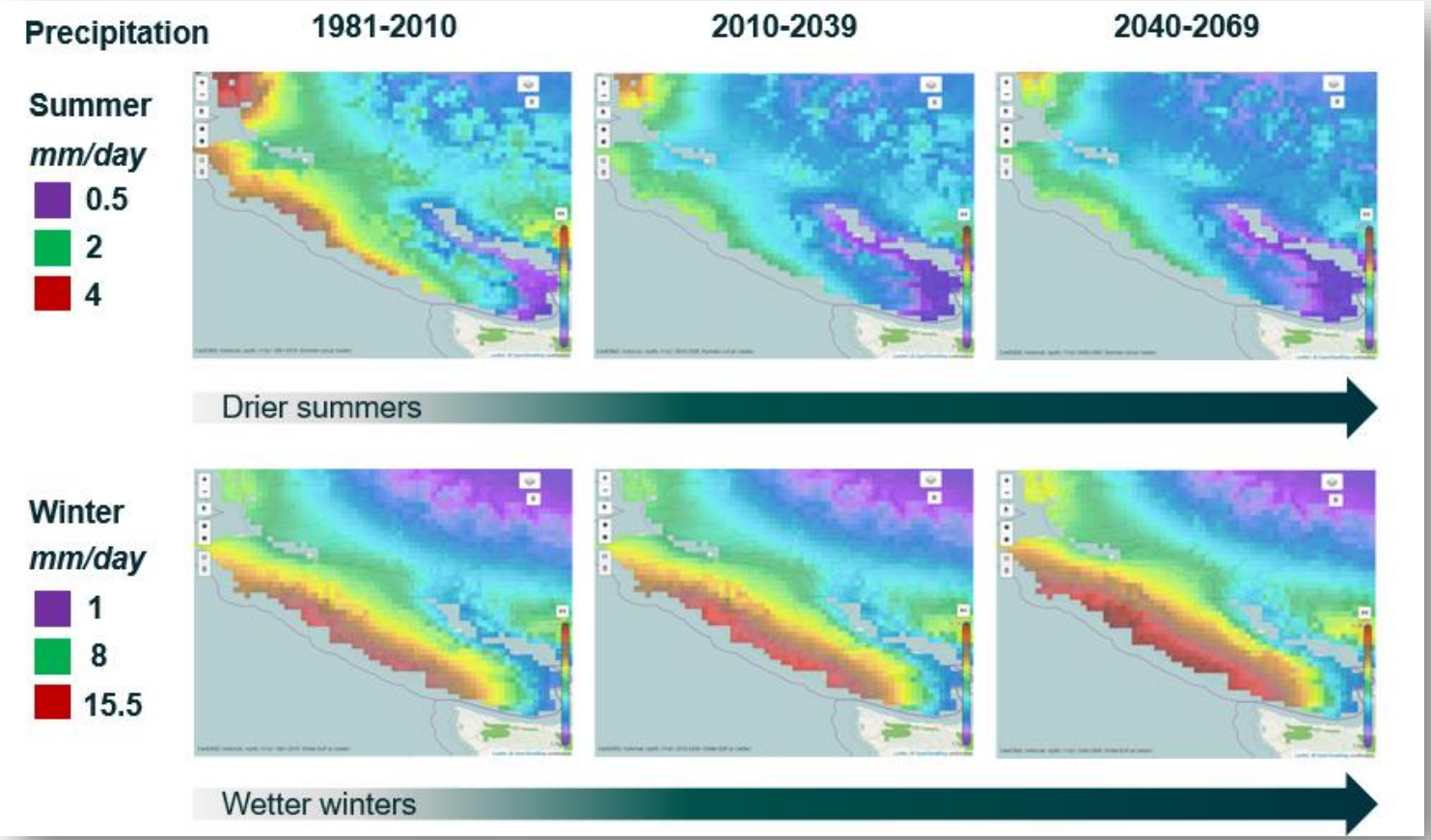


Adaptation Initiatives: Actions meant to reduce or compensate for or adapt to adverse impacts that arise to changes in climate

- Tree improvement
- Silvicultural adjustments
- Infrastructure improvements
- Watershed assessments and collaborative research
- Soil management
- **Advanced weather station network**

Current New Initiative: Modelling

- Incorporate into Enterprise Risk Management
- Communication and engagement focus, including contractor community
- Regional climate modelling



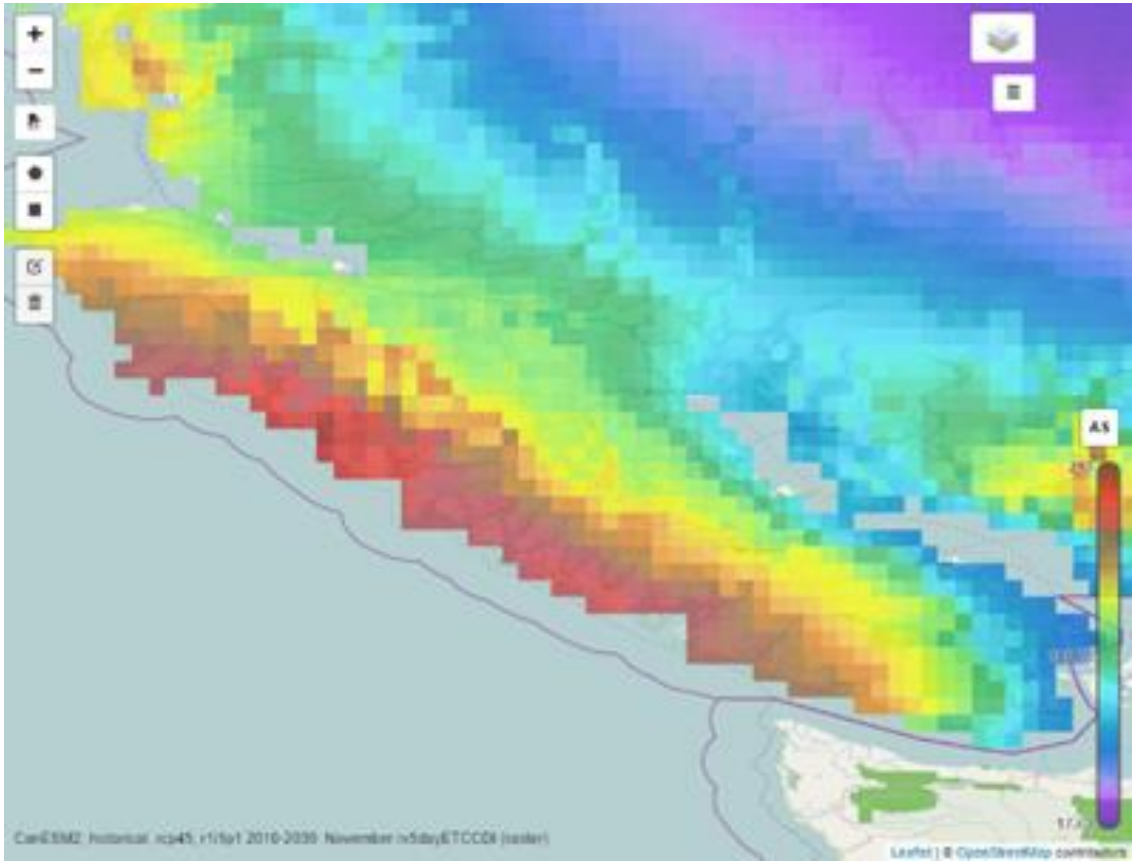
Objectives of regional climate modelling:

