

Climate Disruption

What does it mean for
Upper Columbia Ecosystems?

CBRAC Climate Change Webinar

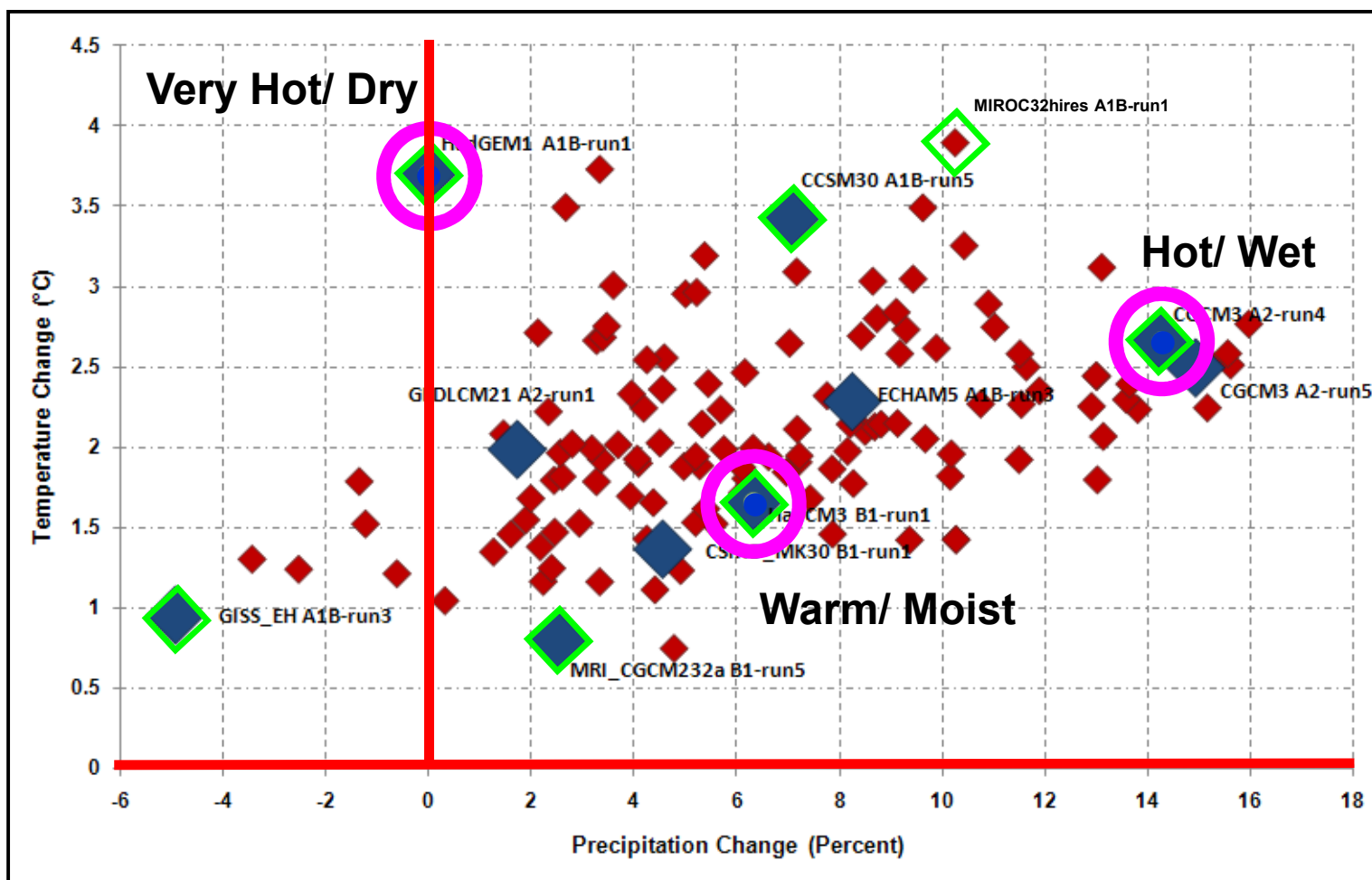
April 21, 2021

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www.kootenayresilience.org

Greg Utzig
Kutenai Nature Investigations Ltd.
Nelson, BC CANADA

GCM / Scenario Combinations

2050s Mean Projections for British Columbia
Annual Temperature and Precipitation



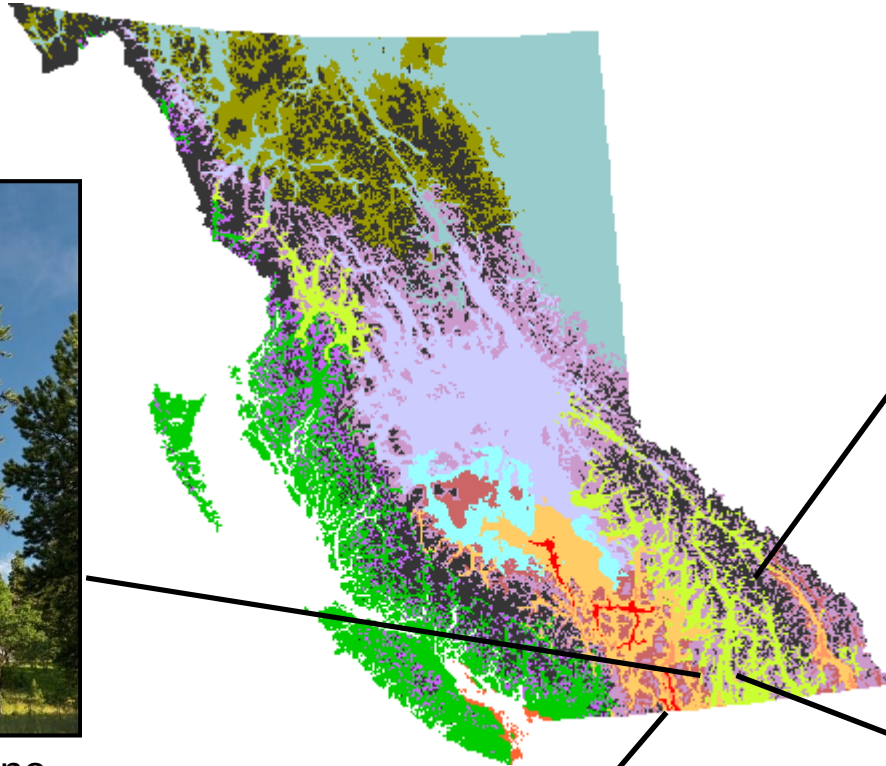
Blue diamonds recommended scenarios
Green/ Purple - scenarios investigated for the Kootenays

