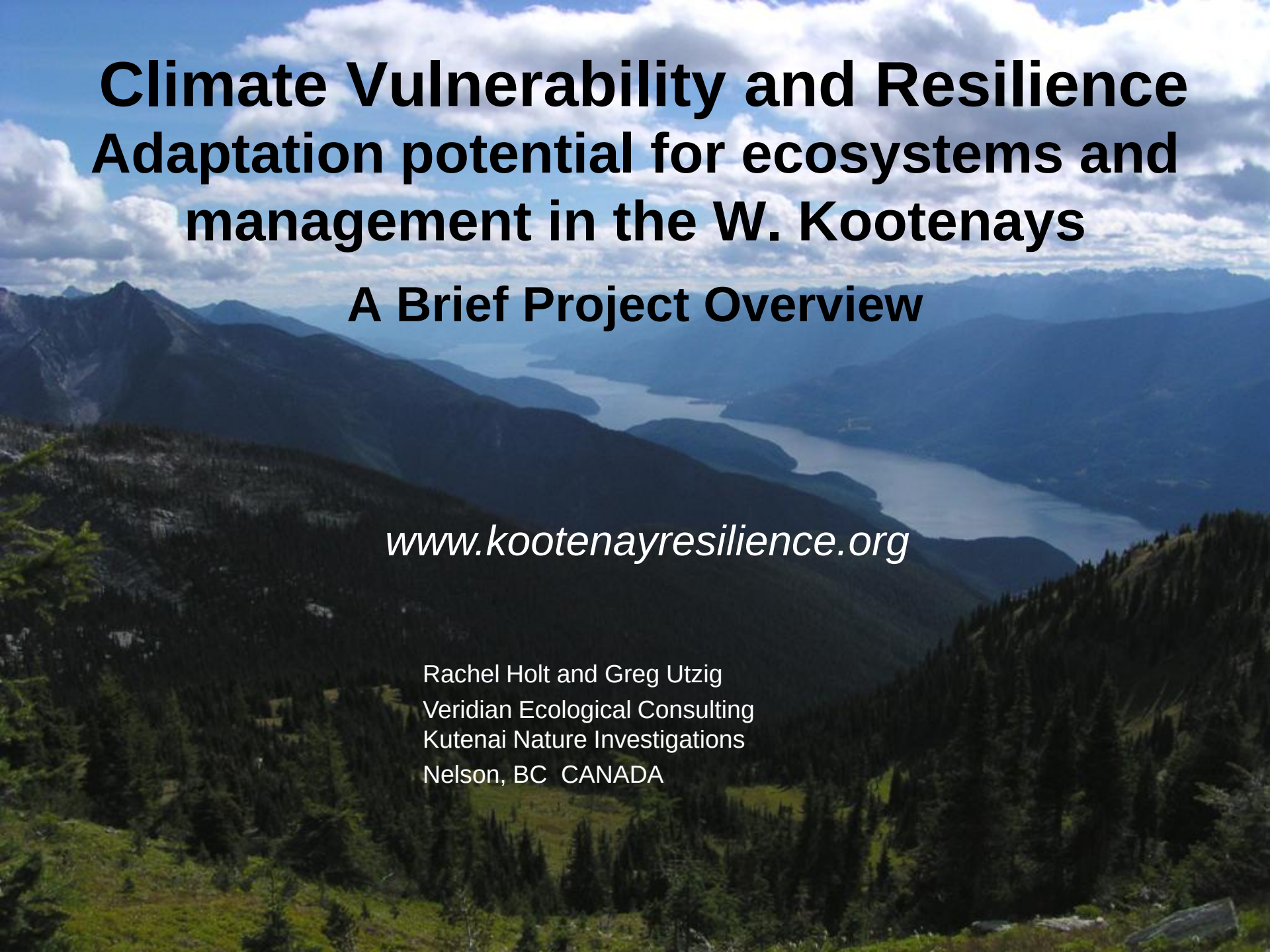


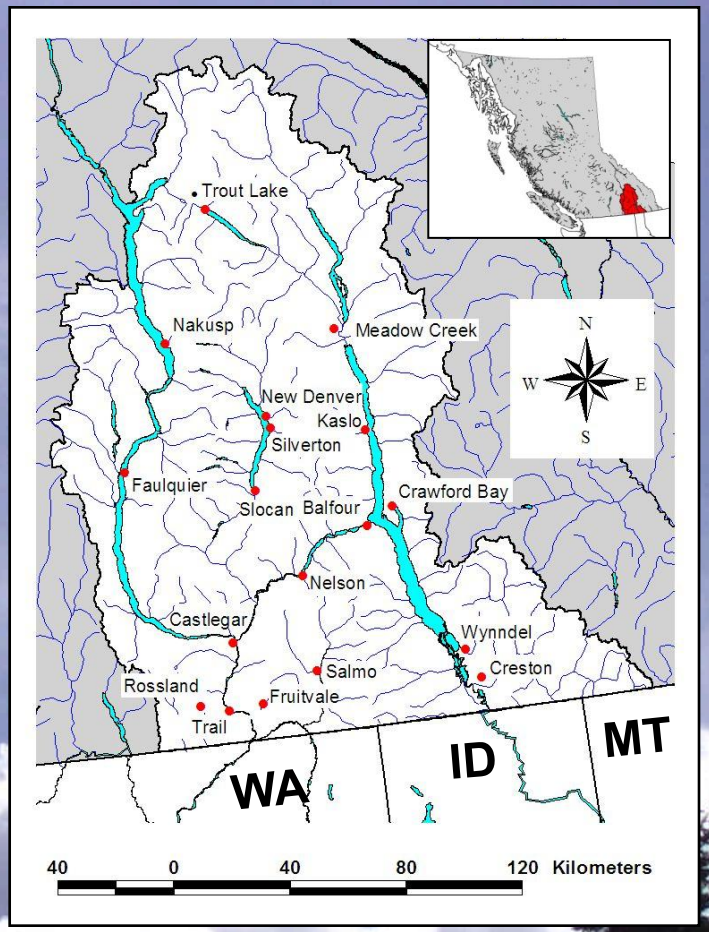
Climate Vulnerability and Resilience
Adaptation potential for ecosystems and management in the W. Kootenays
A Brief Project Overview

www.kootenayresilience.org

Rachel Holt and Greg Utzig
Veridian Ecological Consulting
Kutenai Nature Investigations
Nelson, BC CANADA

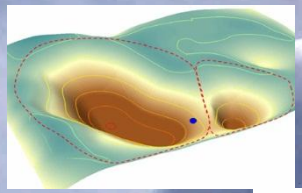
West Kootenay Climate Change Vulnerability and Resilience Project

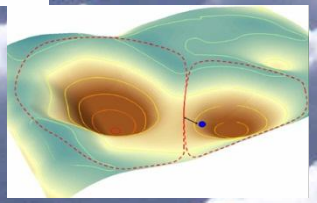
- **Project Participants**
  - **Core Team**
    - Greg Utzig
    - Rachel Holt
    - Heather Pinnell
    - Cindy Pearce
  - **Science Advisors**
  - **Local Forest Managers/ Stakeholders**
- **Funding**
  - **British Columbia Ministry of Forests – Future Forest Ecosystem Scientific Council**
- **Data**
  - **Pacific Climate Impacts Consortium (PCIC)**
  - **University of Alberta – Andreas Hamann's group**



- **Main Objectives**
  - To explore the potential implications of climate change for West Kootenay ecosystems with local forest managers and scientists
  - To undertake an **ecological** vulnerability assessment for the West Kootenays, using a range of climate change scenarios
- **Main Project Components**
  - Collating ***local*** climate change information
  - Summarizing potential impacts
  - Series of workshops with local forest managers and scientists
  - Ecological vulnerability assessment incorporating resilience
  - Identification of adaptation options and barriers
  - Reporting

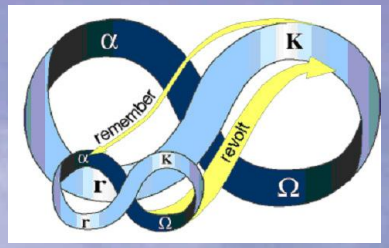
- **Resilience and vulnerability**
  - Somewhat interchangeable
  - Strict versus loose definitions
- **Vulnerability** – exposure x sensitivity x adaptive capacity
- **Resilience**
  - rebounding' from disturbance
  - to avoid changing regime; To re-organize and continue after changing regime
  - Characterized by thresholds and non-linear responses





- **Interpreting significance of projected future bioclimates -**

- No Regime Shift
- Non-Catastrophic regime shift
  - Different natural disturbance regime
  - Different tree species
  - Similar pathway
- Catastrophic regime shift
  - Different natural disturbance regime
  - Different species
  - Stalled pathway / invasive species, brush .. Very slow or difficult to manage out of.



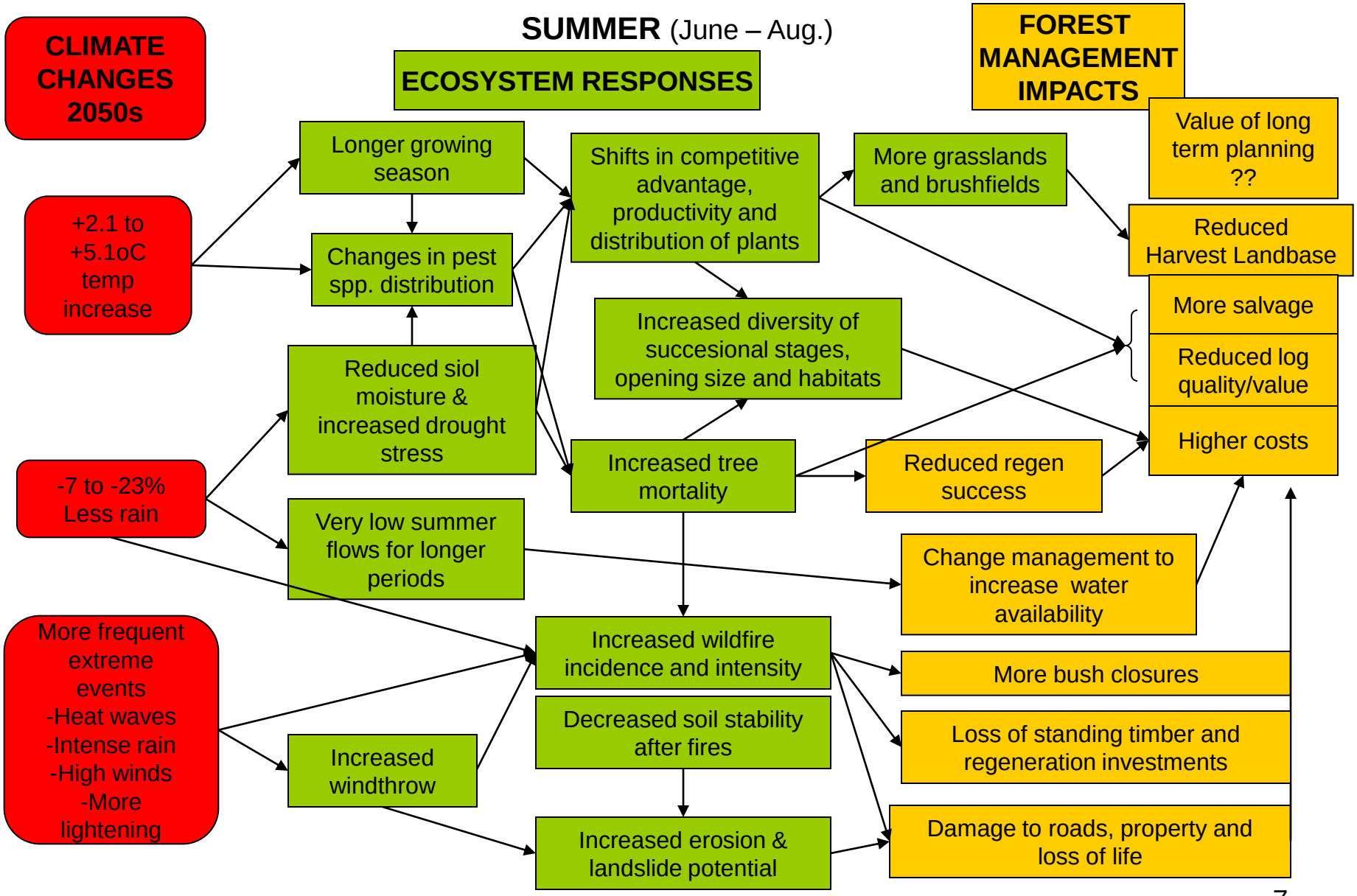
Technical Workshops (2)

- Attendance: 6-12 technical experts in ecology, fire, forest health, geomorphology, silviculture, forest policy