- Support the overarching goal of assessing current and future forest operations vulnerabilities using the best resources available for coastal BC

- Inform decision-making with respect to mitigation and adaptation opportunities

- Use readily available climate tools/data to produce custom climate projections, figures, and reports for 4 different Mosaic operational zones

- Assist with current and future climate-focused certifications and planning (e.g., operational and structural adaptation)



Differences between predicting weather and climate:

MOSAIC FOREST MANAGEMENT

WEATHER:

- **The conditions you actually get**
- *e.g., What you actually wear in the field that day*

WEATHER FORECASTS:

Attempt to create precise and singular *hour-by-hour predictions* of weather on a small spatial scale

CLIMATE:

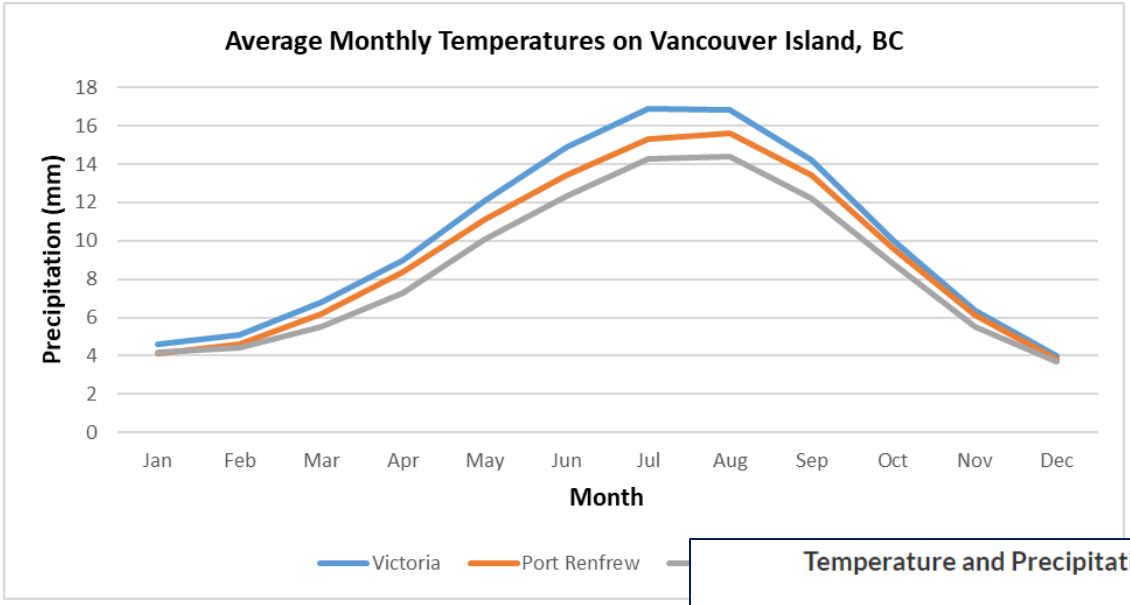
- **The weather you expect, given the time of year (Climate Normal is 30 years)**
- *e.g., The type of field-gear you own*

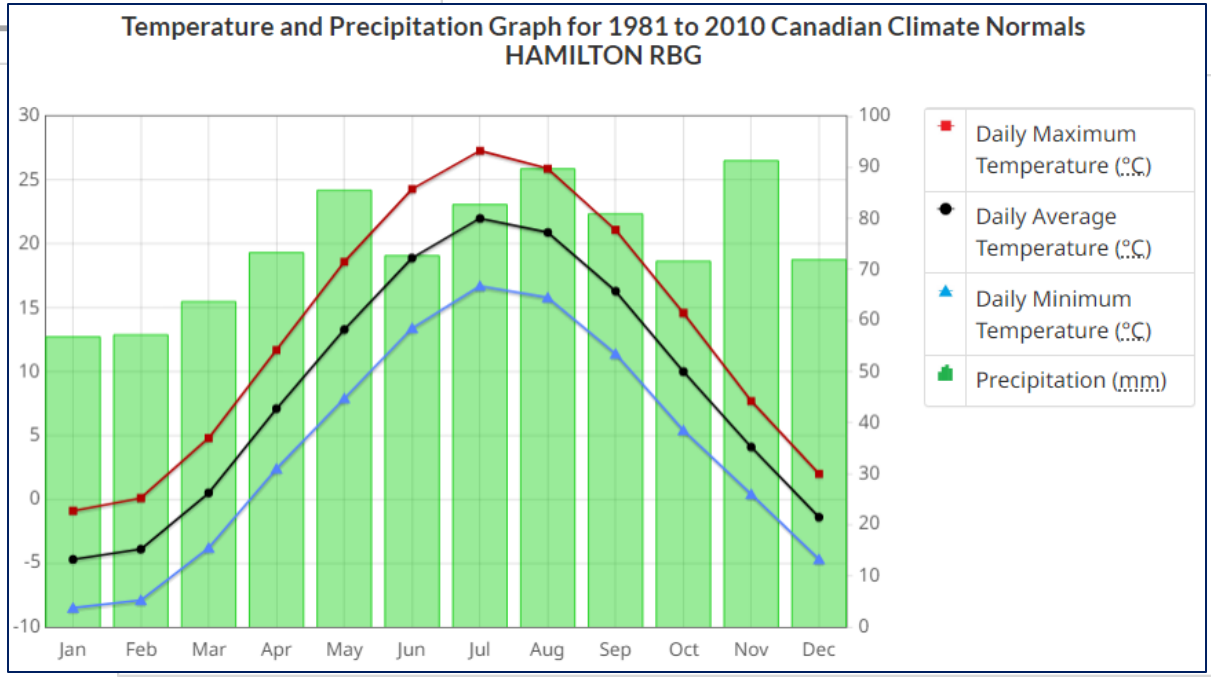
CLIMATE MODELS:

Combine *MANY simulations of possible weather* to produce an integrated picture of what average/extreme conditions might look like in the future, over larger regions

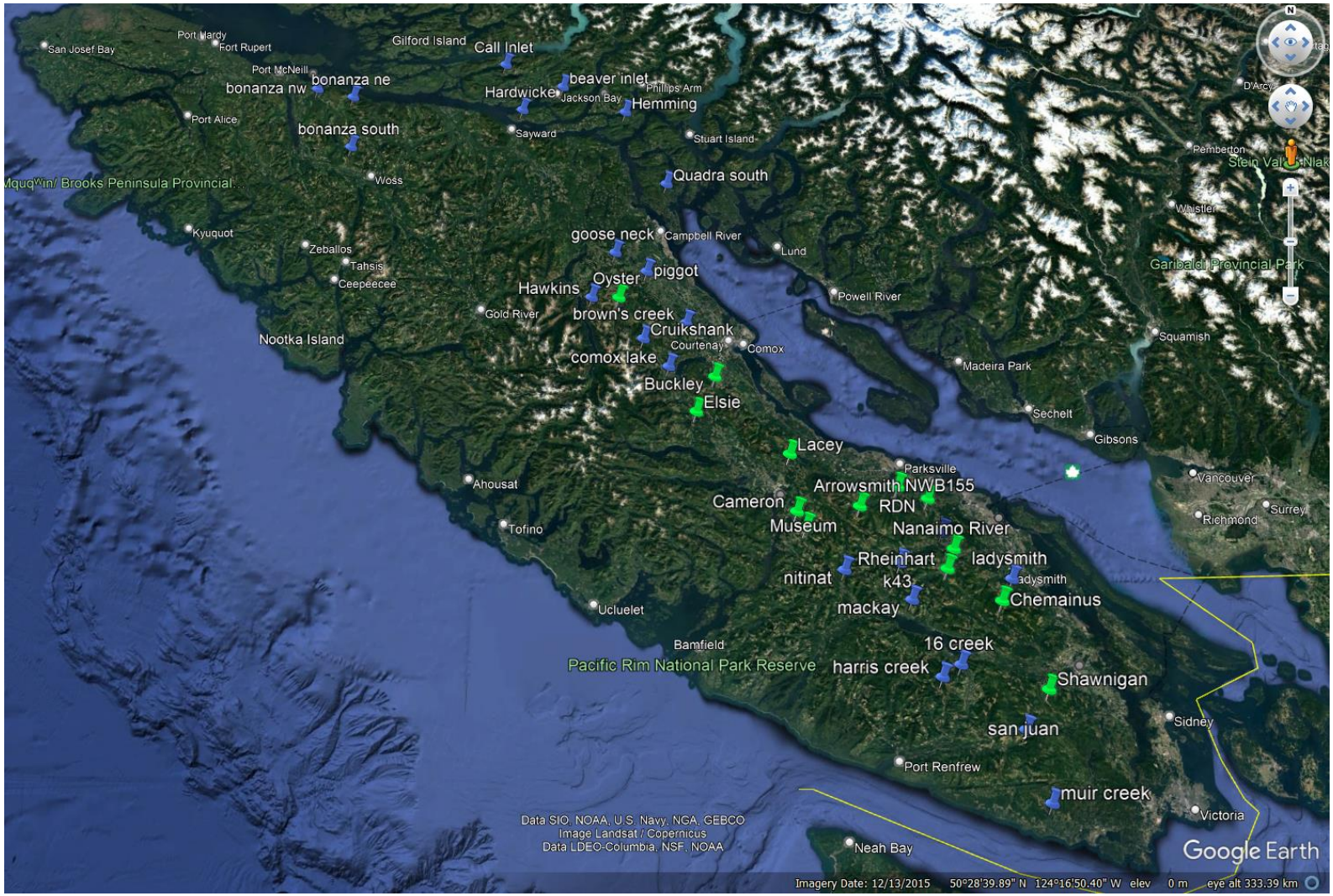
Weather and Climate Differences:

MOSAIC FOREST MANAGEMENT





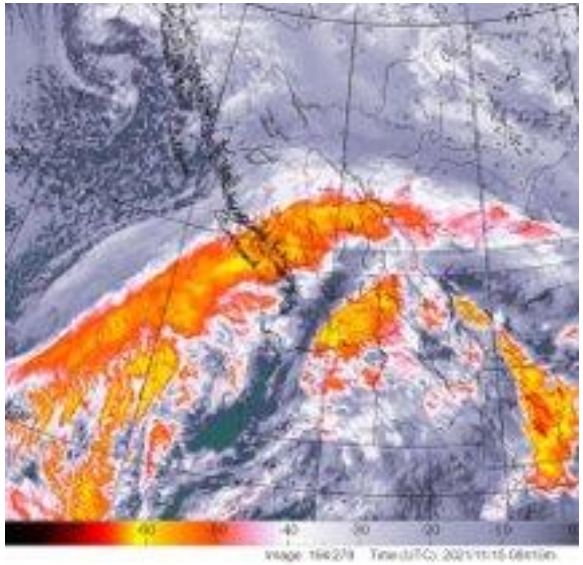
Mosaic Weather Station Network



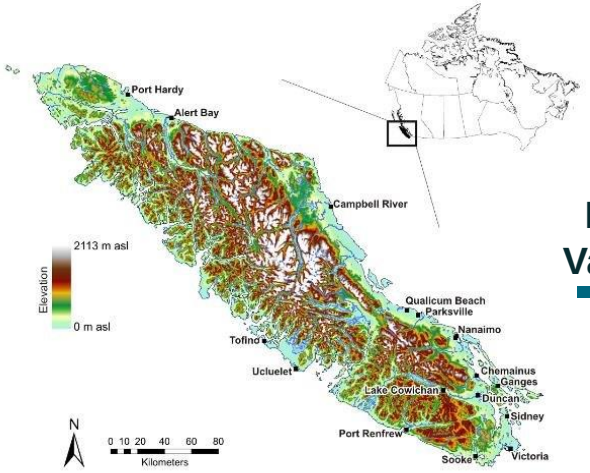
Mosaic Weather Station Data:

CENTRAL ISLAND STATIONS: 0:00 November 13th – 23:00 November 15th, 2021			
STATION	TOTAL RAINFALL (mm)	MAX. WINDSPEED (km/h)	AVG. WINDSPEED (km/h)
Arrowsmith	130.2	97.4	28.56
Ash Lower	81.4	34.0	2.03
Buckley	89.6	56.3	7.51
Cameron Yd	162.8	69.0	6.47
Elsie	87	35.1	4.31
Lacey	115.8	41.9	8.17
Museum	162.9	78.9	8.84
NWB155	123.9	44.2	6.44

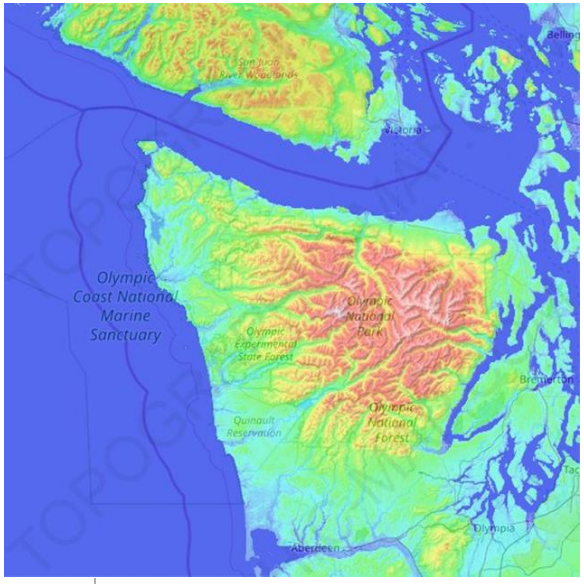
SOUTH ISLAND STATIONS: 0:00 November 13th – 23:00 November 15th, 2021			
STATION	TOTAL RAINFALL (mm)	MAX. WINDSPEED (km/h)	AVG. WINDSPEED (km/h)
16 Creek	235.46	41.91	6.37
Chemainus	183.9	64.8	10.71
First Lake	161.3	32.46	2.36
Harris Creek	225.1	61.88	8.80
K43	238.26	64.56	8.12
Ladysmith	186.44	37.26	2.89
McKay	221.23	48.76	6.25
Muir Creek	215.65	49.04	8.8
NANRvr	165.2	29.5	3.88
Nitnat	209.8	35.77	2.81
RDN	149	48.2	7.82
Rheinhart	234.4	67.5	7.2
San Juan	242.3	60.75	7.31
Shawnigan	189.1	46.6	5.65



Topographical Effects on Vancouver Island, BC:



Insular Mountains: Vancouver Island, BC



Olympic Mountains: Washington State

Climate vulnerabilities of forest operations:

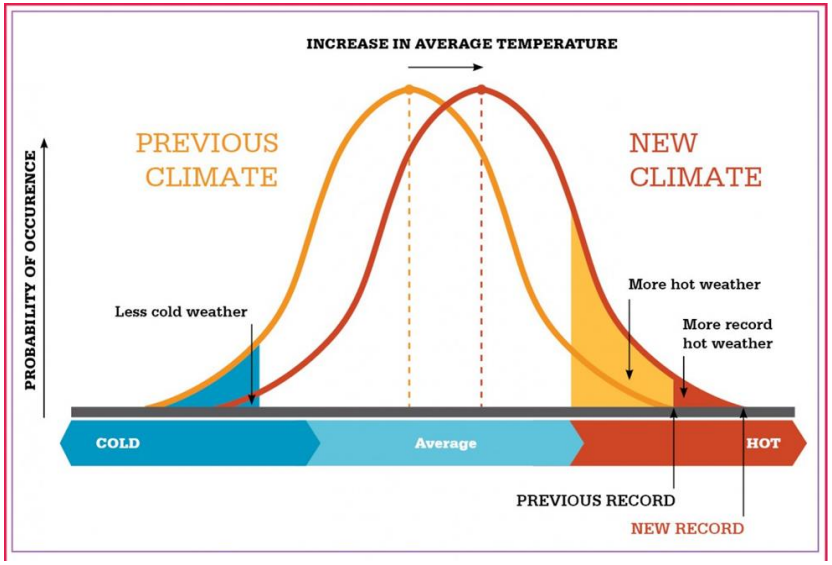
MOSAIC FOREST MANAGEMENT

Changes in ***AVERAGE*** conditions, over time

- **Average weather conditions at a given place**
- **Climate Normals (30-year average)**
- *e.g., Average monthly rainfall/ temperature*

Changes to the intensity and frequency of ***EXTREME*** events, over time

- **Rare occurrences of unusually severe weather at given place**
- *e.g., Size, frequency, and severity of drought/rain events*
- *e.g., Calculation of return-periods*