Adapted from:
Murdock and Spittlehouse 2010

Biogeoclimatic (BEC) Zones



Ponderosa Pine



Engelmann Spruce ï
Subalpine Fir



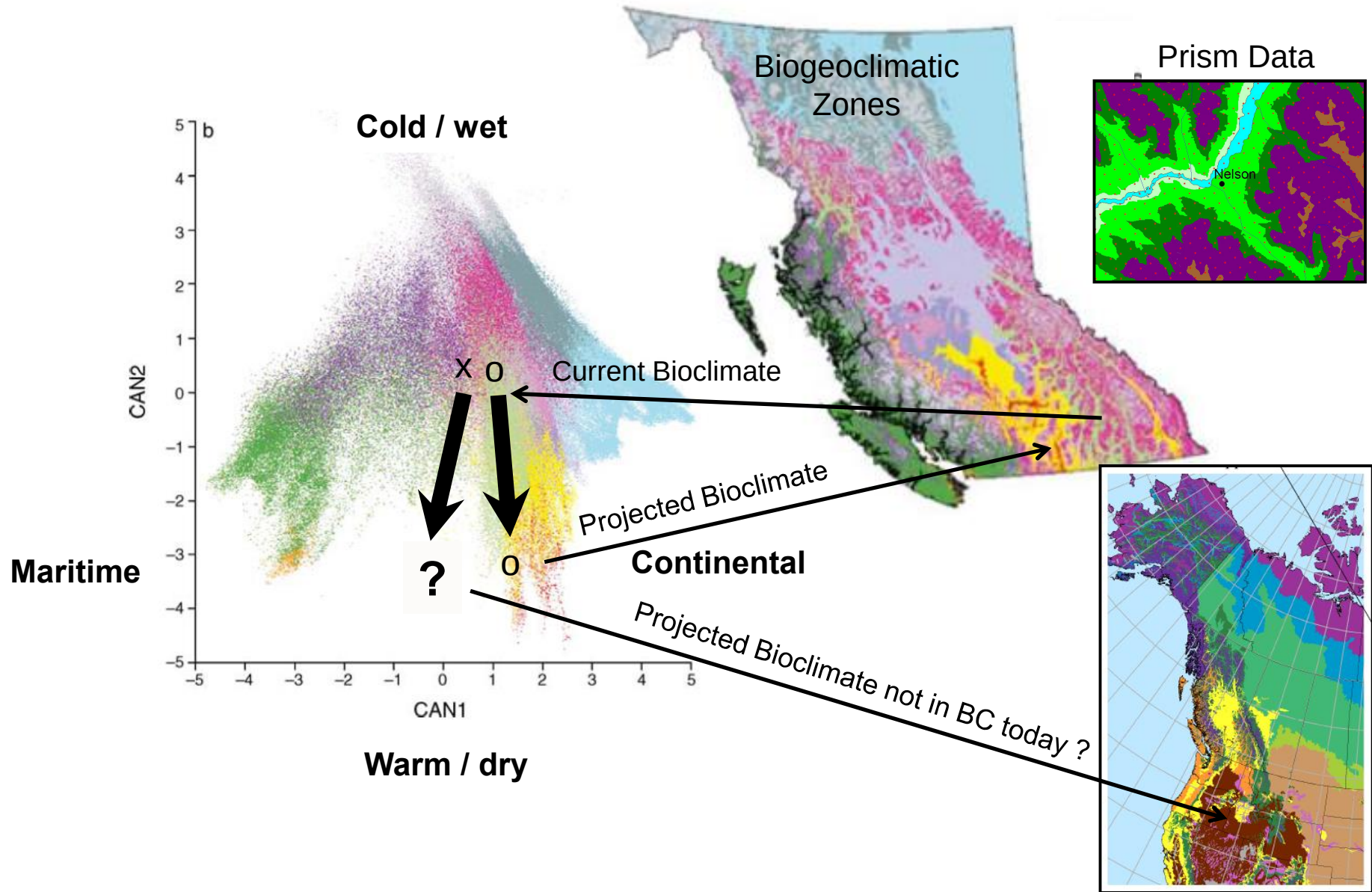
Interior Cedar ï
Hemlock



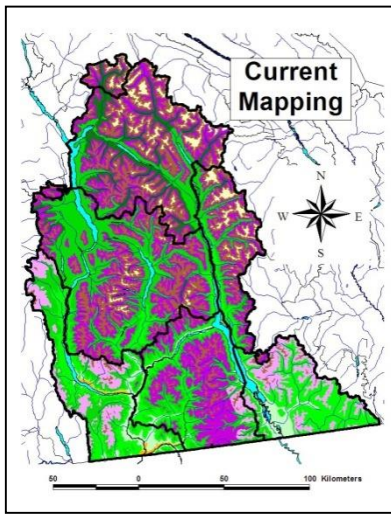
Grasslands/
Sage Brush



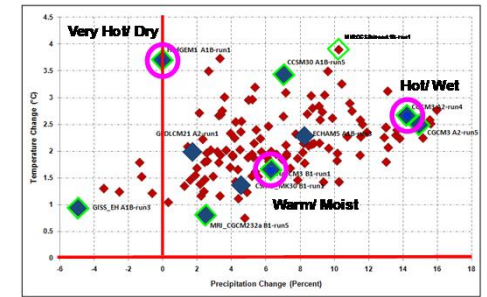
Ecosystem Units as “Bioclimate Envelopes”



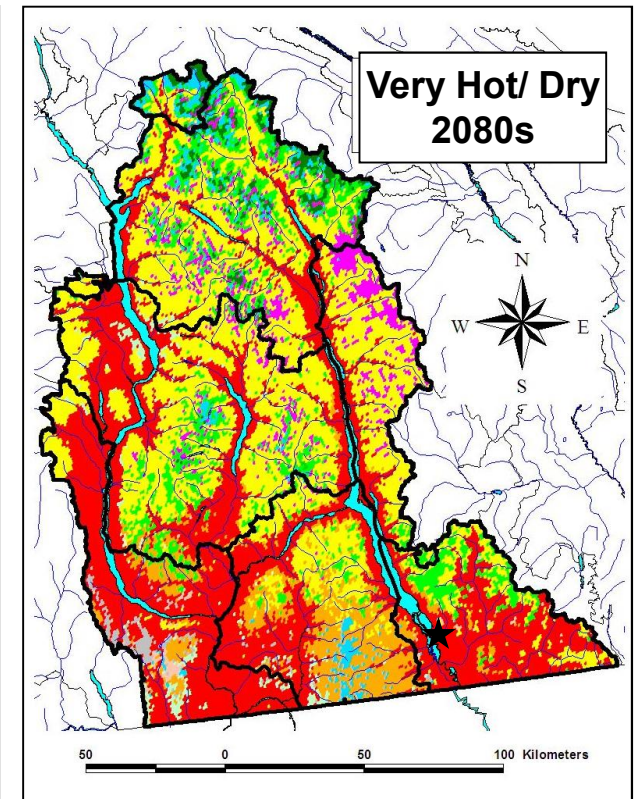
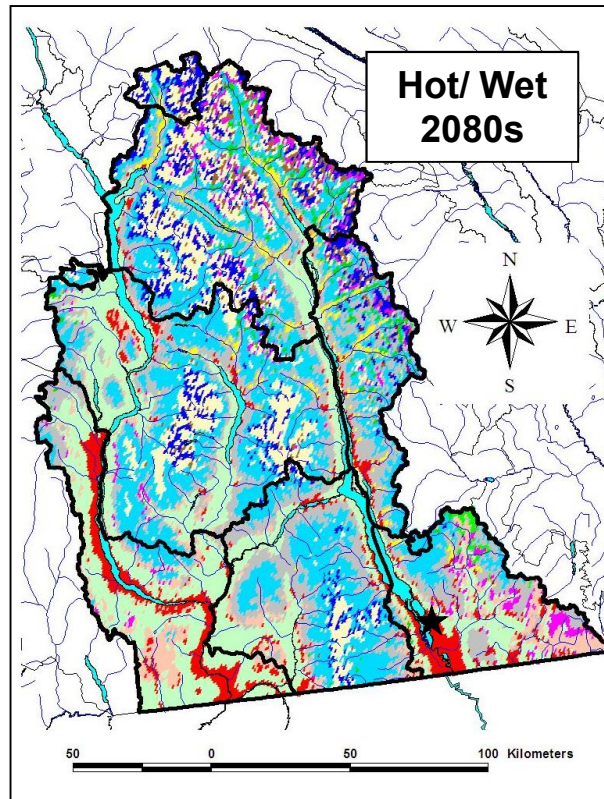
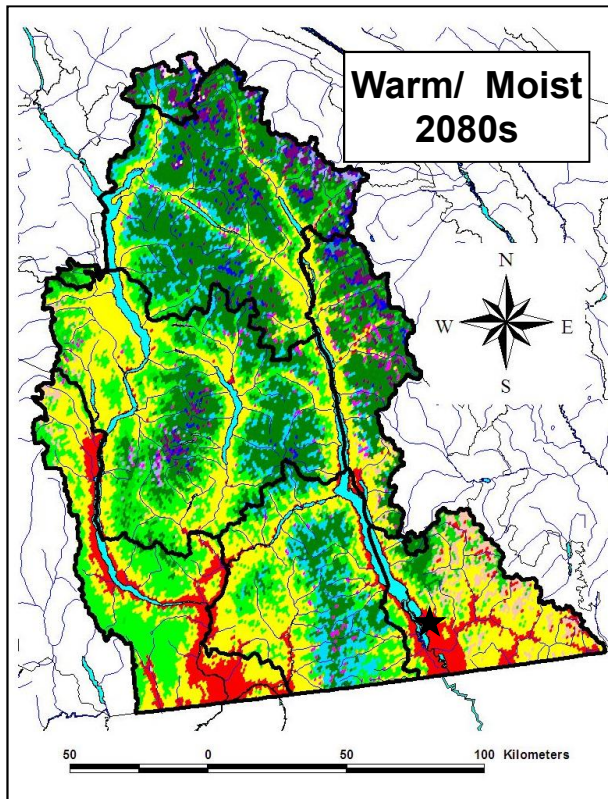
Adapted from: Hamann and Wang 2006 & Roberts and Hamann 2011
Canonical discriminant analysis of PRISM data by BEC Unit



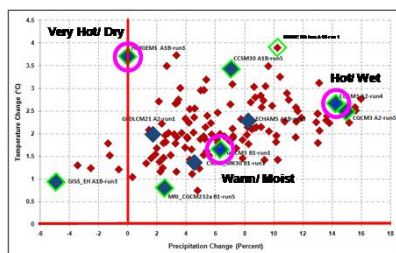
- Alpine
- Alpine parkland
- Wet subalpine forest
- Dry subalpine forest
- Coastal hemlock
- Transitional coast/ interior hemlock
- Montane/sub-boreal spruce forest
- Wet interior cedar/ hemlock
- Moist interior cedar/ hemlock
- Dry interior cedar hemlock
- Grand fir/ Douglas-fir
- Wet Douglas-fir
-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