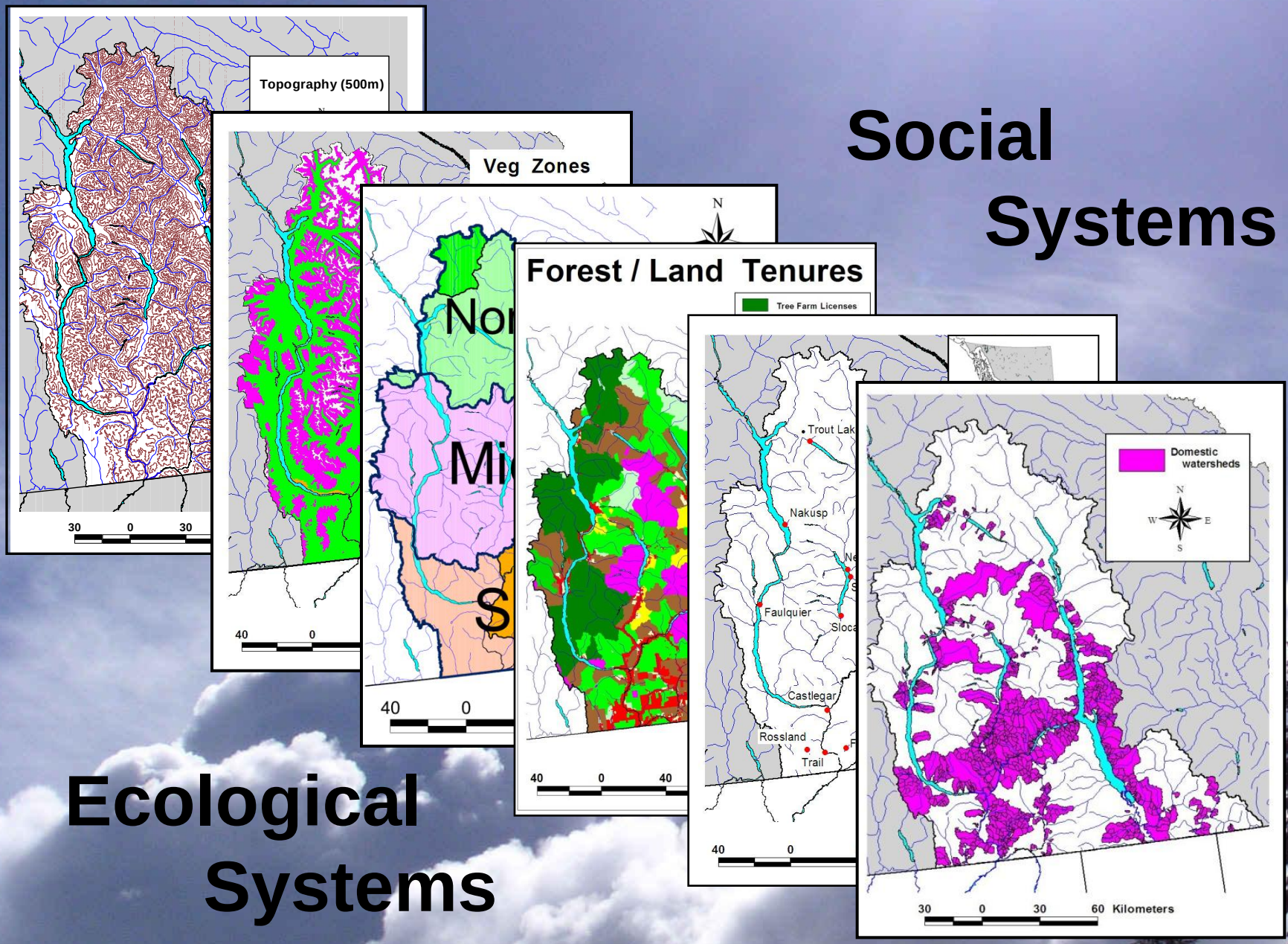
Managers Workshops (3)

- Attendance: 20-30 “forest managers” and “forest practitioners in silviculture, terrestrial and aquatic biology, forest health, field planning, geoscience, hydrology and forest policy
- From government, industry, woodlots, community forests, consulting companies and Regional District planners

West Kootenay Forest Managers Climate Change Impacts – South Sub-Region



Study Area Characteristics

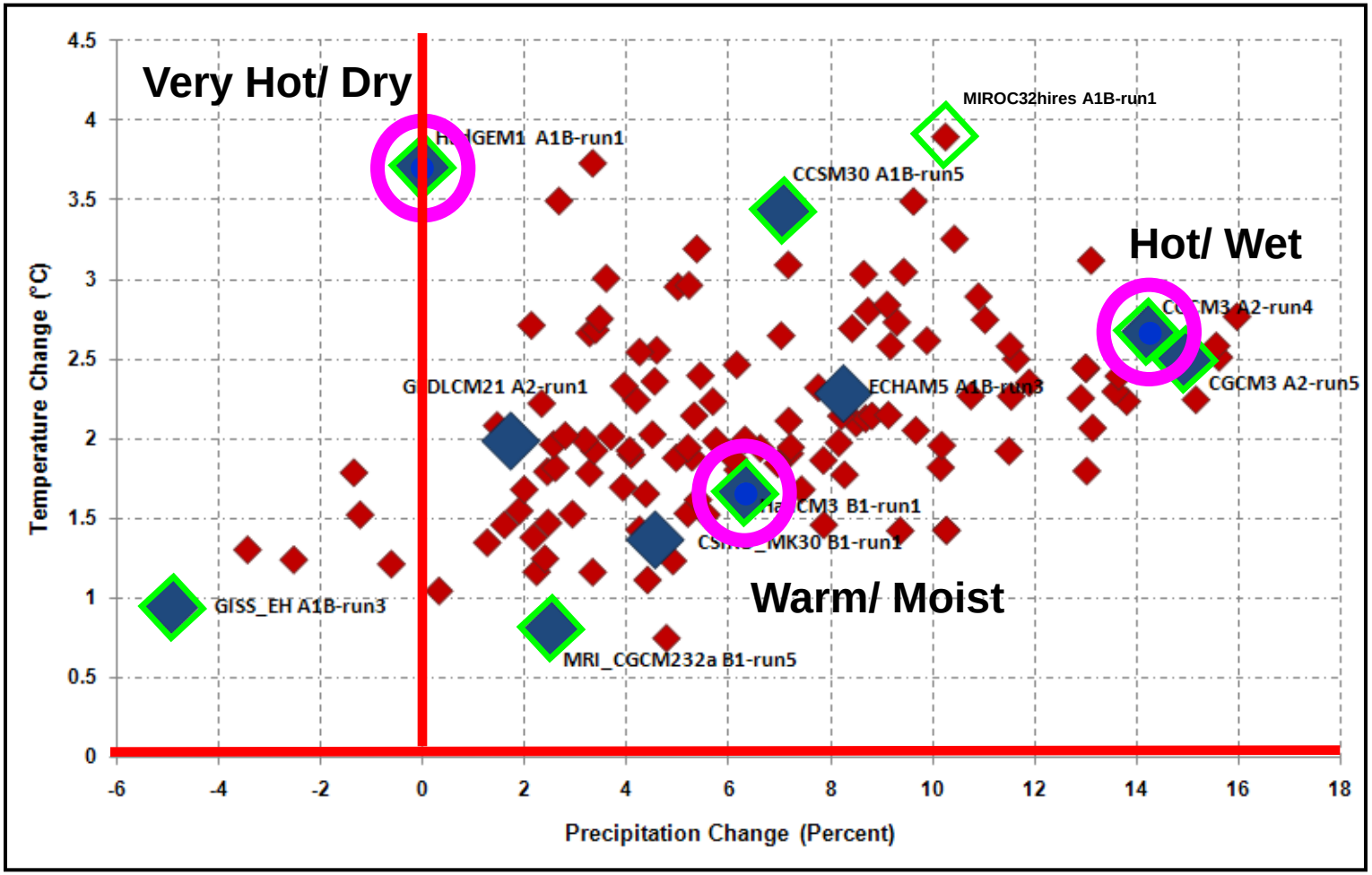


Social Systems

Ecological Systems

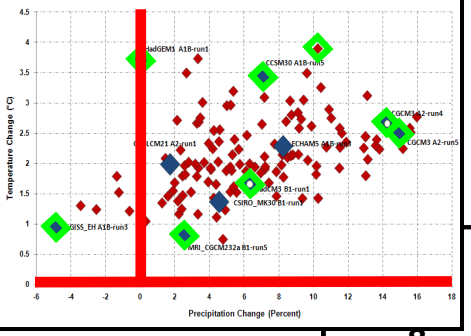
GCM / Scenario Combinations

2050s Mean Projections for British Columbia
Annual Temperature and Precipitation

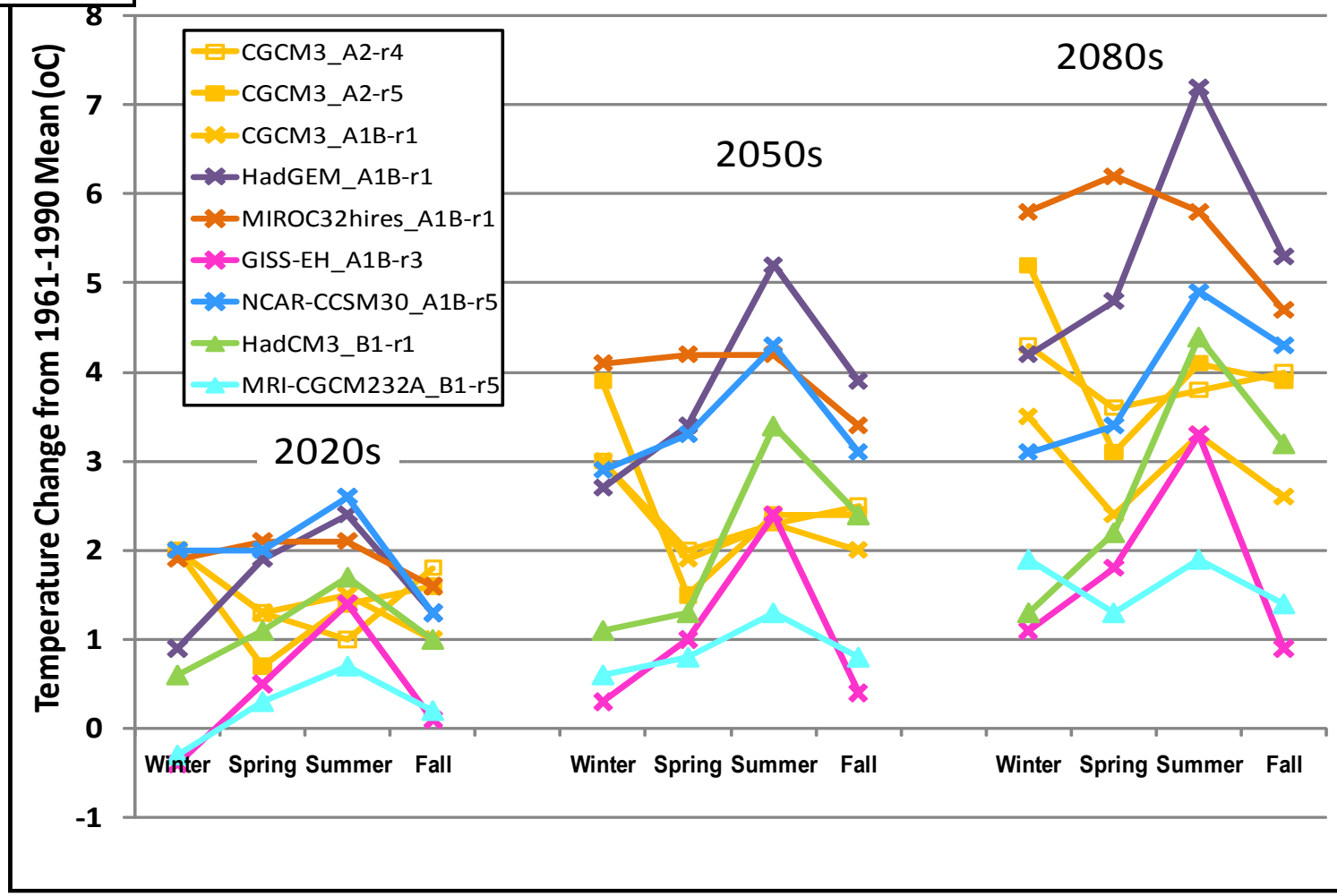


Blue diamonds recommended scenarios
Green/ Purple - scenarios investigated for the West Kootenays