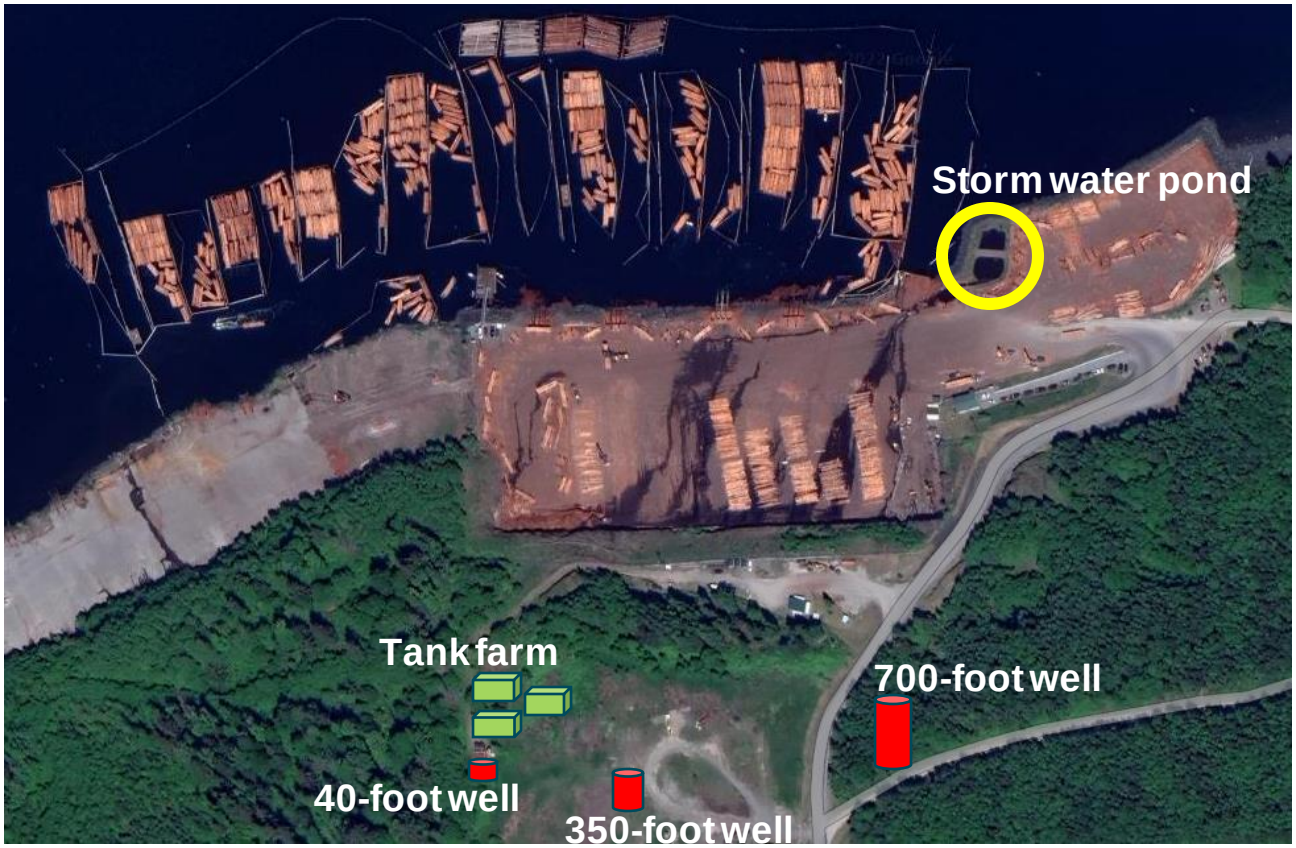
Climate vulnerabilities of forest operations:

MOSAIC FOREST MANAGEMENT

Changes in ***AVERAGE*** conditions, over time

Changes to the intensity and frequency of ***EXTREME*** events, over time

Climate vulnerabilities of forest operations:

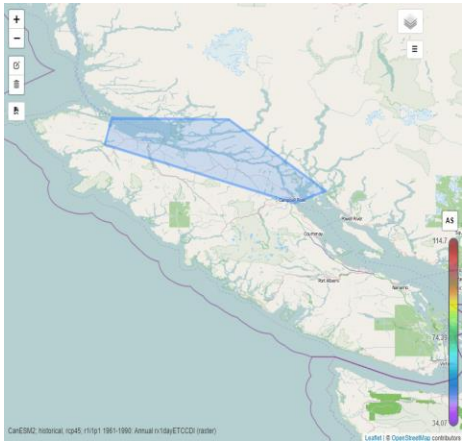


Regional Projections:

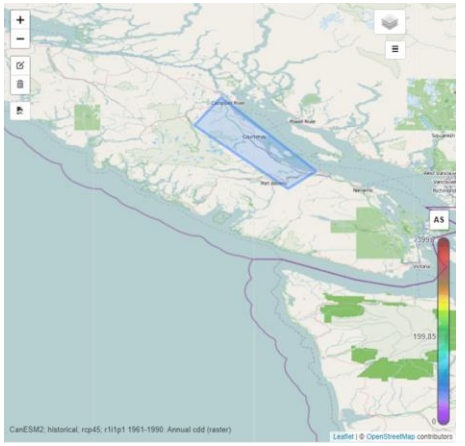
Modelling Key Points

- 4 different regions
- 3 different time periods
  - **1981-2010, 2011-2039, 2040-2069**
- Best model for western Canada selected
  - **CanESM2**
- Most likely climate scenario selected
  - **RCP 4.5**
- Crucial operational climate information was provided by the Climate Solutions Team
  - **Culvert, bridge, and road design**
  - **Wet weather shutdown, flooding, and storm water**
  - **Fire risk and shutdown**
  - **Terrain, watersheds, and soil**
  - **Forest health**
  - **Growth and yield**
  - **Seedling health and planting management**

North Island/Mainland:

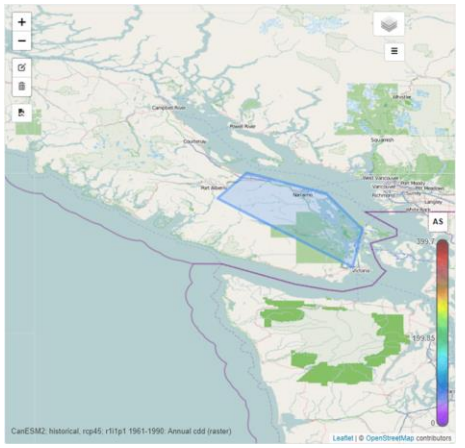


Central Island:



Southwest Island:

Southeast Island:



2046

Changing Climate

MOSAIC FOREST MANAGEMENT

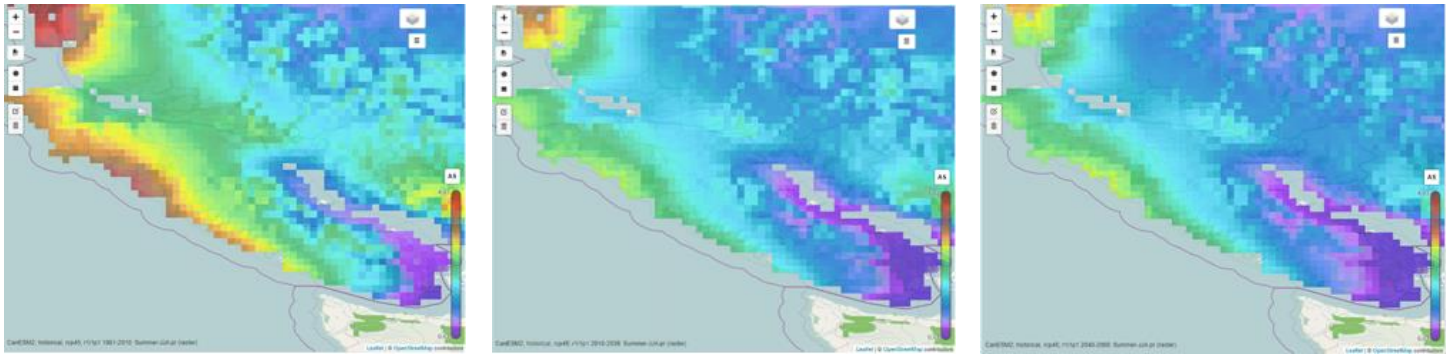
Precipitation

	1981-2010	2010-2039	2040-2069

Summer

mm/day

- 0.5
- 2
- 4

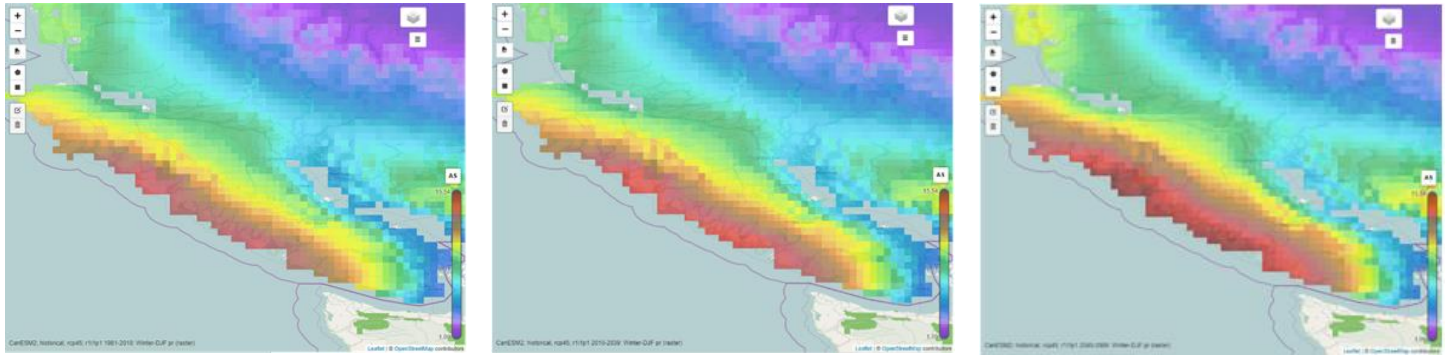


Drier summers

Winter

mm/day

- 1
- 8
- 15.5

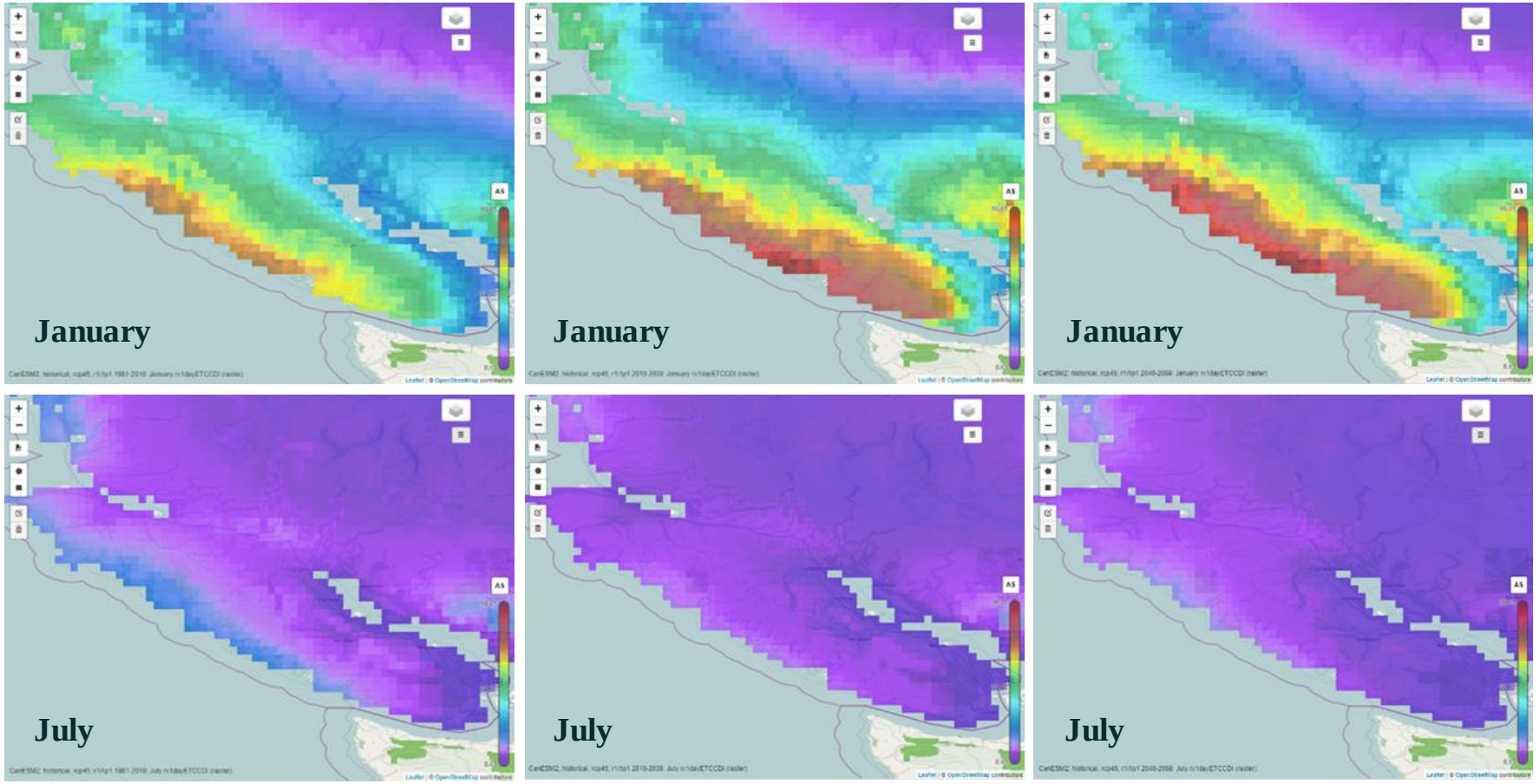


Wetter winters

Maximum 1-day precipitation:

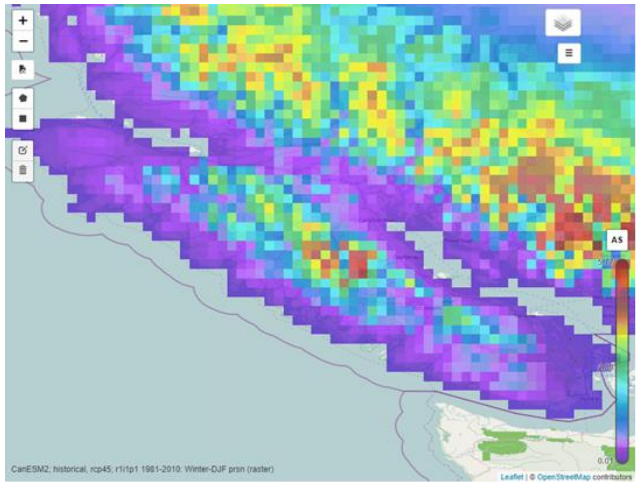
MOSAIC FOREST MANAGEMENT

1981-2010: **2010-2039:** **2040-2069:**

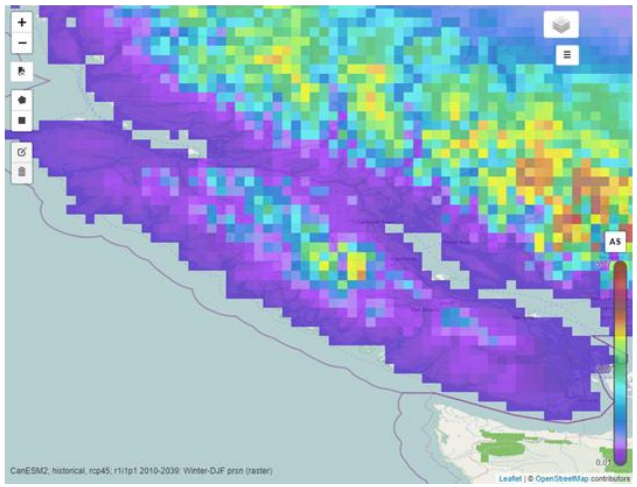


Precipitation as snow:

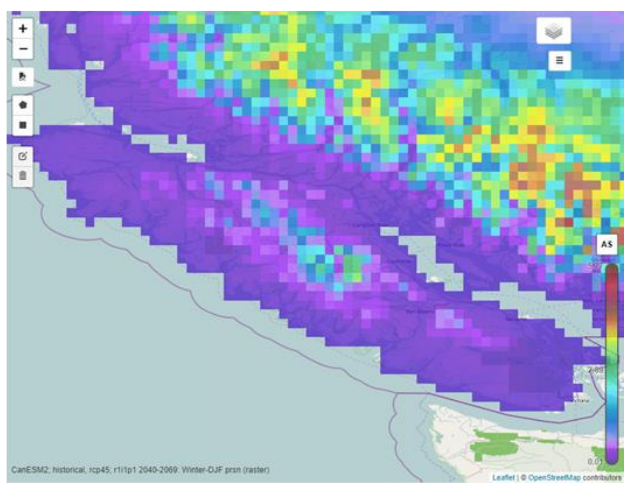
1981-2010:

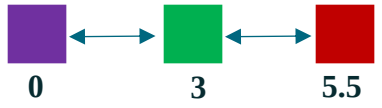


2010-2039:



2040-2069:





Regional Projection "*Snapshots*":

MOSAIC FOREST MANAGEMENT

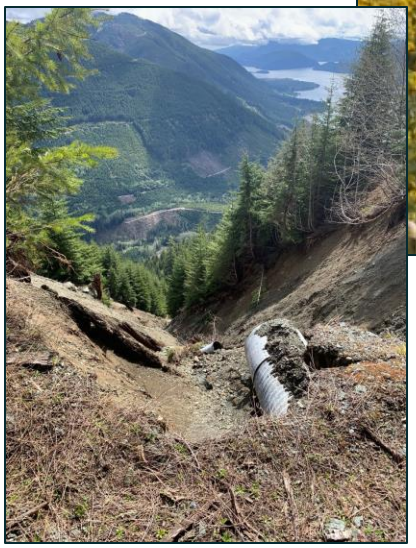
CENTRAL ISLAND:

PRECIPITATION VARIABLE	SEASON	MEAN VALUE (PROJECTED PERCENT CHANGE FROM 1981-2010 BASELINE)		
		1981-2010	2010 - 2039	2040 - 2069
Precipitation at ground level (mm/day)	Annual	4.9	5.1 (+3.9%)	5.2 (+6.1%)
	Summer	1.7	1.3 (-23.2%)	1.0 (-37.5%)
	Winter	8.0	8.5 (+5.2%)	9.0 (+12.6%)
Annual total precipitation in wet days (mm)	Annual	1779.4	1882.8 (+5.8%)	1943.9 (+9.2%)
Precipitation as snow ($kg/m^2/day$)	Fall	0.22	0.19 (-13.6%)	0.23 (+4.5%)
	Winter	1.2	0.64 (-47.1%)	0.38 (-68.6%)
	Spring	0.43	0.31 (-27.9%)	0.16 (-62.8%)
Annual count of days with at least 20 mm of precipitation (days)	Annual	24.4	26.9 (+10.2%)	28.4 (+16.4%)
Annual total precipitation when daily precipitation exceeds the 95th percentile of wet day precipitation (mm)	Annual	379	506 (+33.5%)	540 (+42.5%)
20-year annual maximum 1-day precipitation amount (mm)	Annual	89.3	102.2 (+14.4%)	109.4 (+22.4%)
50-year annual maximum 1-day precipitation amount (mm)	Annual	96.9	112.4 (+15.9%)	141.4 (+45.9%)
5-year annual maximum 1-day precipitation amount (mm)	Annual	75.5	84.5 (+11.9%)	77.9 (+3.1%)
Maximum 1-day precipitation (mm)	Annual	65.1	77.7 (+19.4%)	79.8 (+22.6%)
Maximum 5-day precipitation (mm)	Annual	144.2	158.3 (+9.8%)	161 (+22.6%)
Maximum number of consecutive days with less than 1 mm of precipitation (mm)	Annual	22	23.7 (+7.8%)	27.9 (+26.6%)