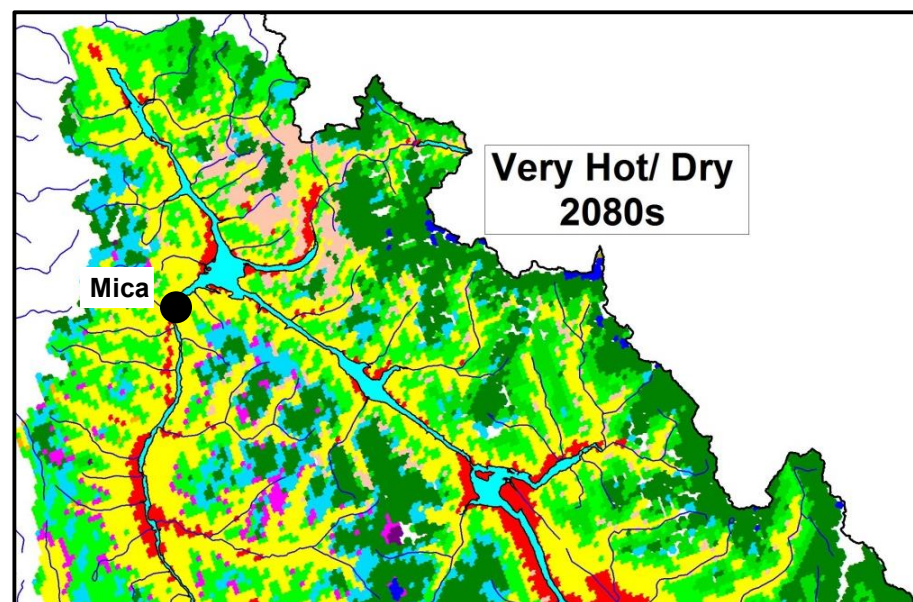
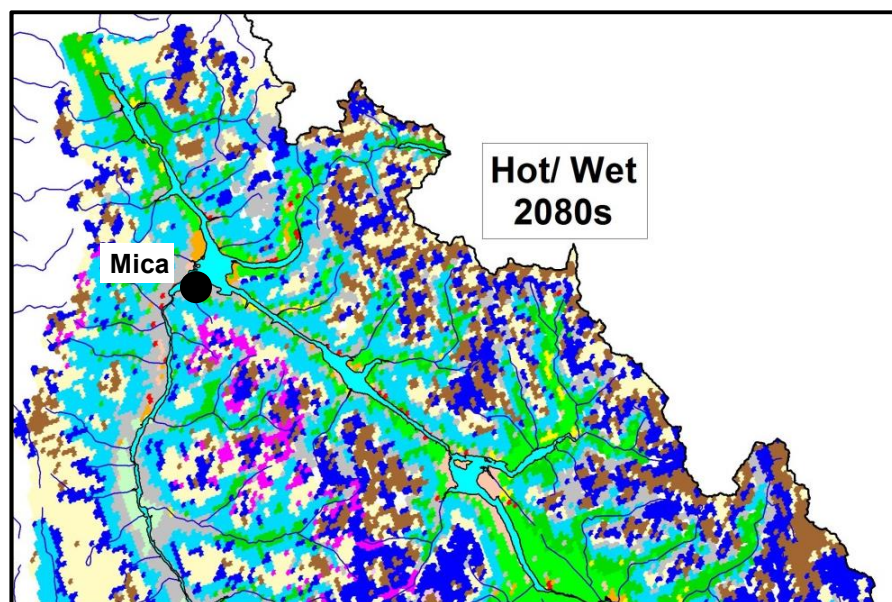
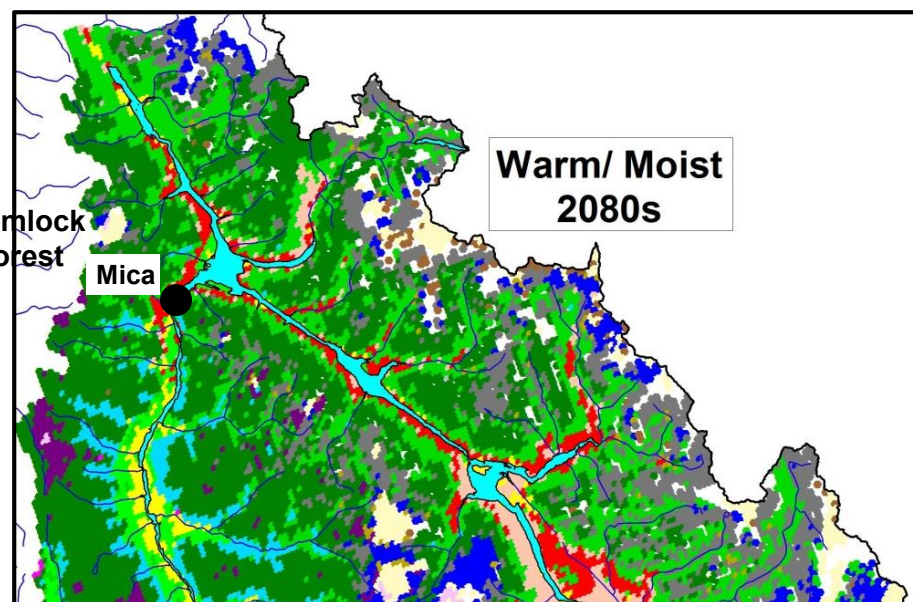
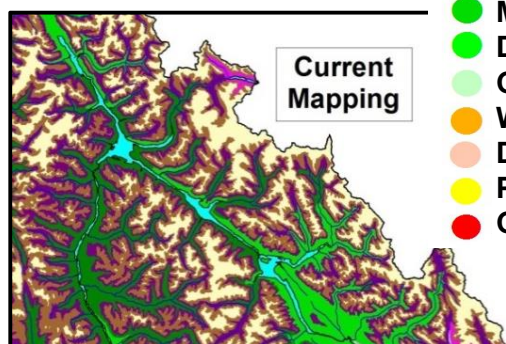
A Range of Projected Bioclimate Envelopes

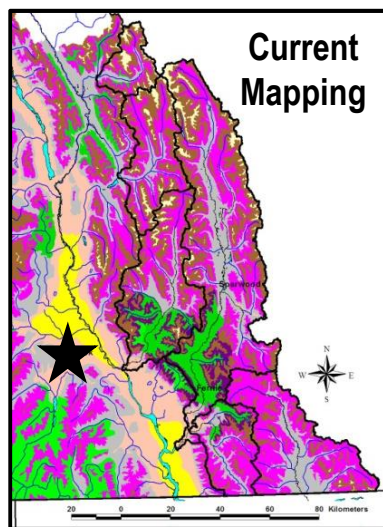


Original data from: Roberts and Hamann, U of A; HadCM3_B1, CGCM3_A3, HadGEM_A1B

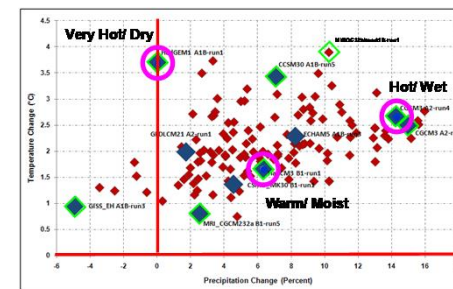


- Alpine
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- Wet subalpine forest
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- Coastal mountain hemlock
- Coastal western hemlock
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- Moist interior cedar/ hemlock
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- Wet Douglas-fir
- Dry Douglas-fir
- Ponderosa pine savannah
- Grassland/ steppe

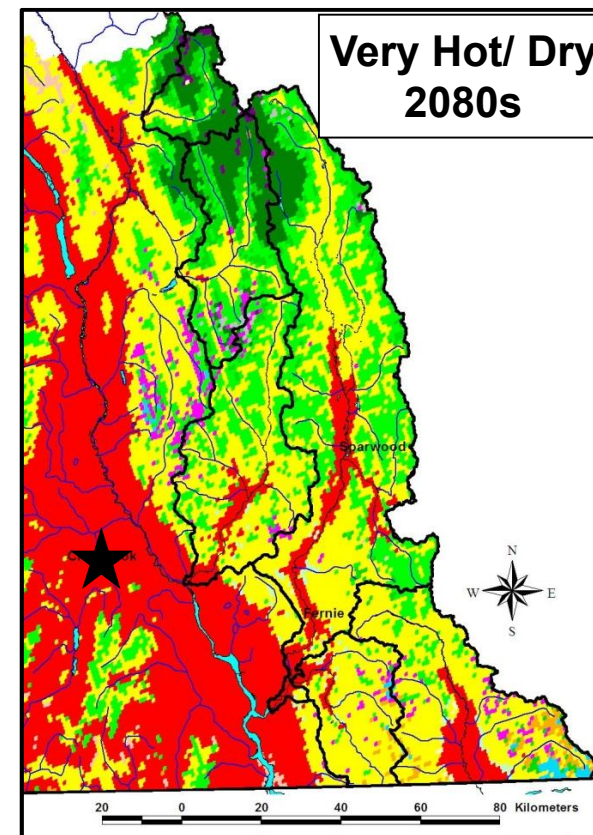
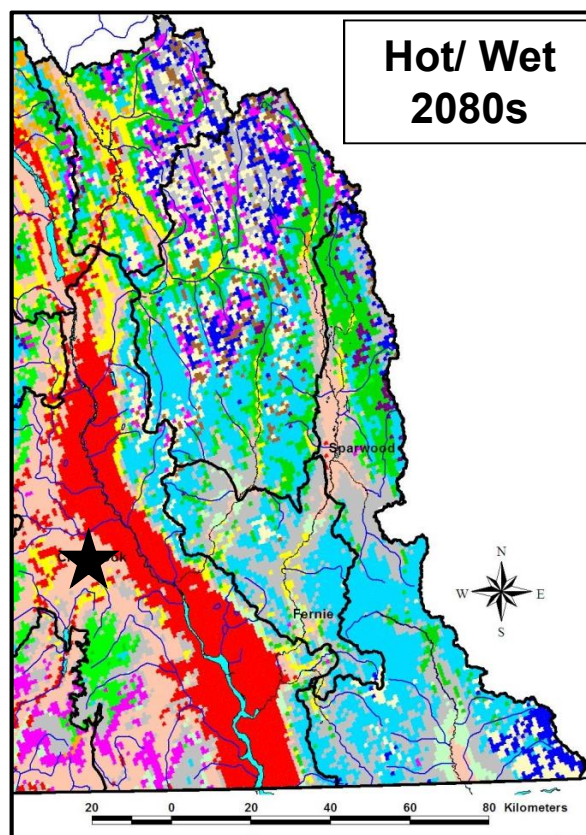
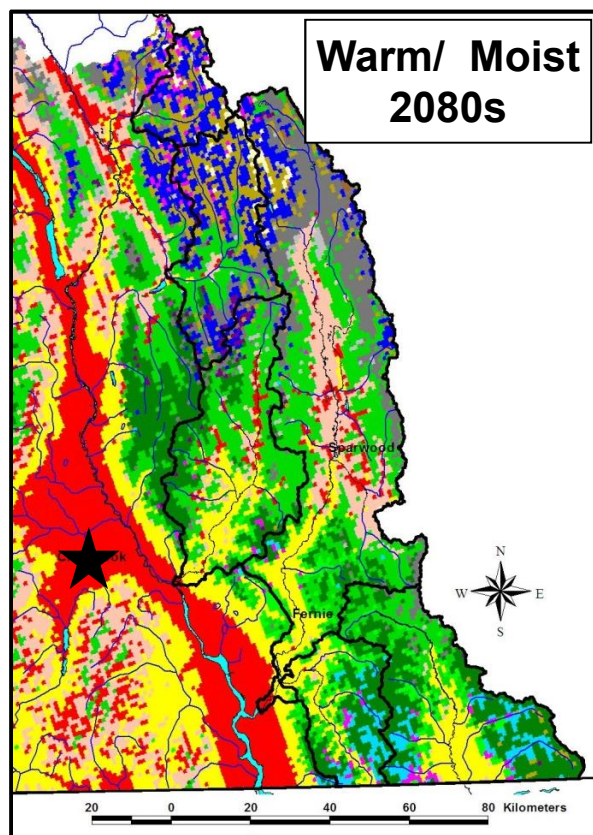