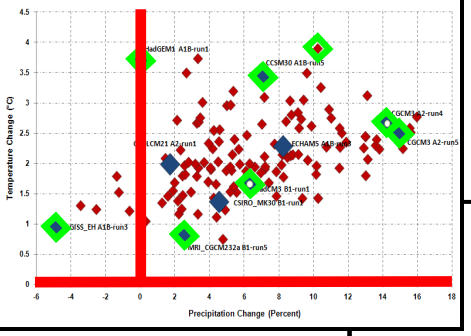
Adapted from:
Murdock and Spittlehouse 2010



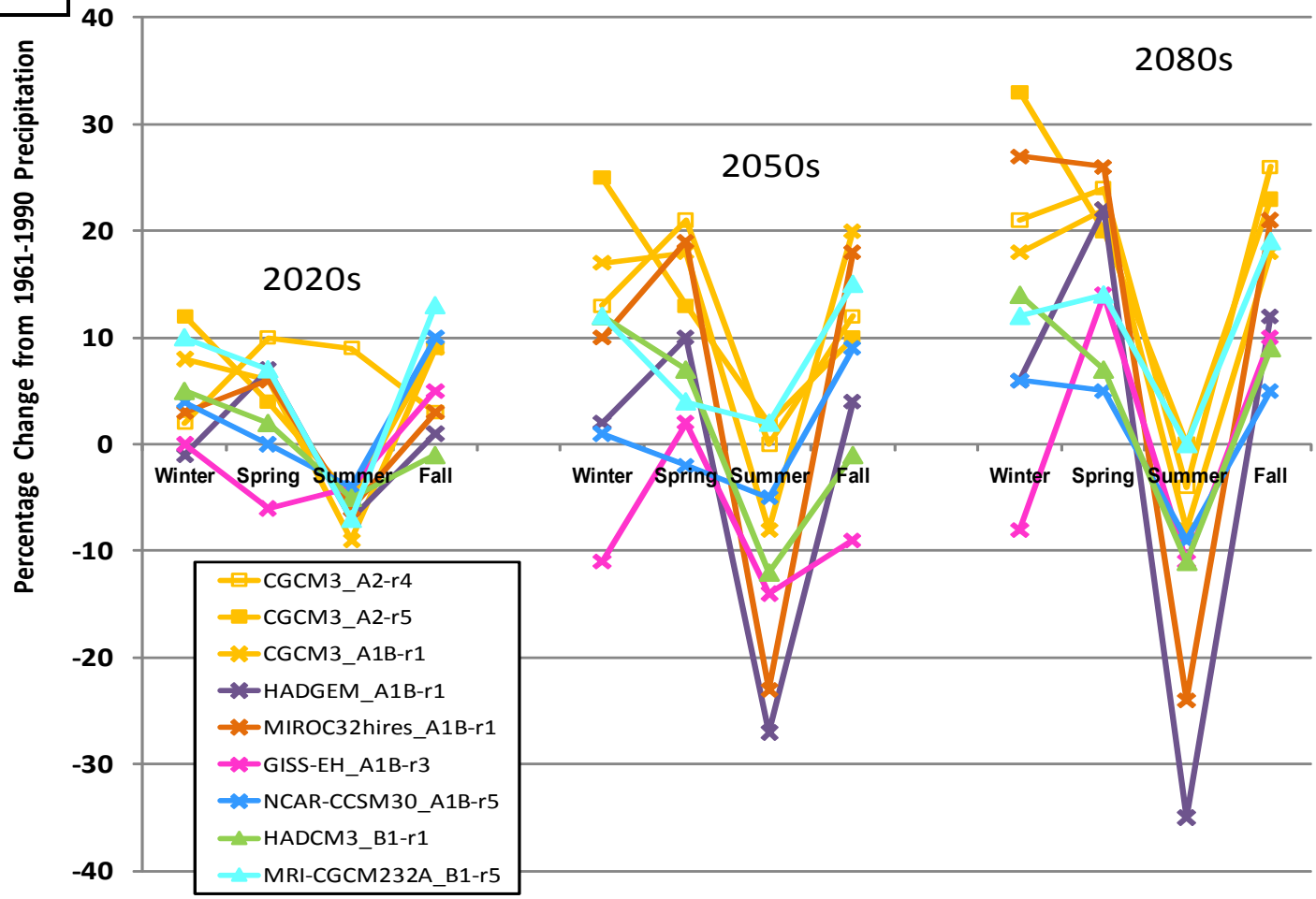
West Kootenay Mean Seasonal Temperature Projections



Data from: PCIC Regional Analysis Tool

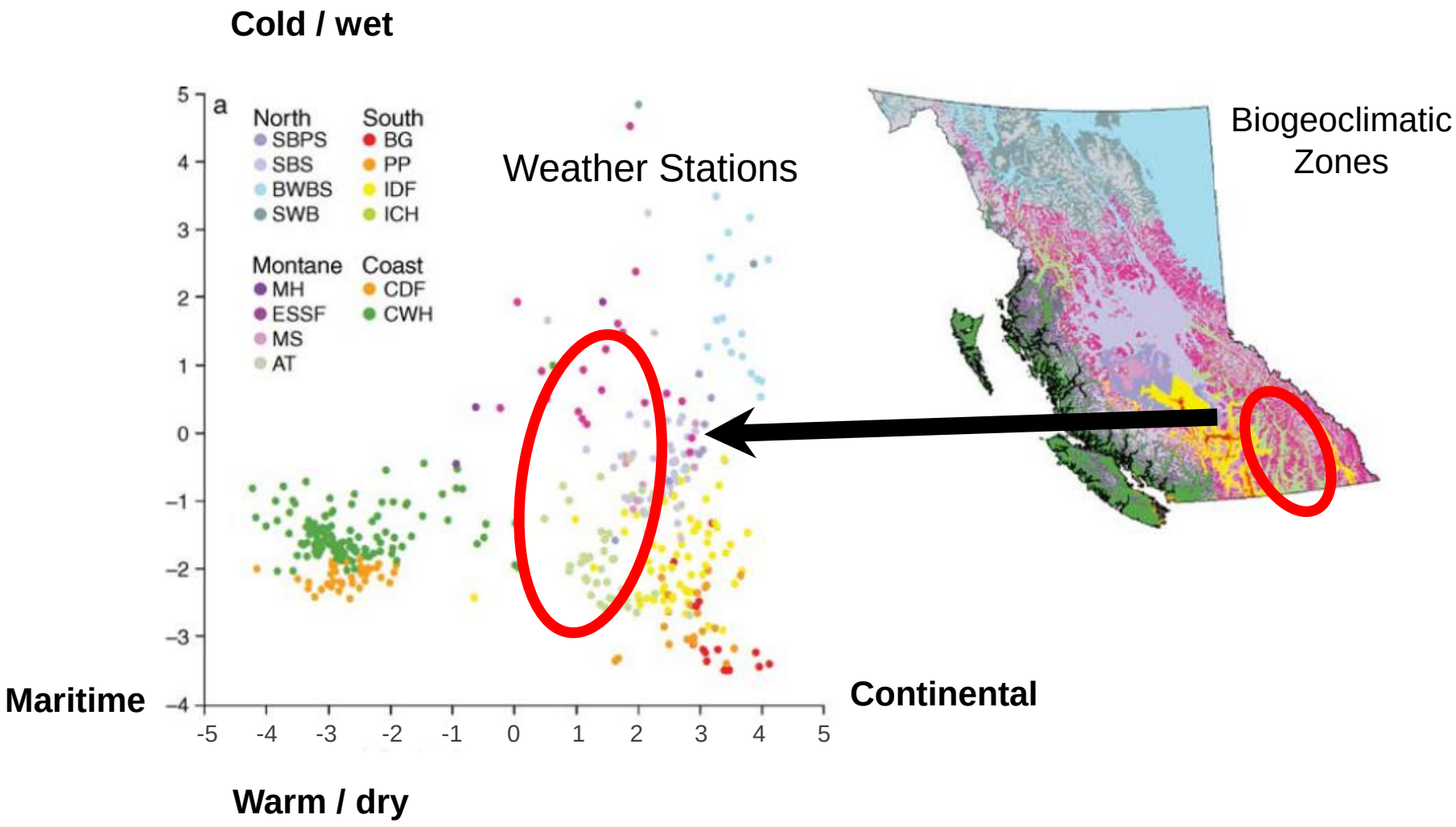


West Kootenay Mean Seasonal Precipitation Projections



Data from: PCIC Regional Analysis Tool

Ecosystem Units in Multivariate Climate Space – “Bioclimate Envelopes”

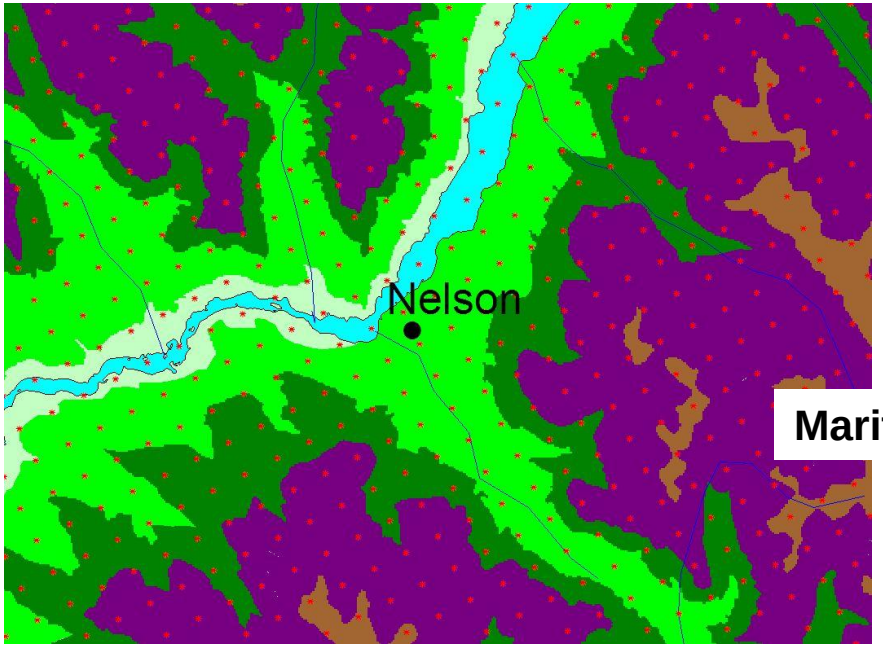


From:
Hamann and Wang 2006

Ecosystem Units in Multivariate Climate Space

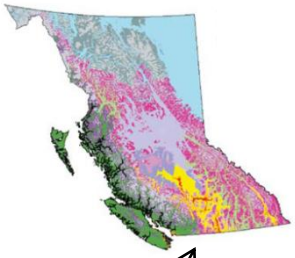
Prism Data (ClimateWNA)

(climate station data interpolated to a 1 km grid)