TEMPERATURE VARIABLE	SEASON	MEAN VALUE (PROJECTED CHANGE FROM 1981-2010 BASELINE)		
		1981-2010	2010 - 2039	2040 - 2069
Frost days (days)	Annual	91.7	57.2 (-37.6%)	38.9 (-57.6%)
Growing degree days (days)	Annual	1650.7	2001 (+21.3%)	2260 (+36.9%)
Growing season length (days)	Annual	234.7	266 (+13.2%)	287 (+22.1%)
20-year annual maximum daily maximum temperature (°C)	Annual	34.3	36.5 (+6.4%)	38.0 (+10.8%)
5-year annual maximum daily maximum temperature (°C)	Annual	33	35.1 (+6.4%)	36.7 (+11.2%)
Number of summer days (days)	Annual	24.4	37.9 (+55%)	52.2 (+113%)
Percentage of days when daily maximum temperature is above the 90th percentile (%)	Annual	12.4	22.1 (+70.9%)	30.9 (+139%)
Maximum of daily maximum temperature (°C)	Annual	30.9	33.2 (+7.4%)	34.9 (+12.9%)
Warm spell duration index (days)	Annual	7.9	21.8 (+177%)	46.9 (+496%)

Model Implications

- Elevated risk of wildfire
- Native species at risk / invasive species growth
  - Rising cedar dieback levels and invasive spread
- Landslides and flooding from more frequent and intense winter storms
- Thinning to support adaptation and mitigation



Mosaic and Mitigation

MOSAIC FOREST MANAGEMENT

Forests and forest products play a key role in climate change mitigation.

Across Mosaic's private lands, more than half a billion trees are growing and capturing carbon.

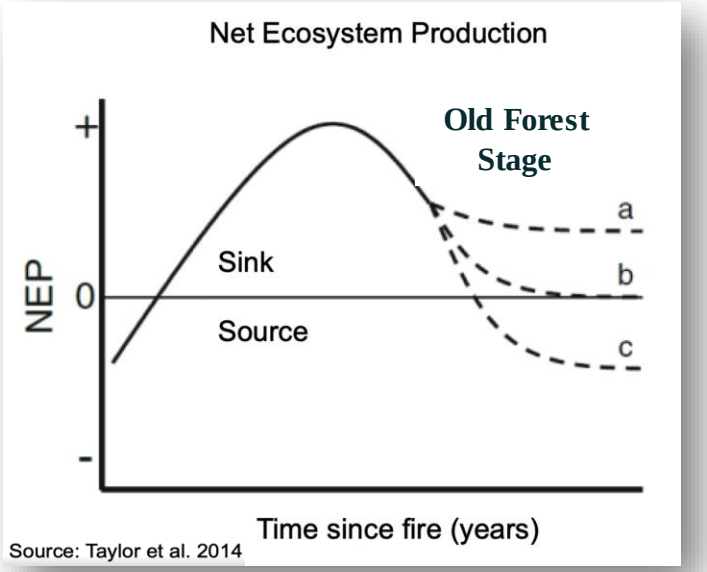
Mosaic continues to progress the commitment of becoming net-zero by 2035 and achieved important milestones in 2021:

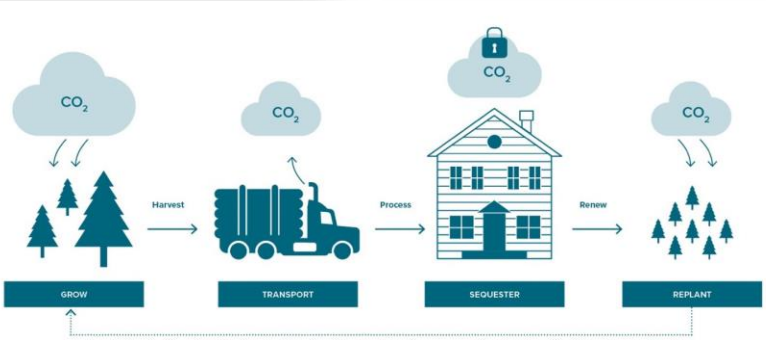
- Reduced on-site burning of residuals by a further 3%, for a total reduction of over 18% since 2018;
- Announced the trial of the world's first electric log trucks.

CARBON TRUST ISO 14064-3 ORGANISATIONAL CARBON FOOTPRINT

Carbon & Climate Change — Mosaic Forest Management (mosaicforests.com)

Sustainability Report — Mosaic Forest Management (mosaicforests.com)





BigCoast Forest Climate Initiative

MOSAIC FOREST MANAGEMENT

The BigCoast Forest Climate Initiative defers the harvesting of 40,000 hectares (100,000 acres) of private land in Coastal British Columbia

- **Project Type**: Improved Forest Management in Temperate Forests
- **Standard:** Verified Carbon Standard (VCS) VM00012
- **GHG Emission Reduction:** >20M metric tonnes CO_2e

BIGCO$_2$AST FOREST CLIMATE INITIATIVE

www.bigcoastforest.com

Unique and Charismatic Features of The BigCoast Forest Climate Initiative

- Old Forest Retention
- Socially Sensitive Harvest Areas
- Key Drinking Water Sheds
- Group Project Opportunities

Extension Partners:

PACIFIC SALMON FOUNDATION psf.ca

IPCA INNOVATION

SUSTAINABLE DEVELOPMENT GOALS

14 LIFE BELOW WATER

15 LIFE ON LAND

13 CLIMATE ACTION

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

6 CLEAN WATER AND SANITATION


MOSAIC
FOREST MANAGEMENT
Thank you!