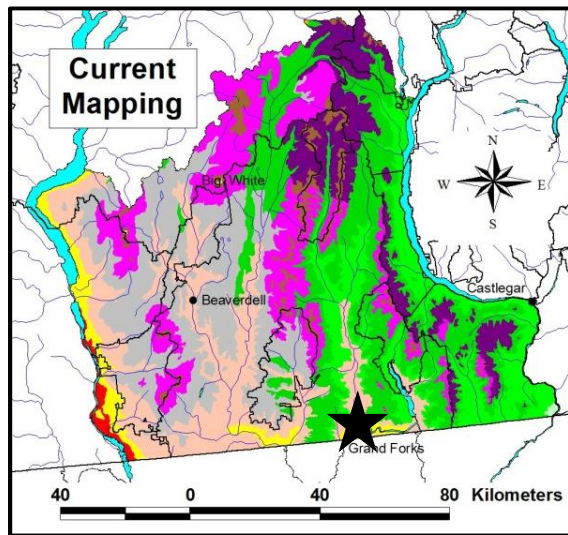


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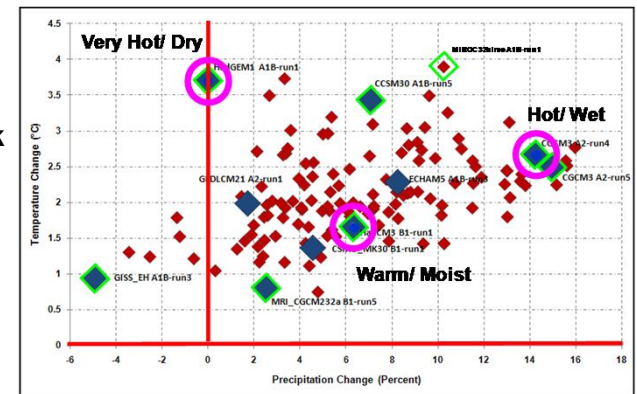


A Range of Projected Bioclimate Envelopes

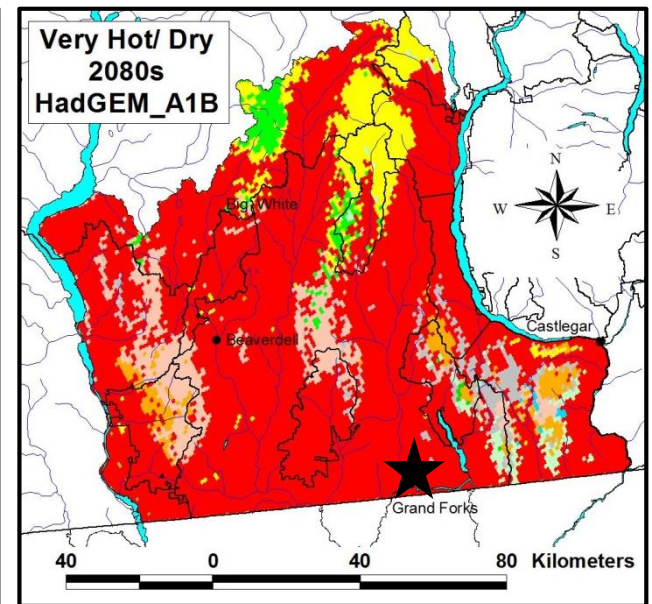
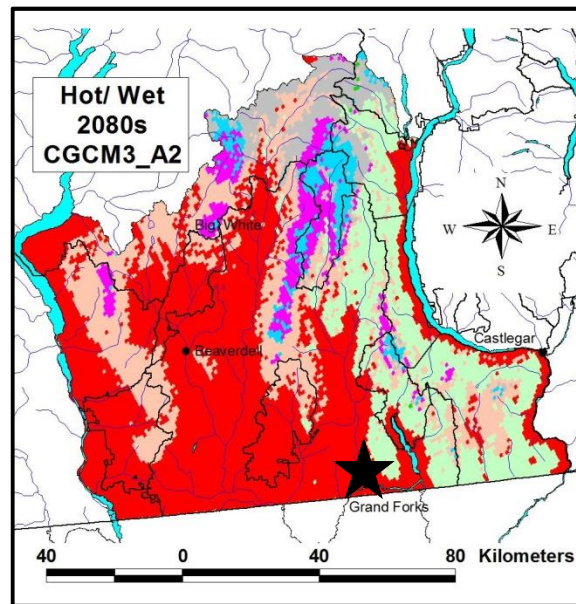
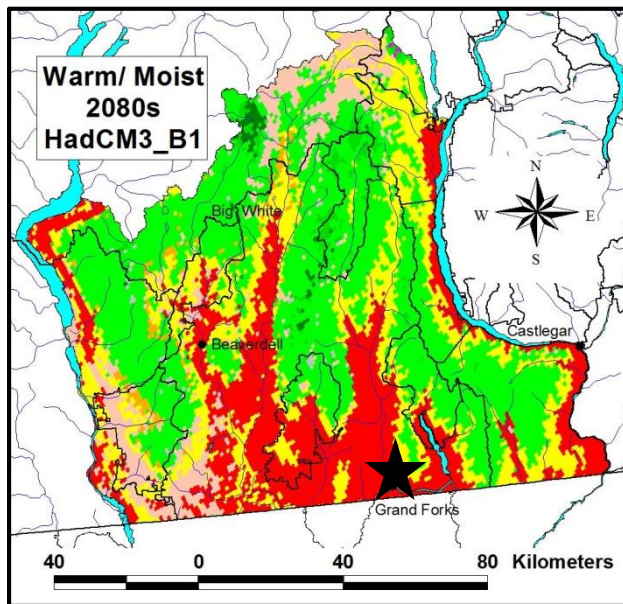