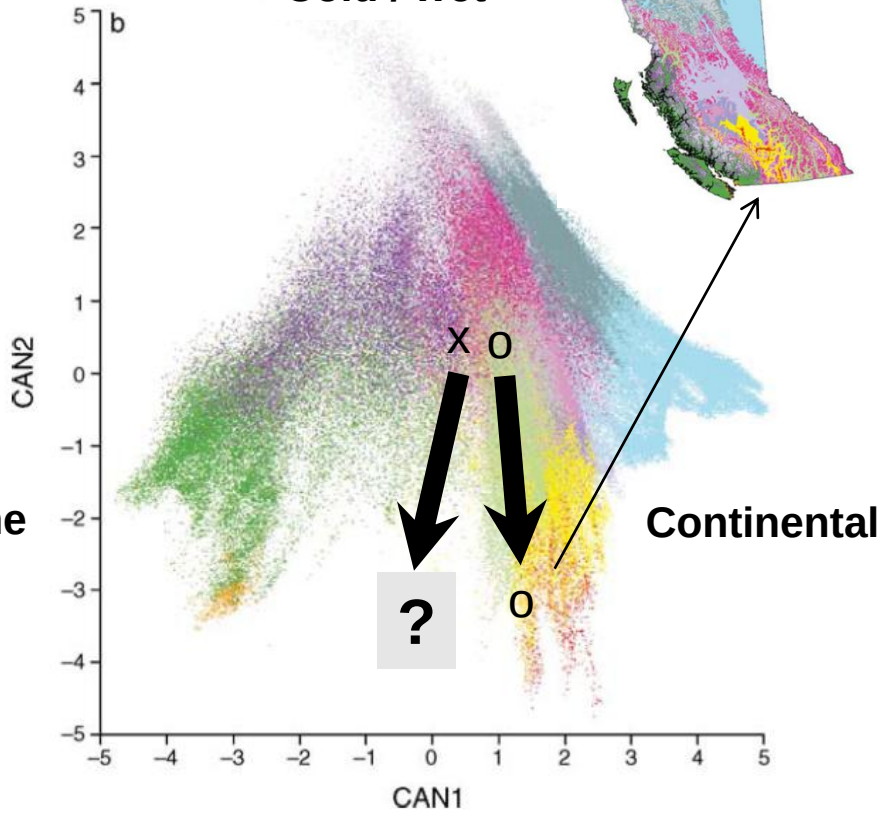


Maritime

Biogeoclimatic Zones



Cold / wet



Continental

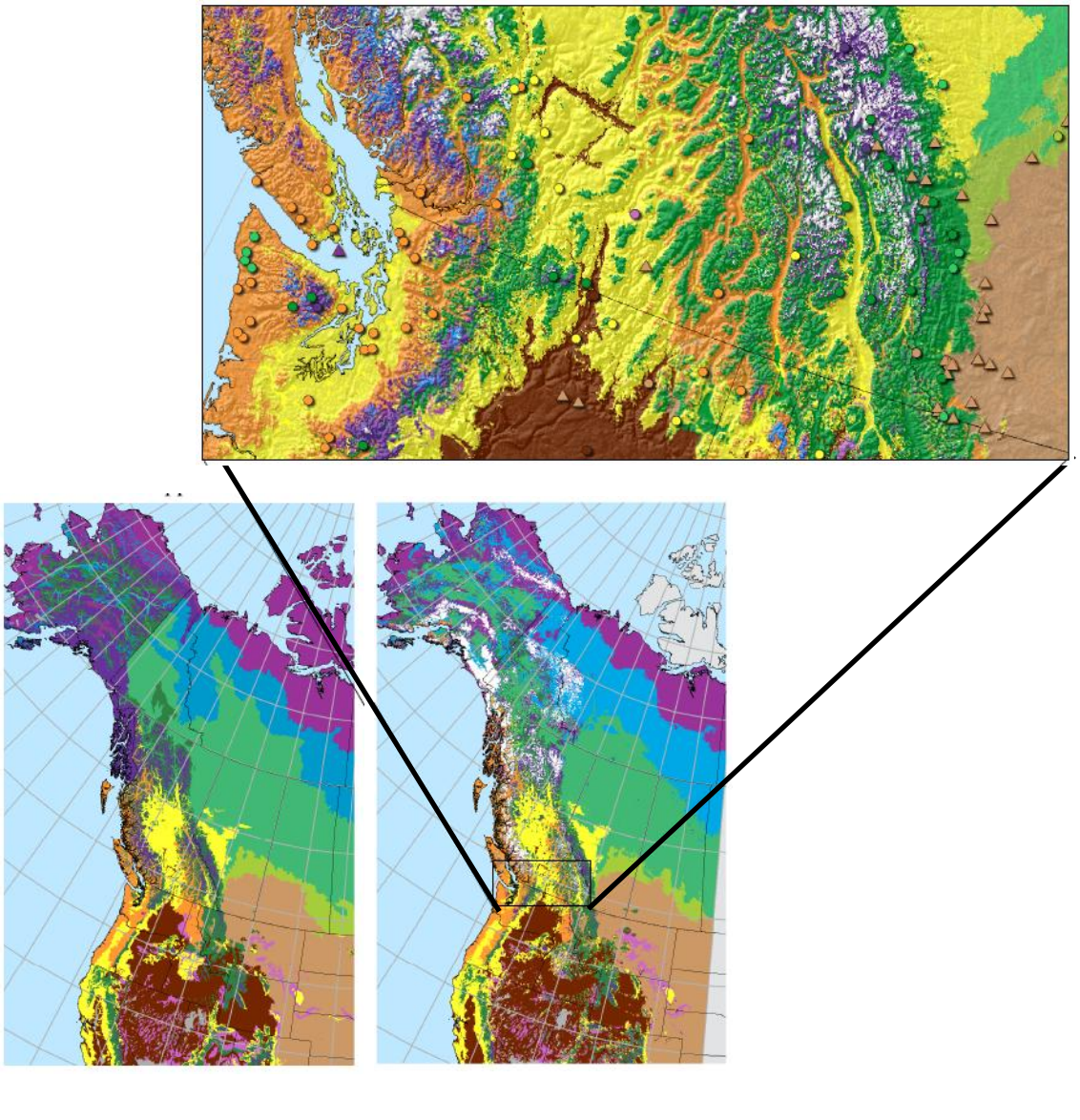
Warm / dry

Non-analogue or Novel bioclimate envelopes

Adapted from:
Hamann and Wang 2006

Projected Climate Envelope Shifts

Western North America (not limited to BC)



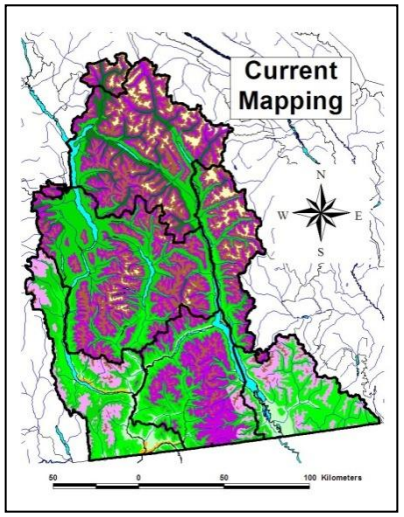
1 km grid

770 ecosystem units

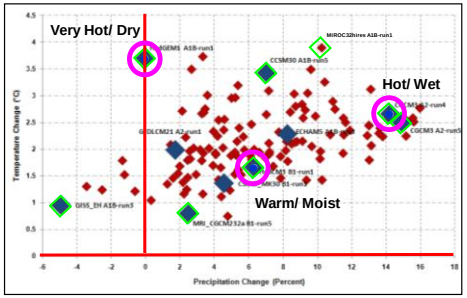
- BC – BEC subzone variants
- Alberta – Seed zones
- USA (48) – Level 4 Ecoregions
- Alaska – Ecosystems of Alaska
- Canada Other – National Ecological Framework

University of Alberta
David Roberts/ Andreas Hamann

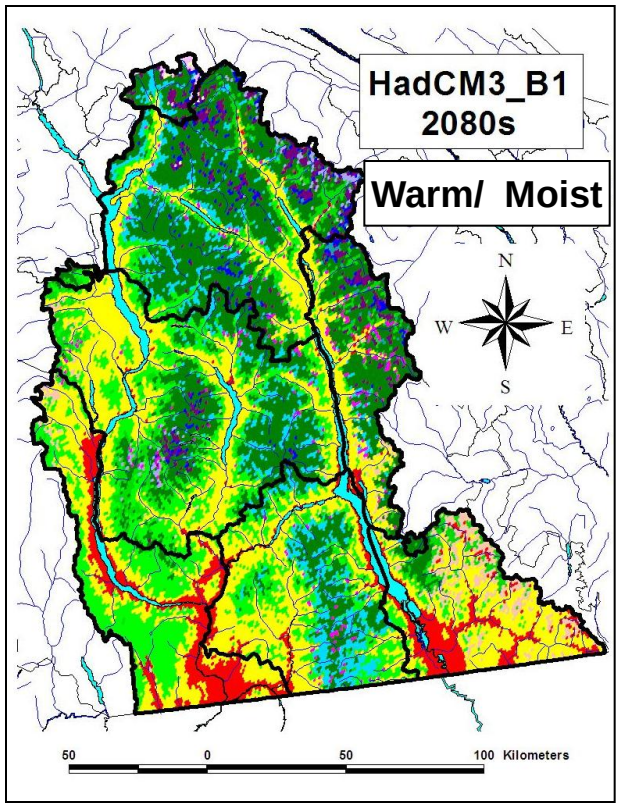
From:
Roberts and Hamann 2011

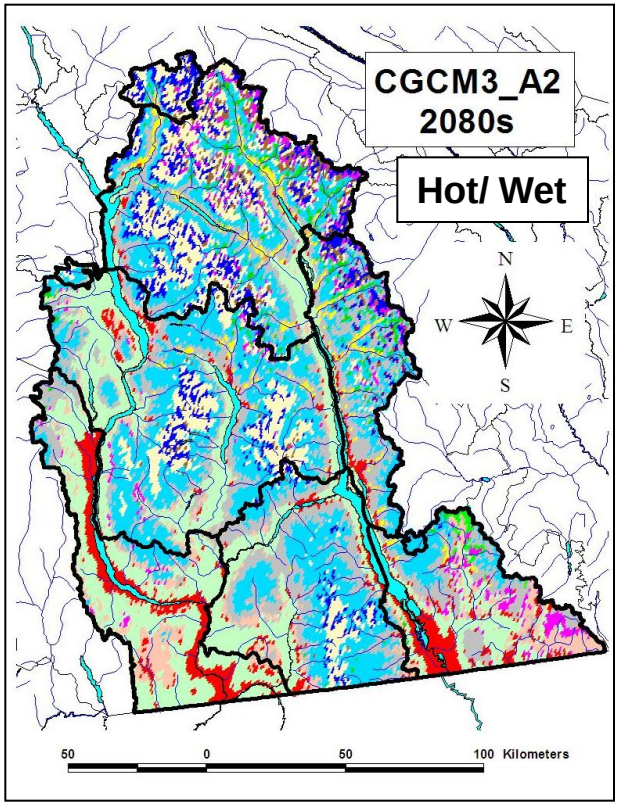


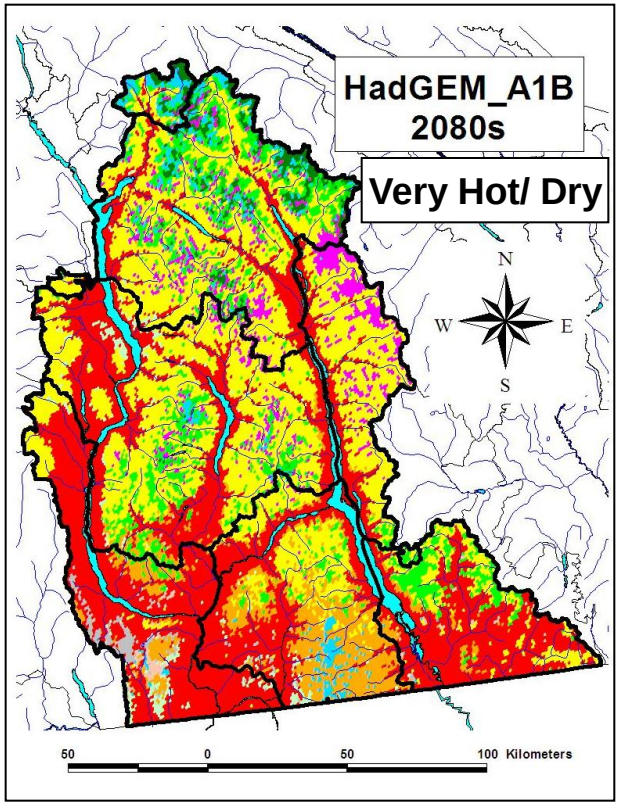
- Alpine
- Alpine parkland
- Wet subalpine forest
- Dry subalpine forest
- Coastal hemlock
- Transitional coast/ interior hemlock
- Montane/sub-boreal spruce forest
- Wet interior cedar/ hemlock
- Moist interior cedar/ hemlock
- Dry interior cedar hemlock
- Grand fir/ Douglas-fir
- Wet Douglas-fir
- Dry Douglas-fir
- Ponderosa pine savanah
- Grassland/ steppe