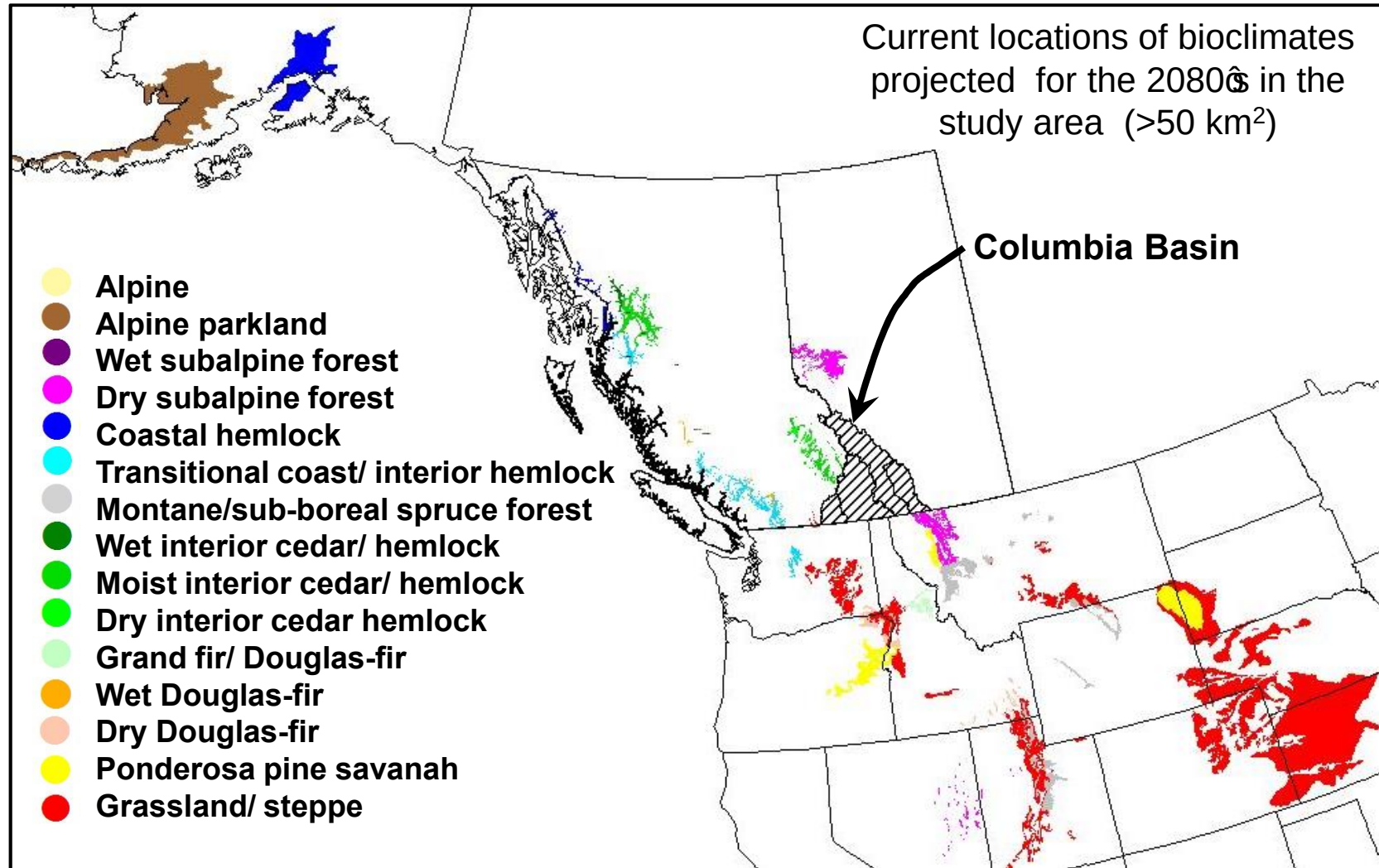
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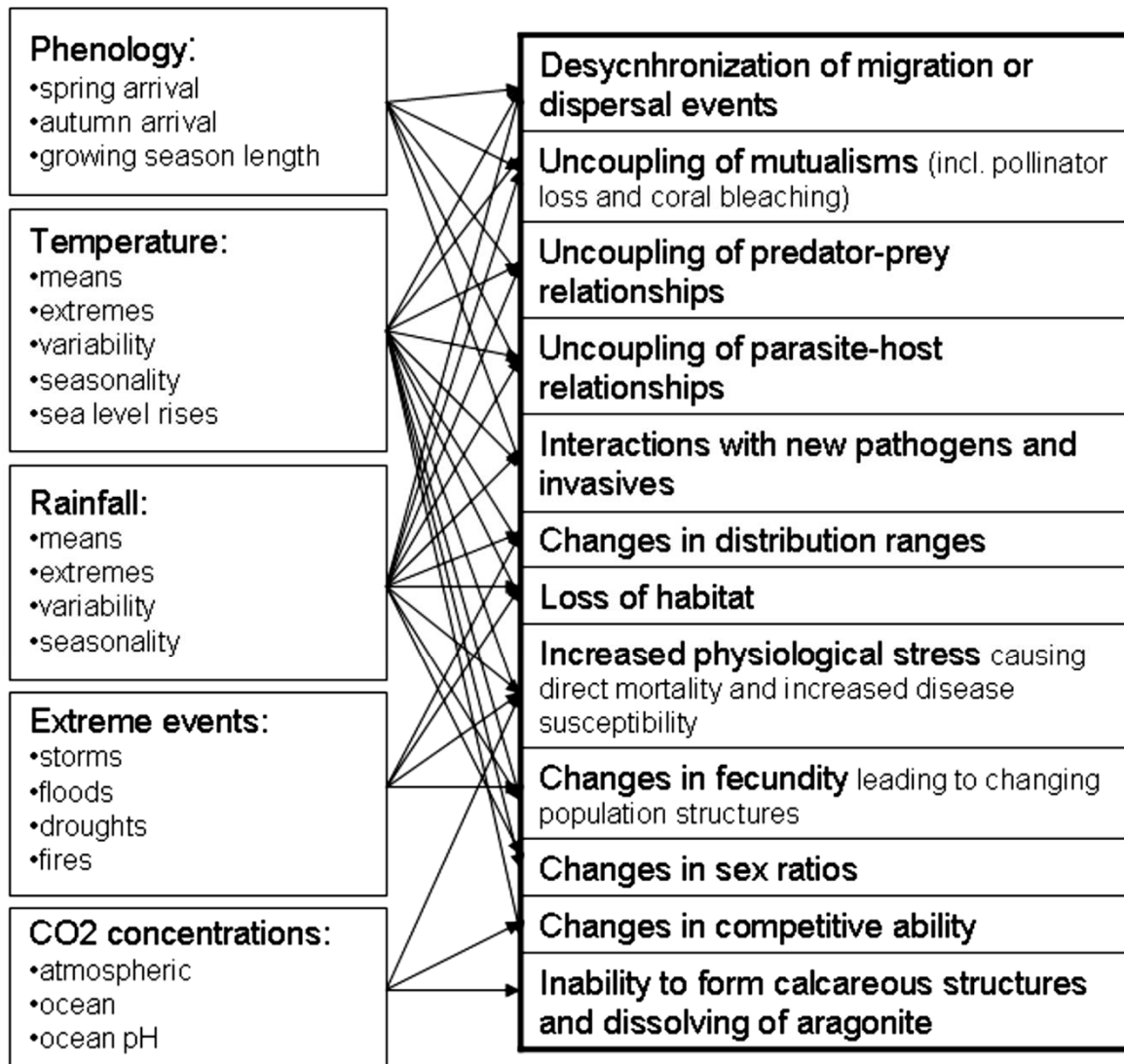


Bioclimate Envelopes and Ecosystems



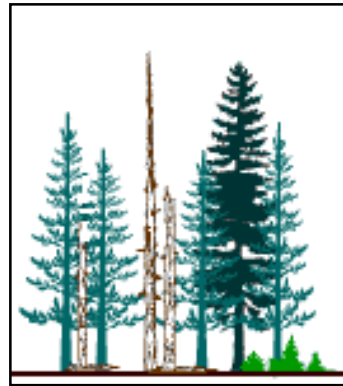
PREDICTED CHANGE

EFFECTS ON SPECIES

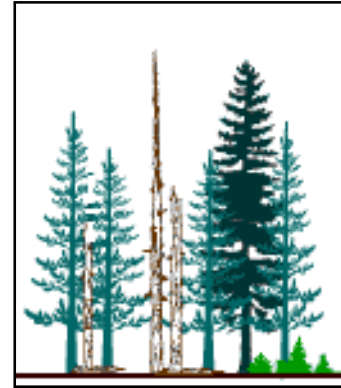


From: Foden et al. 2008

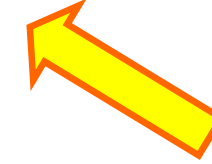
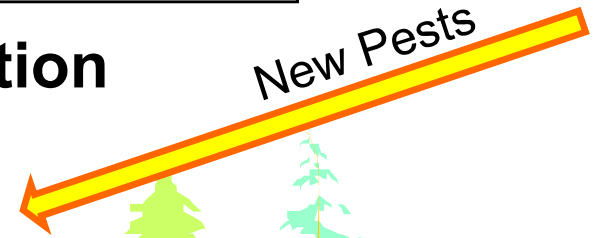
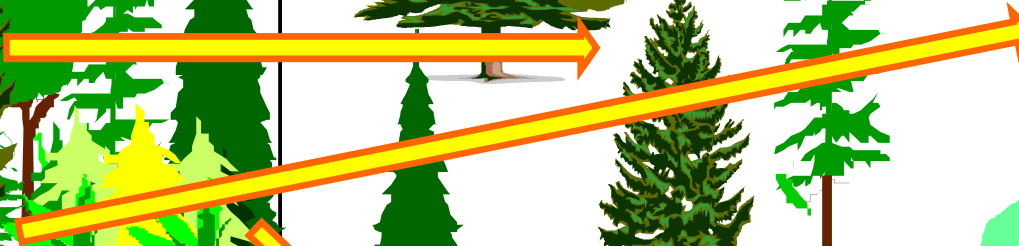
Ecosystem Response



**Ecosystem
Range Shifts
(rarely)**



**Ecosystem Re-organization
(much more likely)**

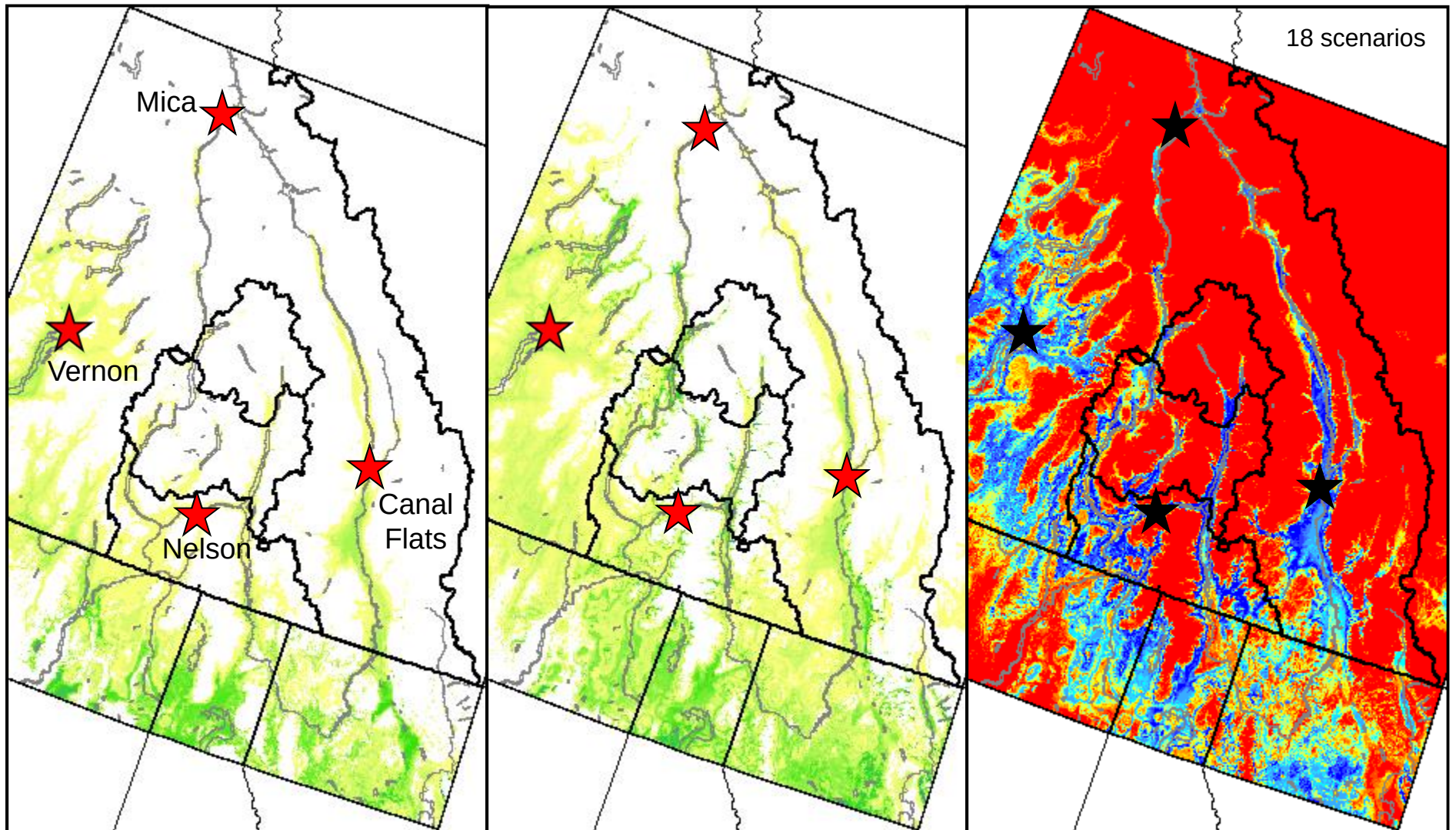


New Species

Habitat projections for Ponderosa Pine

Current

2020s



From:
Laura Gray 2010

Frequency

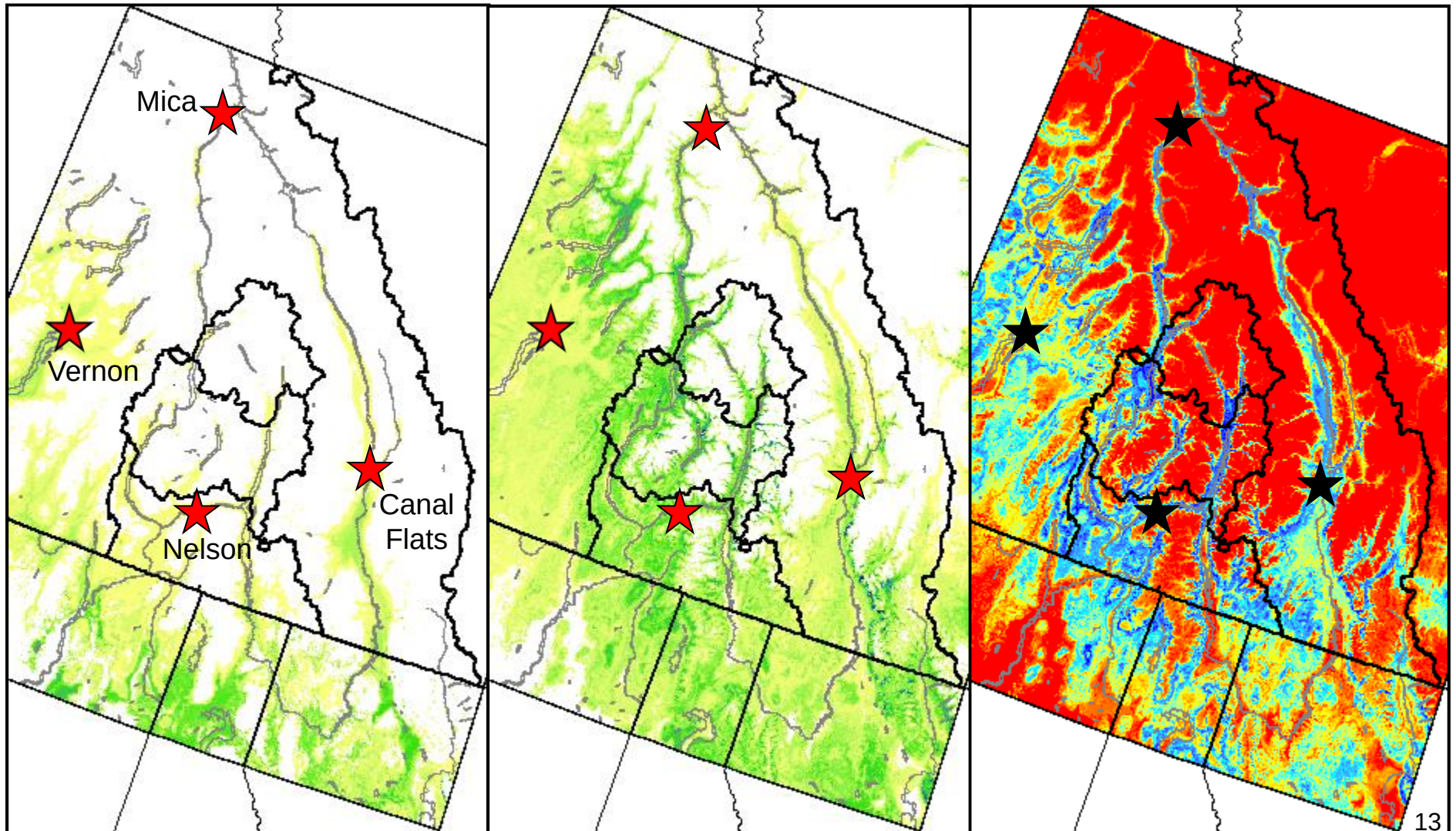
Frequency	<5	10	15	20	25	35	45	55	65	75%
Color	Lightest Yellow	Yellow	Light Green	Green	Dark Green	Teal	Blue-Teal	Blue	Dark Blue	Black