A Range of Projected Bioclimate Envelopes

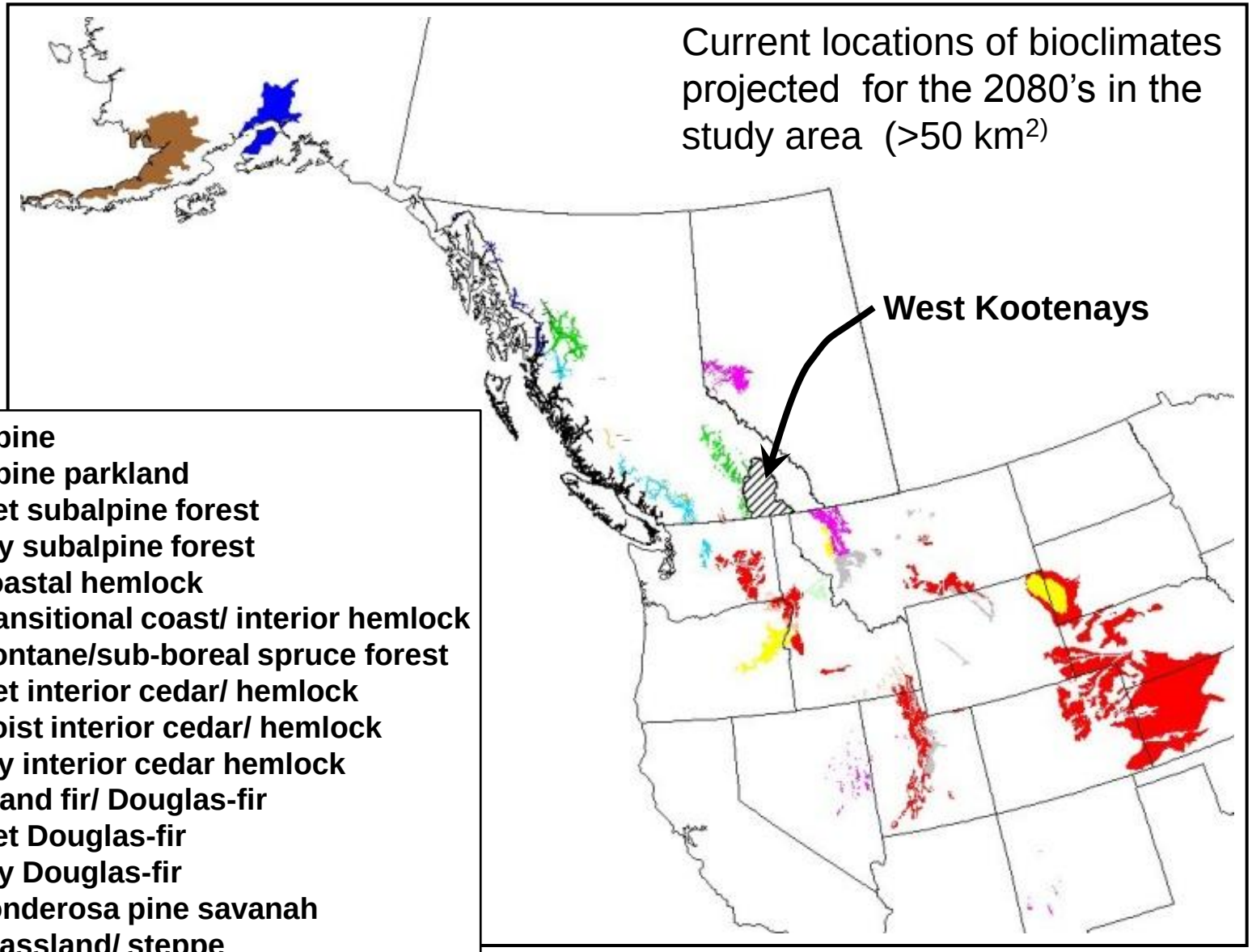






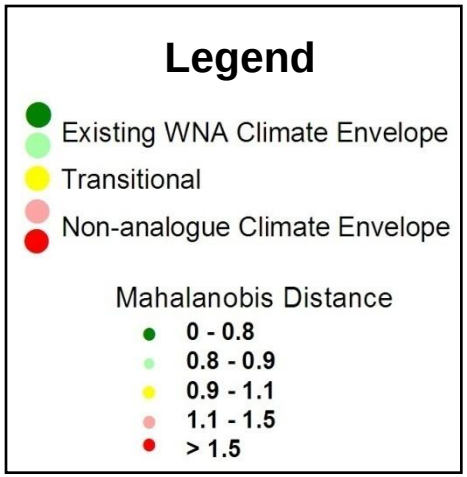
Original data from: Roberts and Hamann, U of A

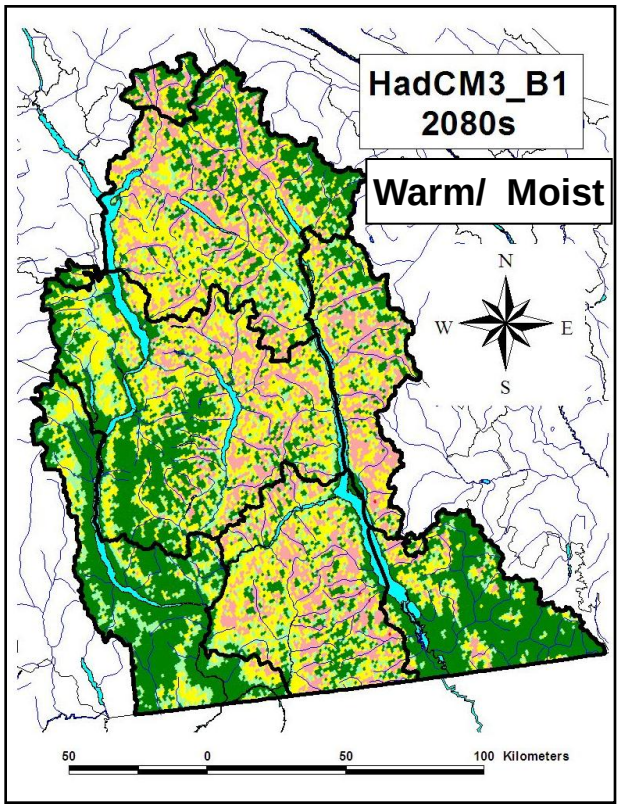
Bioclimate Envelopes and Ecosystems

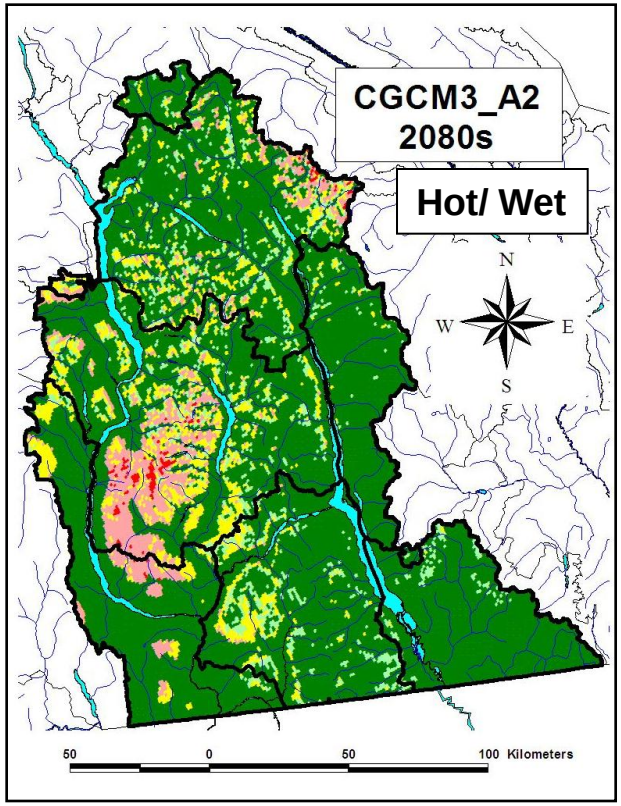


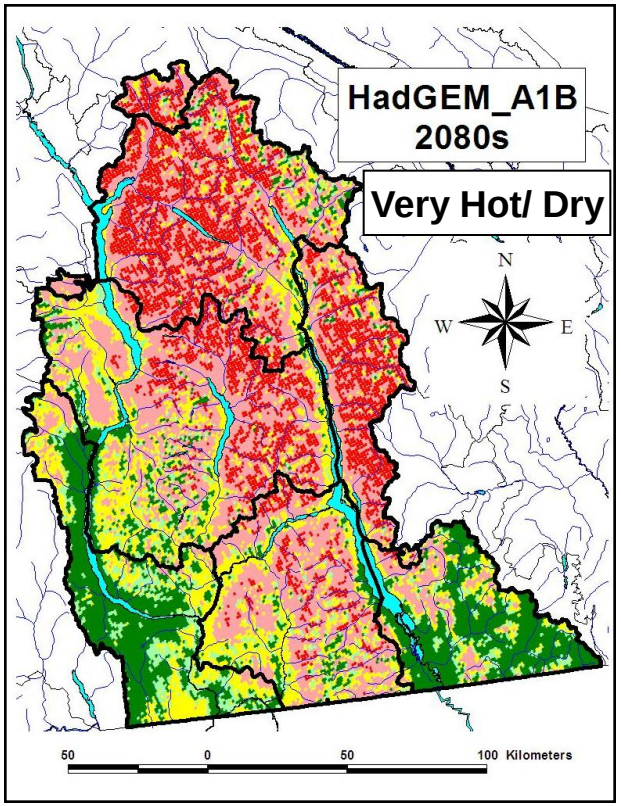
Original data from: Roberts and Hamann, U of A