Absent 100% 50% 100% Present

Habitat projections for Ponderosa Pine

Current

2050s

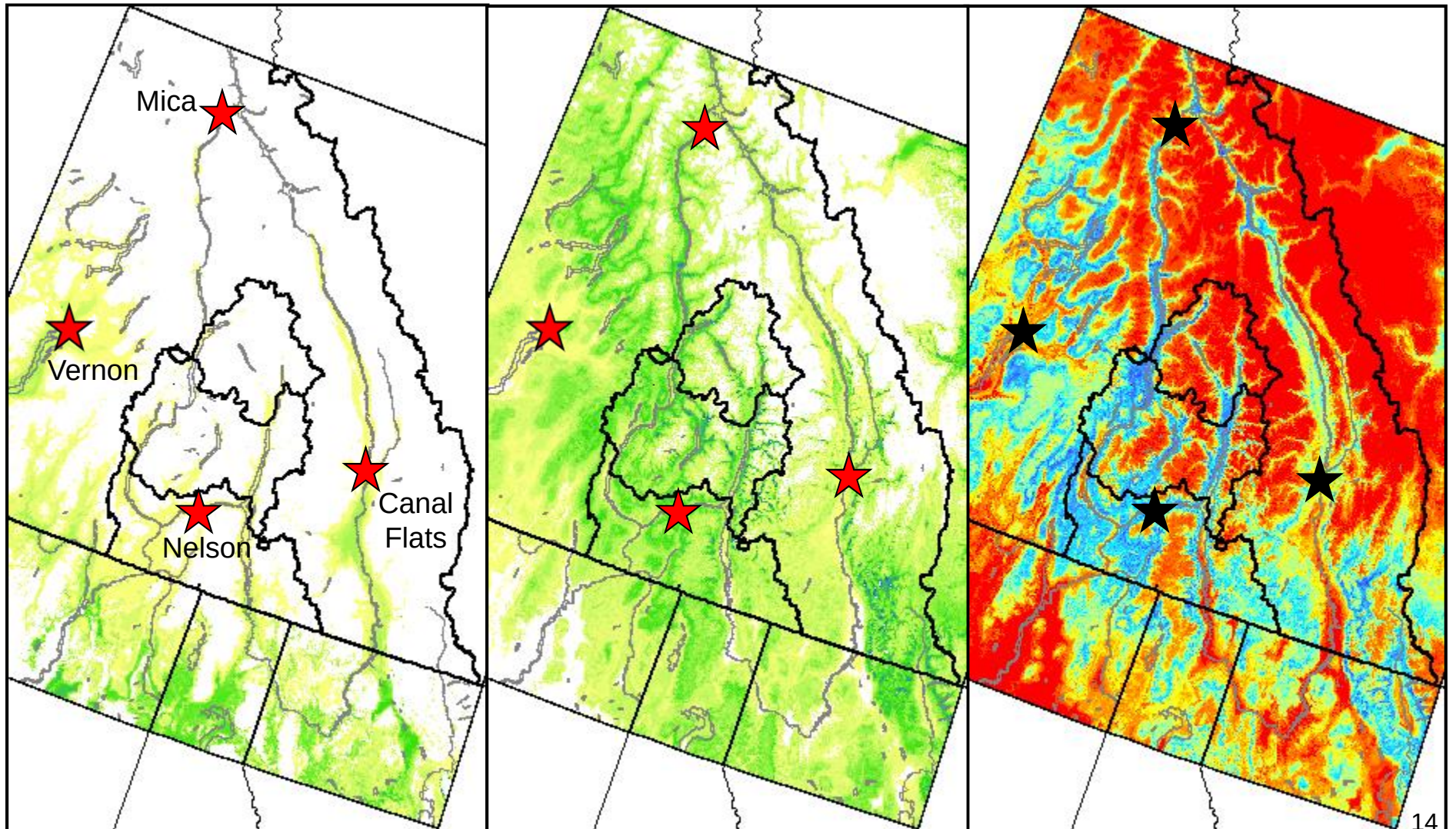


From:
Laura Gray 2010

Habitat projections for Ponderosa Pine

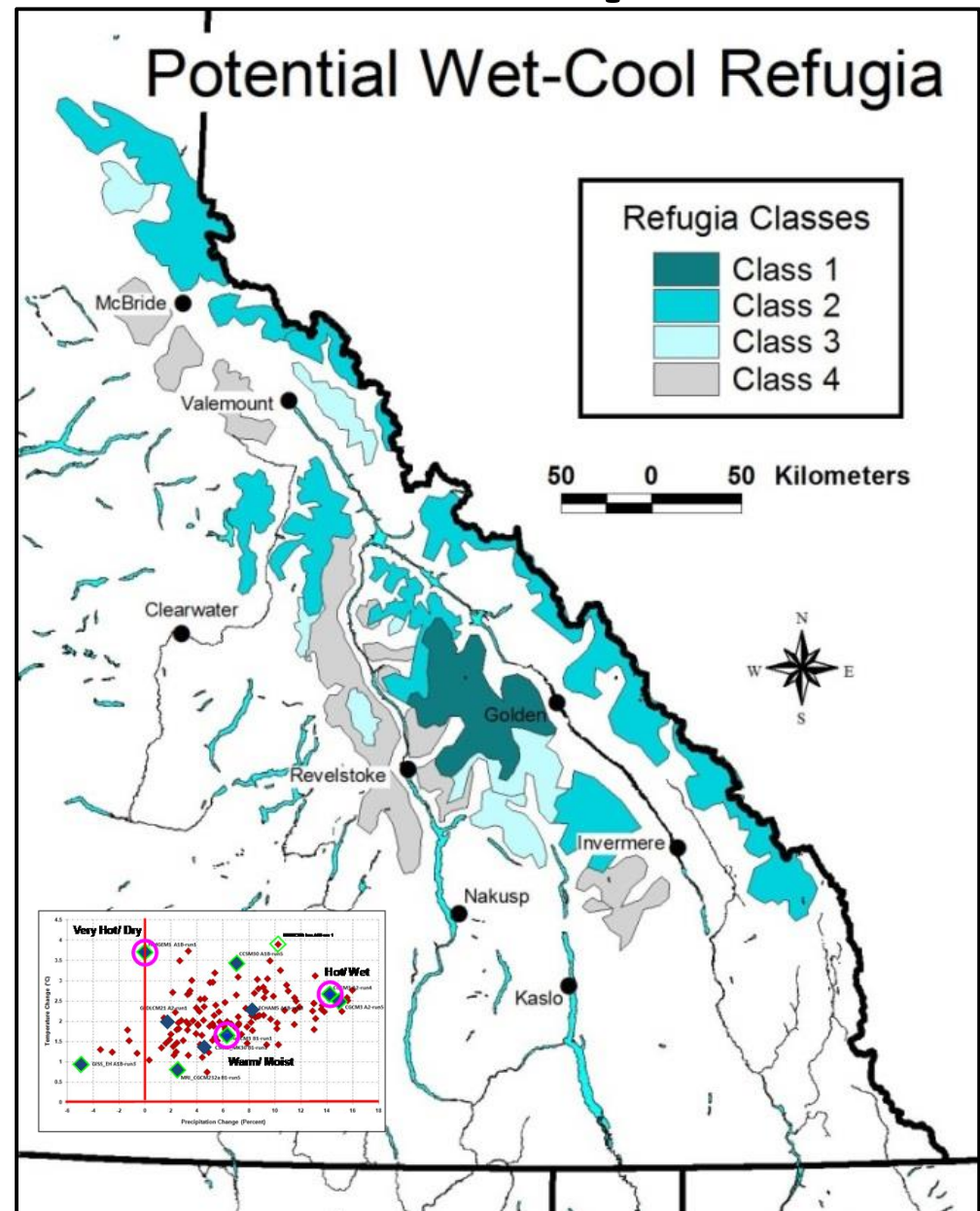
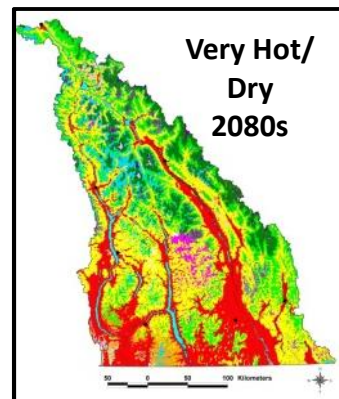
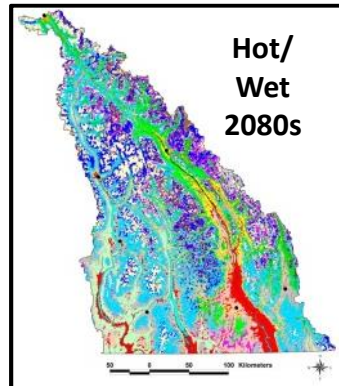
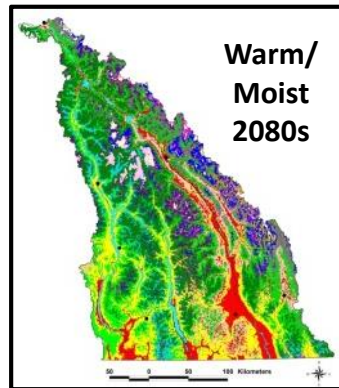
Current

2080s



From:
Laura Gray 2010

Will wet-cool environments persist?