Potential for Non-Analogue or Novel Bioclimate Envelopes

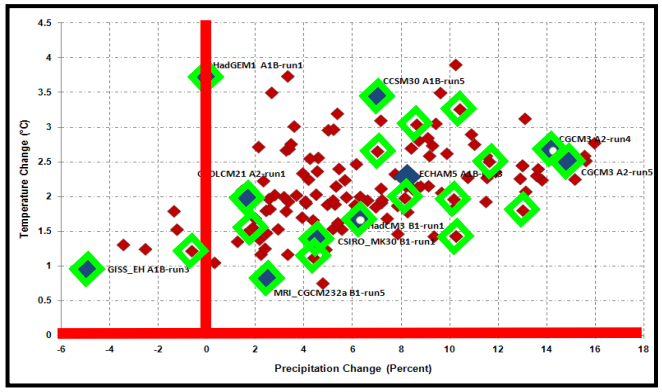


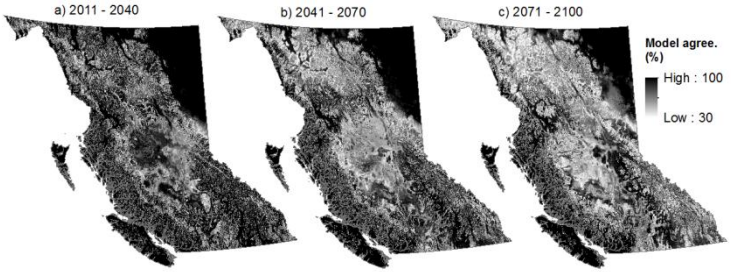


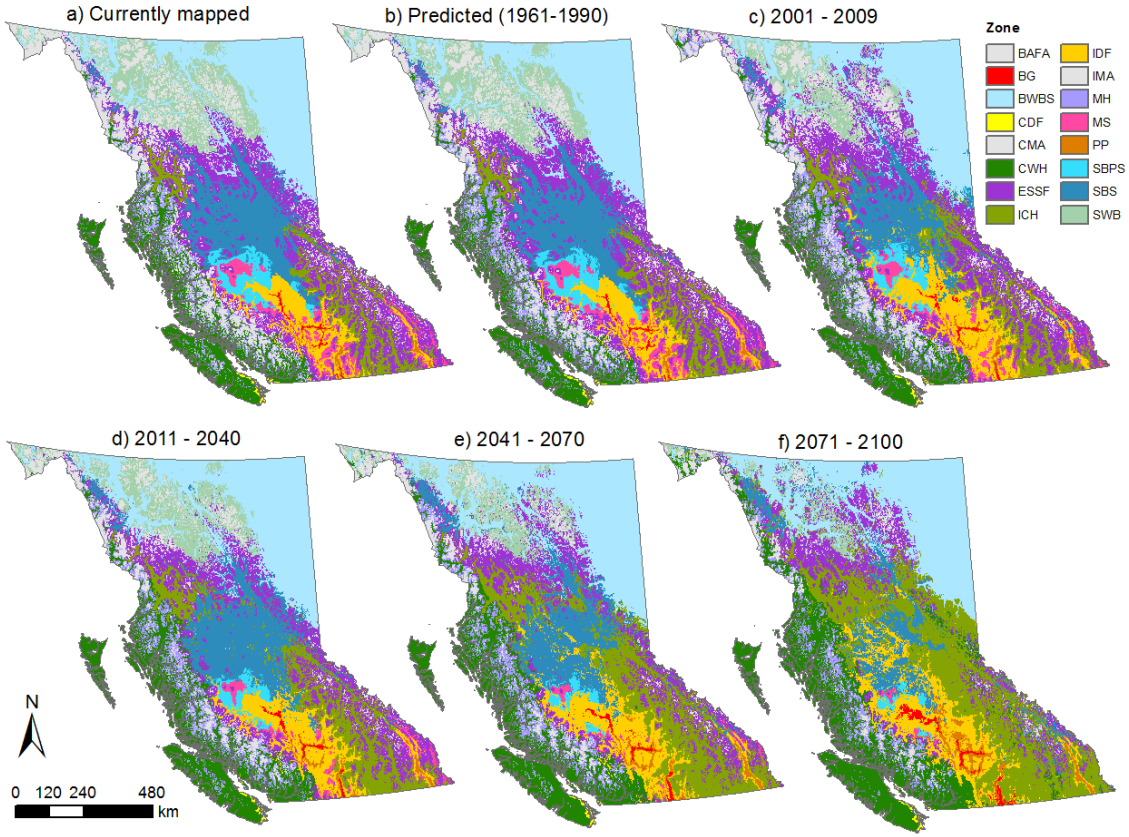




An Ensemble Projection of Bioclimate Envelopes

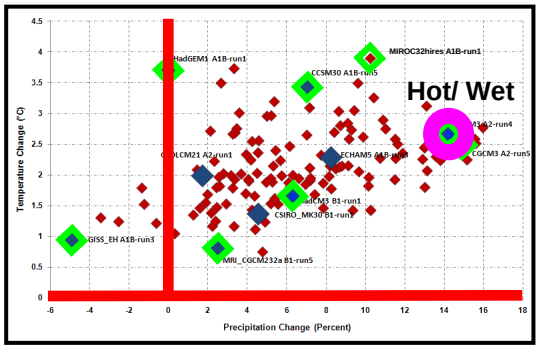


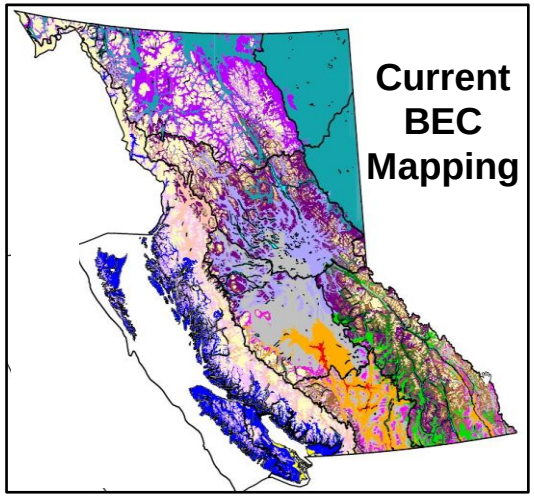


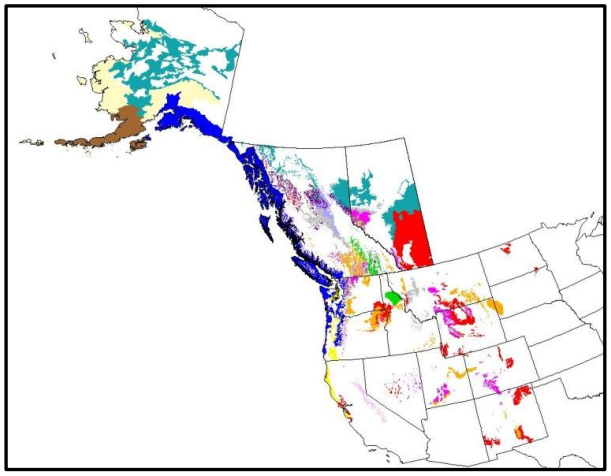


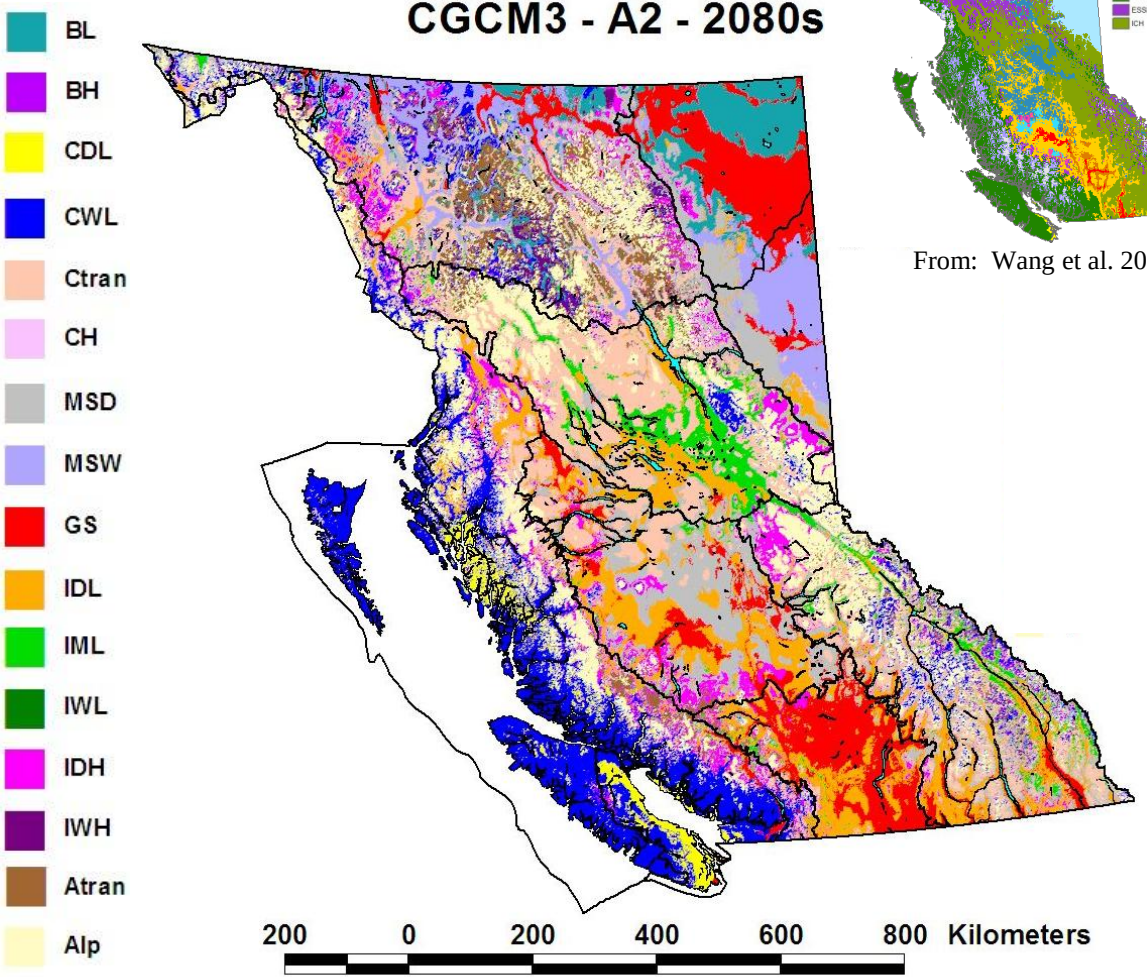
From: Wang et al. 2012

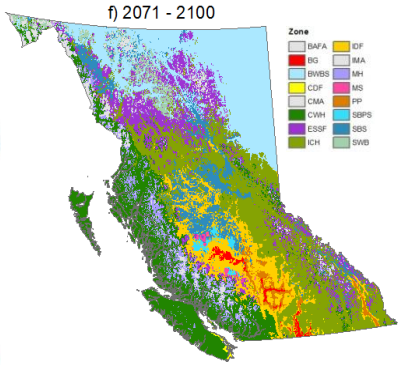
Bioclimate Envelope Projections







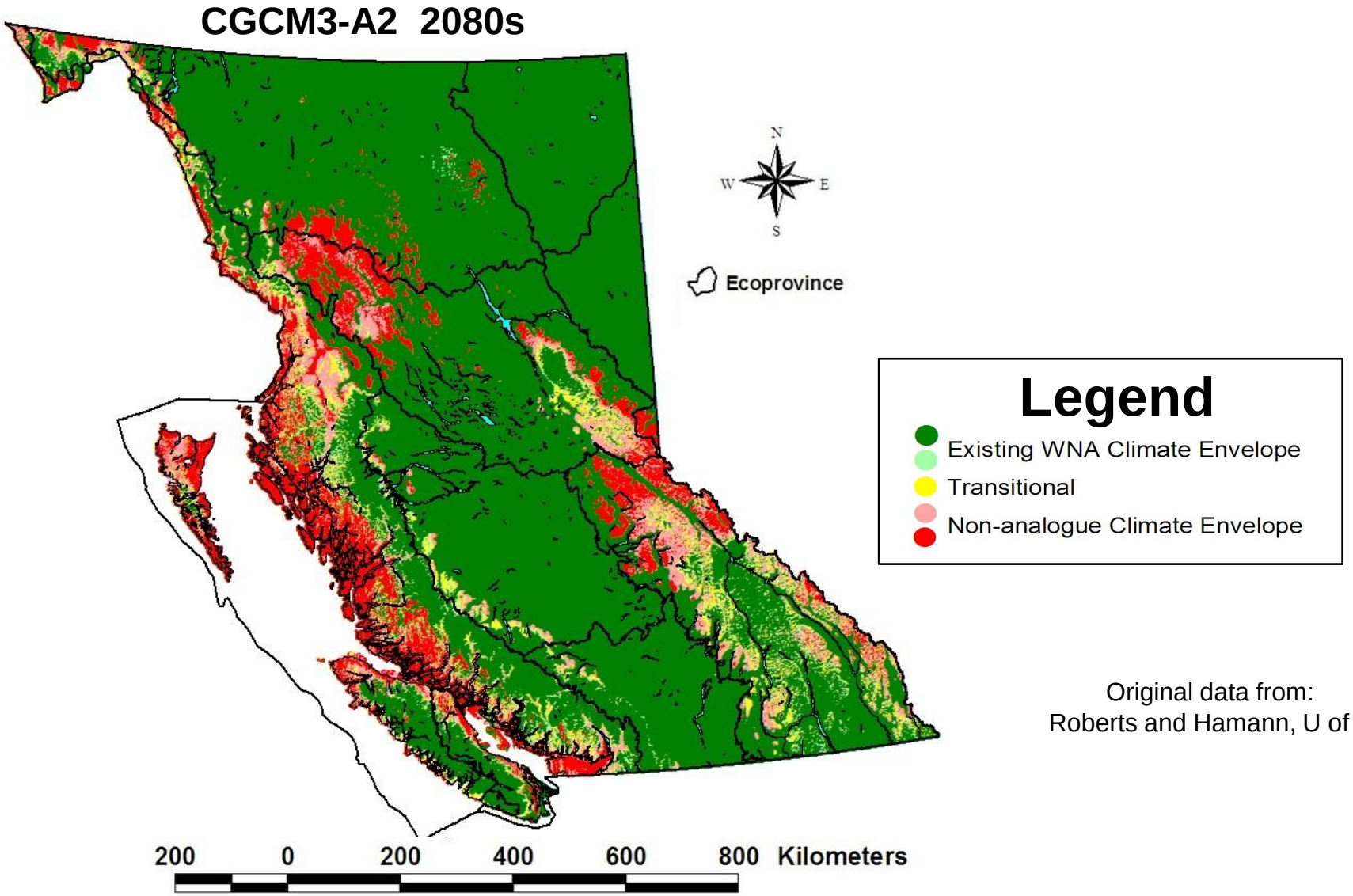




From: Wang et al. 2012

Original data from: Roberts and Hamann, U of A

Novel or Non-analogue Bioclimate Envelopes

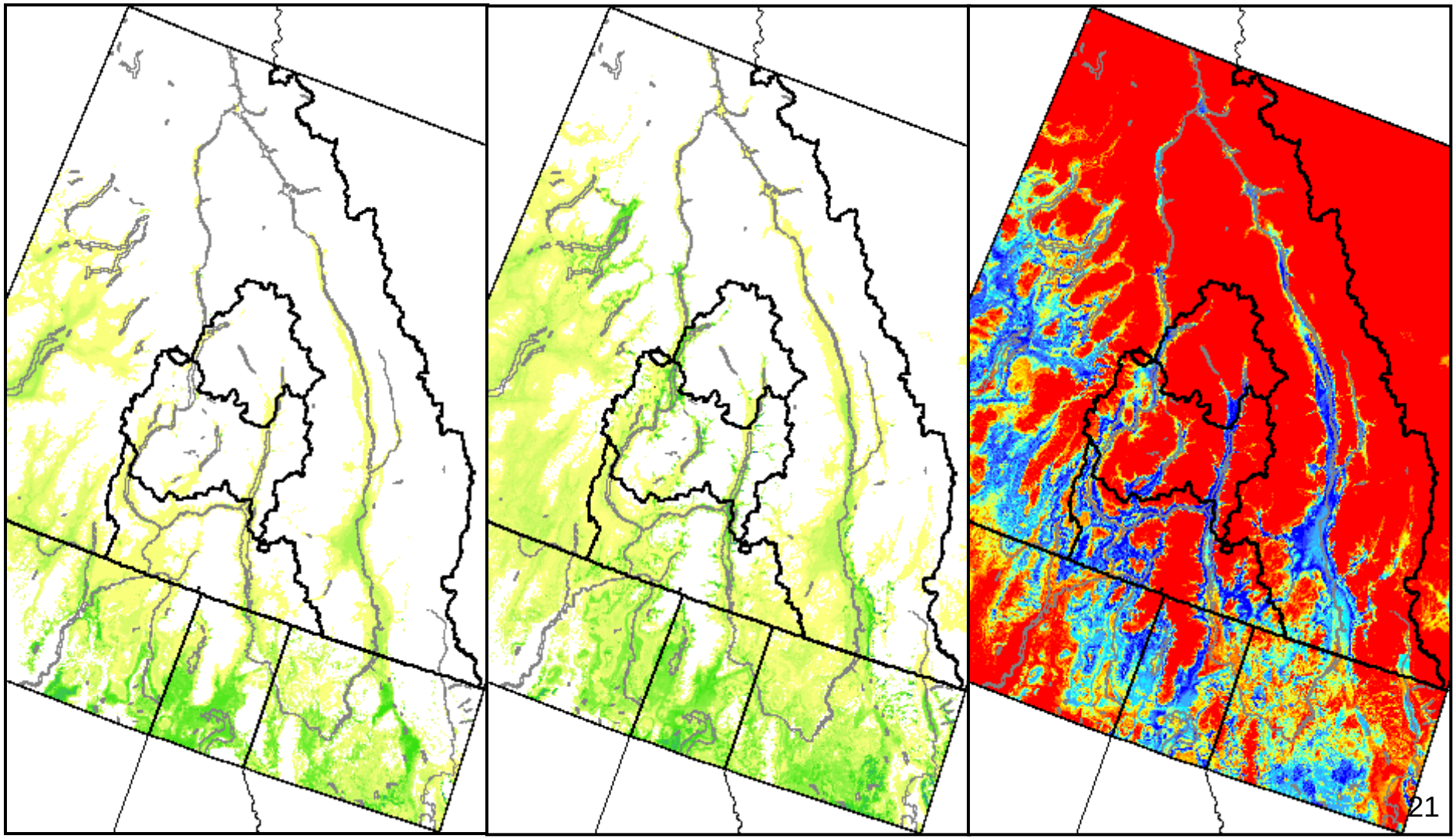


Original data from:
Roberts and Hamann, U of A

Habitat projections for Ponderosa Pine

Current

2020s



From:
Laura Gray 2010

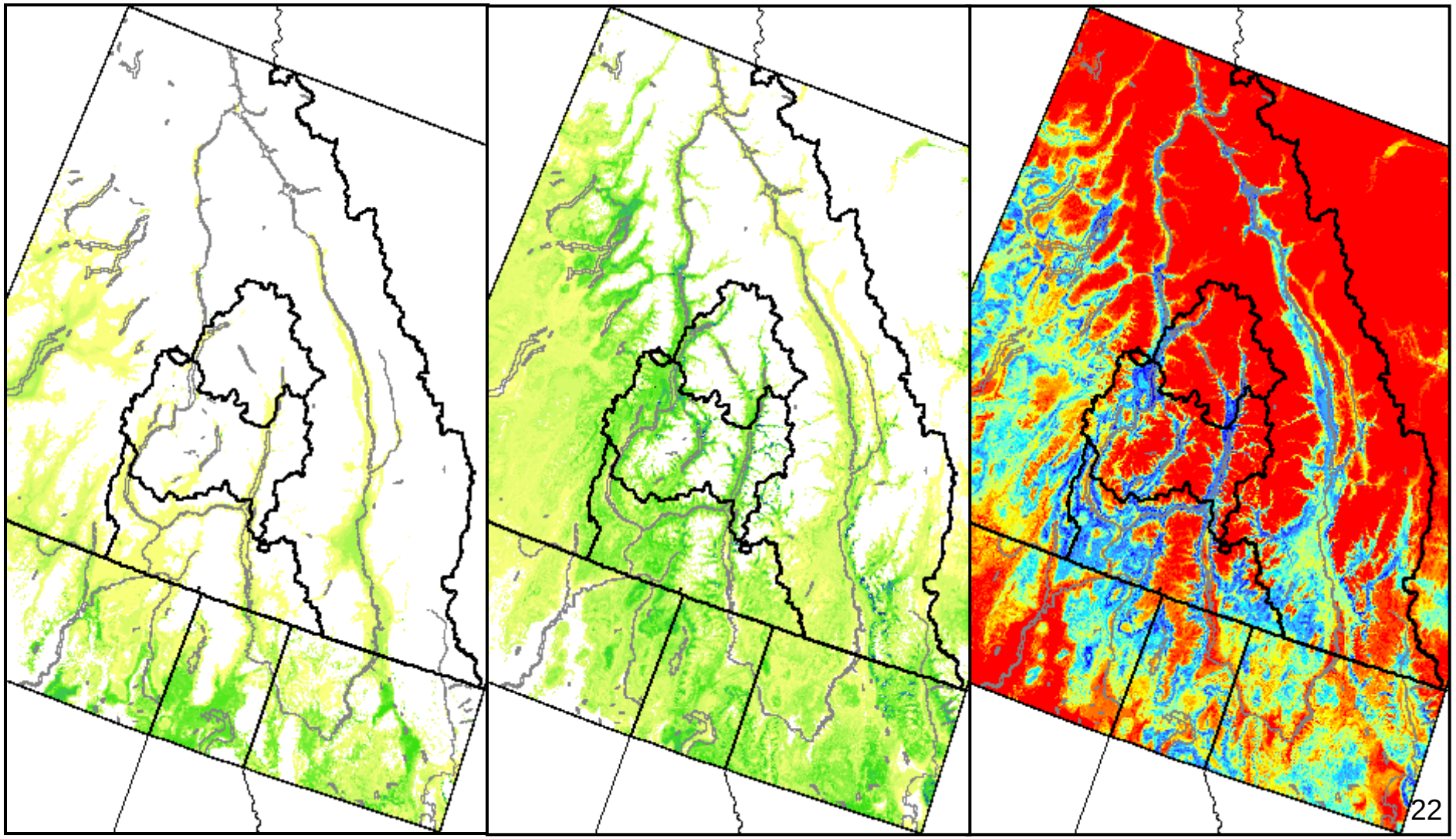
Frequency <5 10 15 20 25 35 45 55 65 75%

Absent 100% 50% 100% Present

Habitat projections for Ponderosa Pine

Current

2050s



From:
Laura Gray 2010

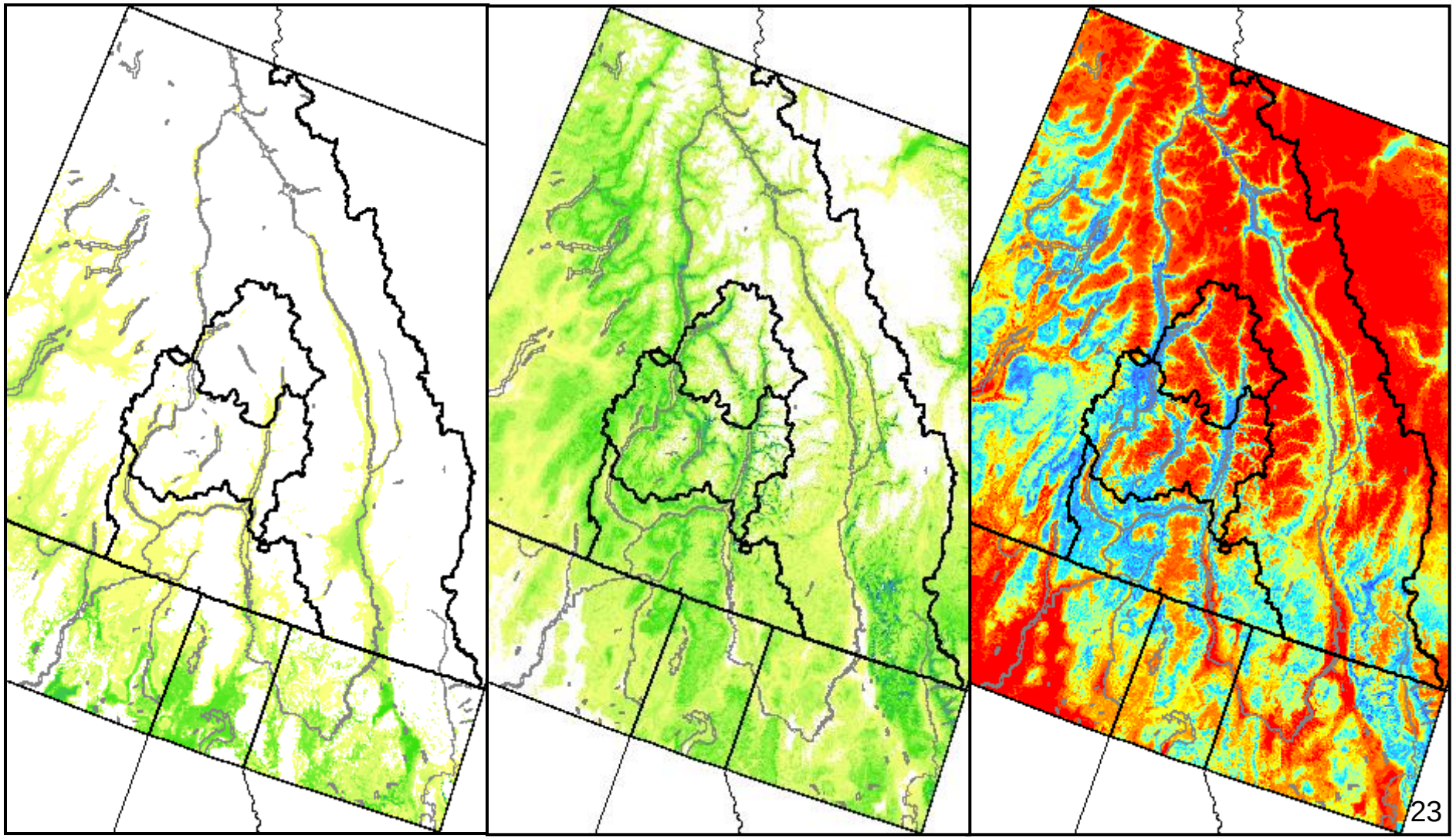
Frequency <5 10 15 20 25 35 45 55 65 75%

Absent 100% 50% 100% Present

Habitat projections for Ponderosa Pine

Current

2080s



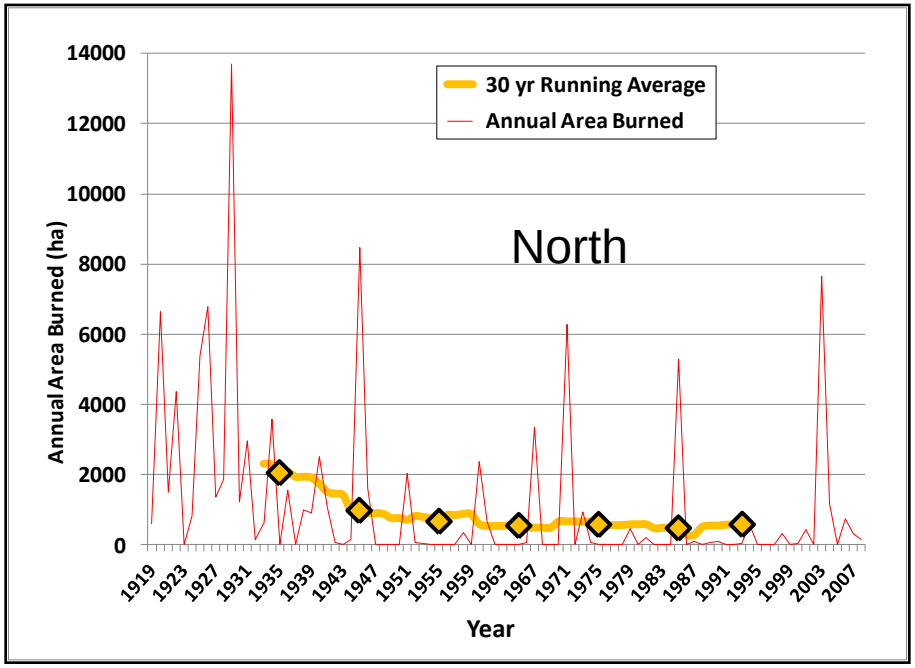
From:
Laura Gray 2010

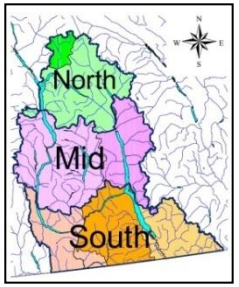
Frequency <5 10 15 20 25 35 45 55 65 75%

Absent 100% 50% 100% Present

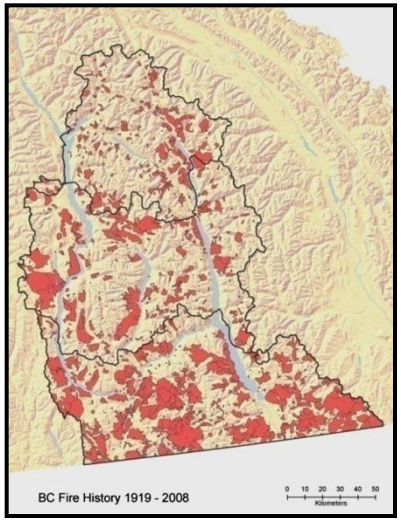
West Kootenay Fire History

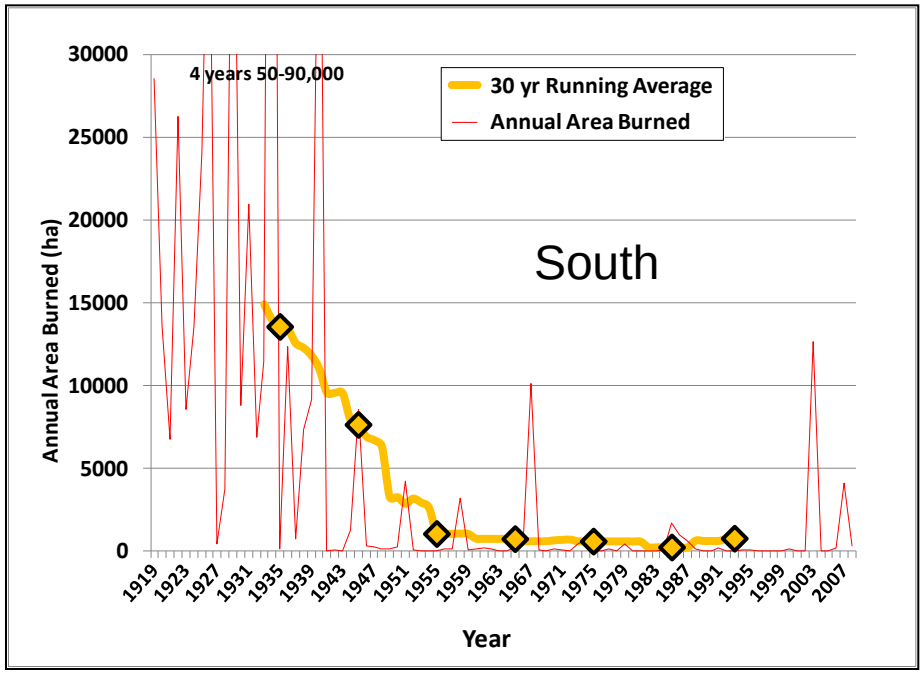
Annual Area Burned



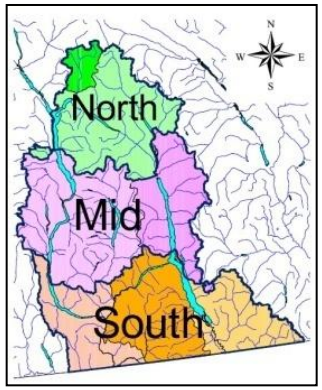


Touchstones Archives, Nelson

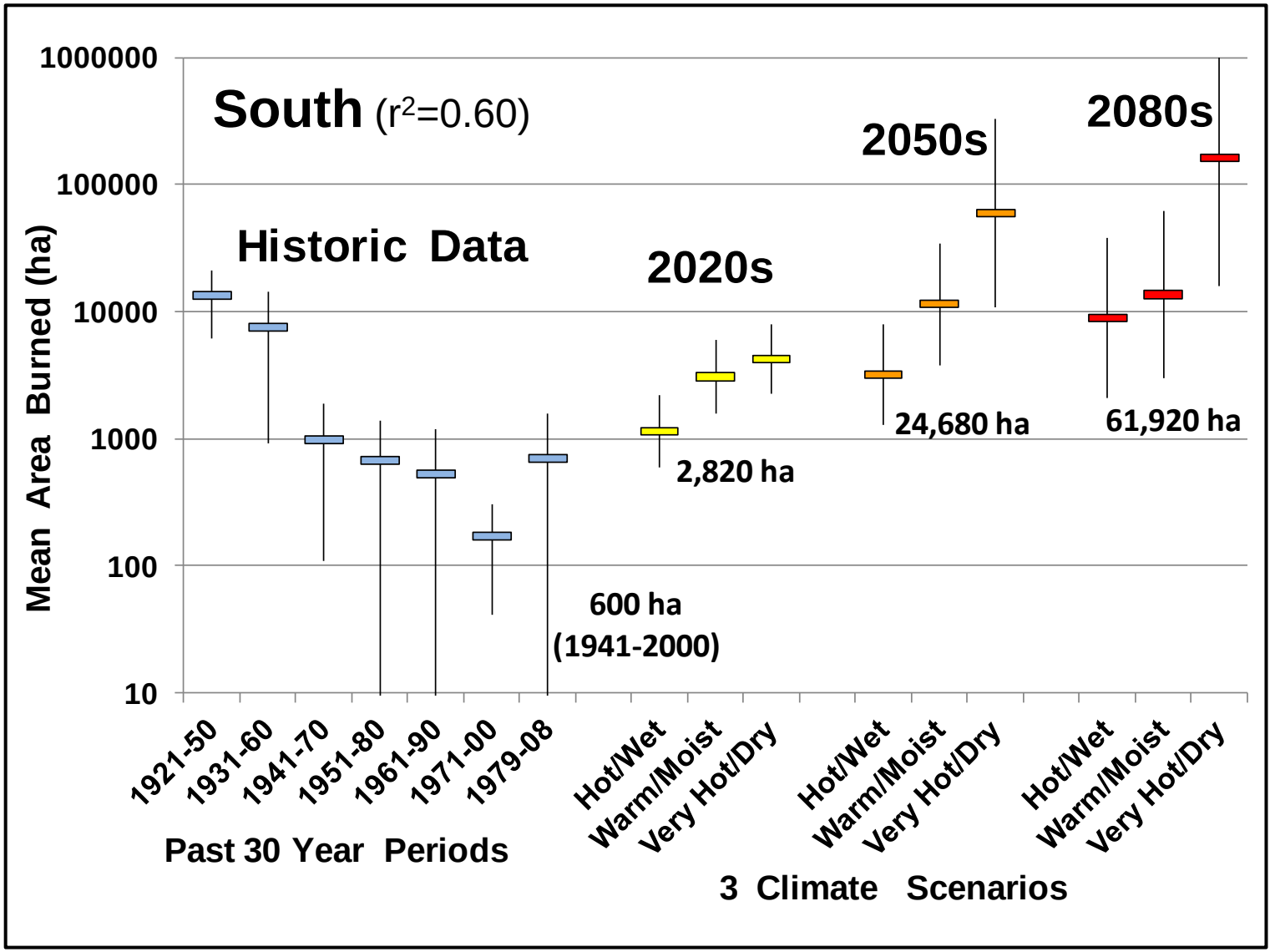




Multiple Regression Analysis

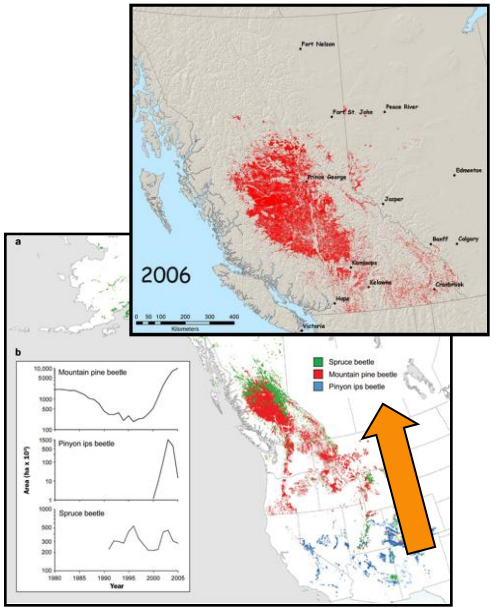


Jordan 2007

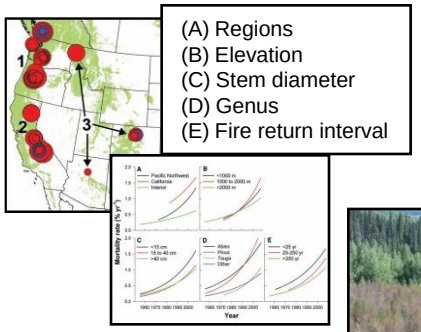


Insects/ Pathogens /Decline Syndromes

- Tree decline – drought/ loss of resistance
- Bark Beetles
  - Mountain pine beetle, spruce bark beetle, Ips beetles, Douglas-fir beetle …..
- Defoliators, blights, pathogens
  - Spruce budworm, dothistroma, larch needle cast, root disease
- Complex Interactions
  - Birch die-back, yellow cedar, 5-needle pines

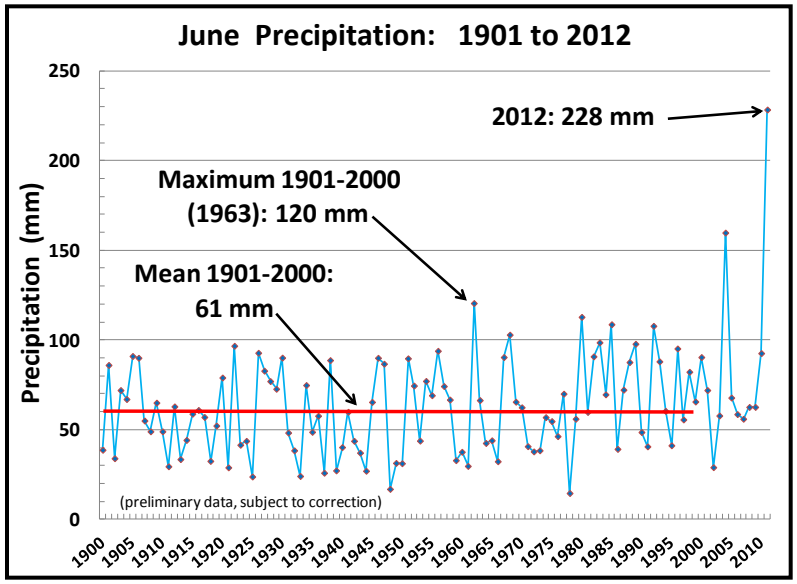


From: Raffa et al. 2008



Climatic Extremes – One Example

Precipitation 2012 Johnson's Landing



Increased Soil Moisture

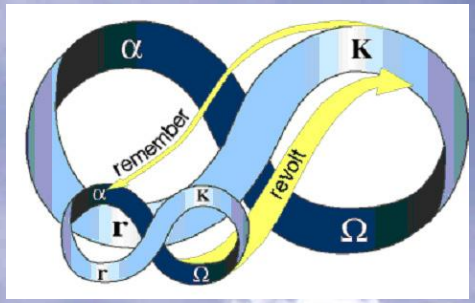
Decreased Soil Strength

Landslide

Impacts

- 4 people killed
- 4 houses destroyed
- 6 properties damaged/ loss of access
- Community water system destroyed
- Main road destroyed
- Damage to utilities
- Ongoing future risks

- Vulnerabilities
  - Changing disturbance regimes (e.g. lack of appropriate seed sources after disturbance)
  - Potential for climate change to amplify cumulative impacts of past development
  - Complexity of impacts due to cross-scale interactions and inter-species relationships (competition, predator/prey, host/pest, interdependence)



From: www.resalliance.org

Local adaptation options

- Suite of generally applicable recommendations:
  - Silvicultural systems
  - Stand level management/ biodiversity
  - Regeneration strategies
- Started to develop subregion specific recommendations
  - Requires significant focus of time / effort to continue
  - Vulnerability assessment provides part of the base information
  - need to incorporate risks / values assessment

- Barriers
  - Uncertainty and insufficient knowledge regarding responses
  - Limited research and monitoring capacity
  - Lack of champion – this is nobody's job ….
  - Perceived / real legislative barriers
  - Lack of climate-relevant land use plans and TSR
  - Risks of doing nothing appear smaller than risks of adapting
  - Lack of public interest and political will
  - Psychological Dragons ……

- Opportunities
  - Adaptive management and increasing resilience
  - Reductions in GHG emissions and impacts
  - Increasing integrated nature of resource management
  - Develop leadership …….
    - What are the alternatives if there is no leadership ?

www.kootenayresilience.org

Thank You

"We have options, but the past is not one of them"

Sauchyn and Kulshreshtha 2008, p.295

"Times have changed – no longer is our goal sustainable development …. our goal must now be sustainable survival"