Projected Changes for the 2050s

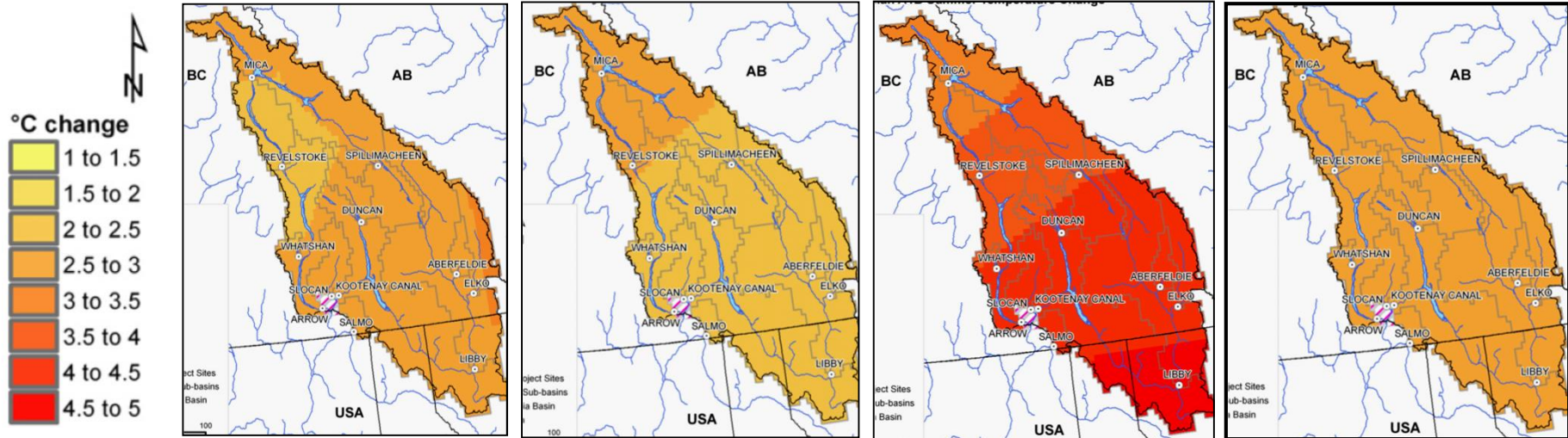
Temperature

Winter

Spring

Summer

Fall



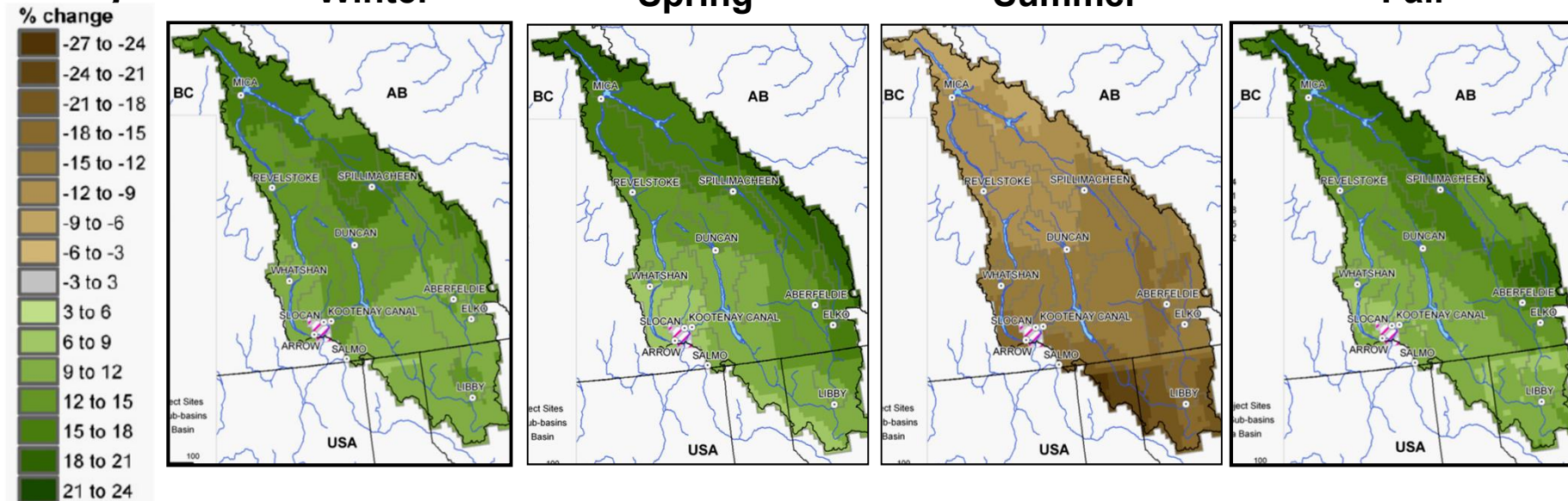
Precipitation

Winter

Spring

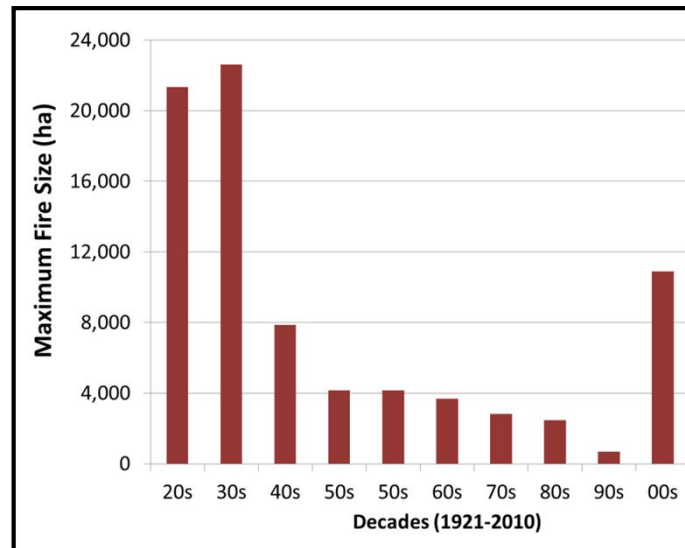
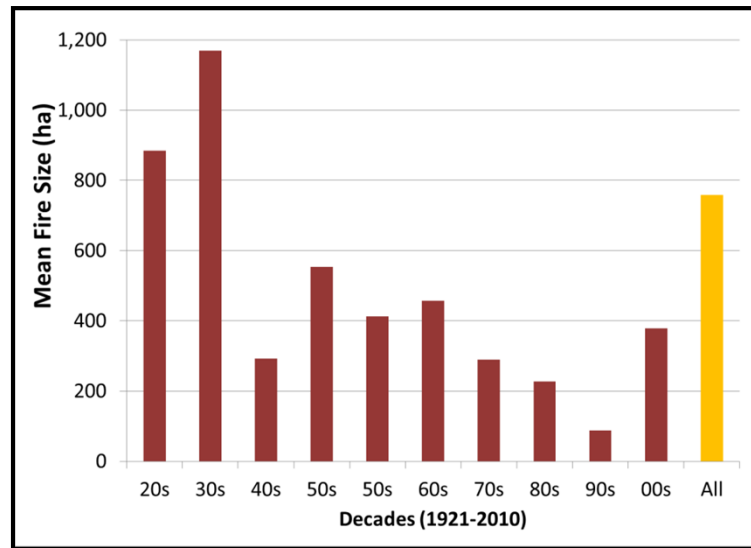
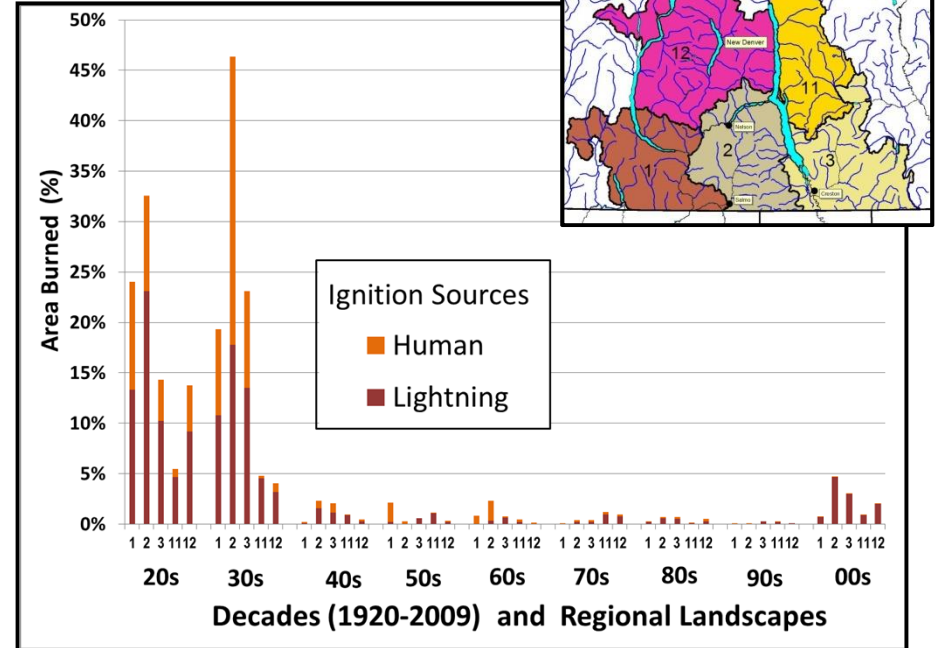
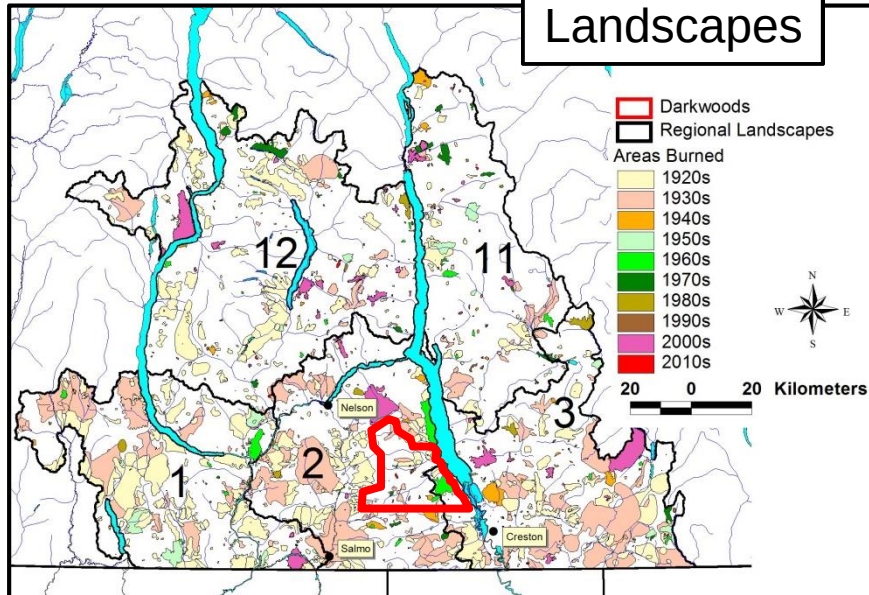
Summer

Fall



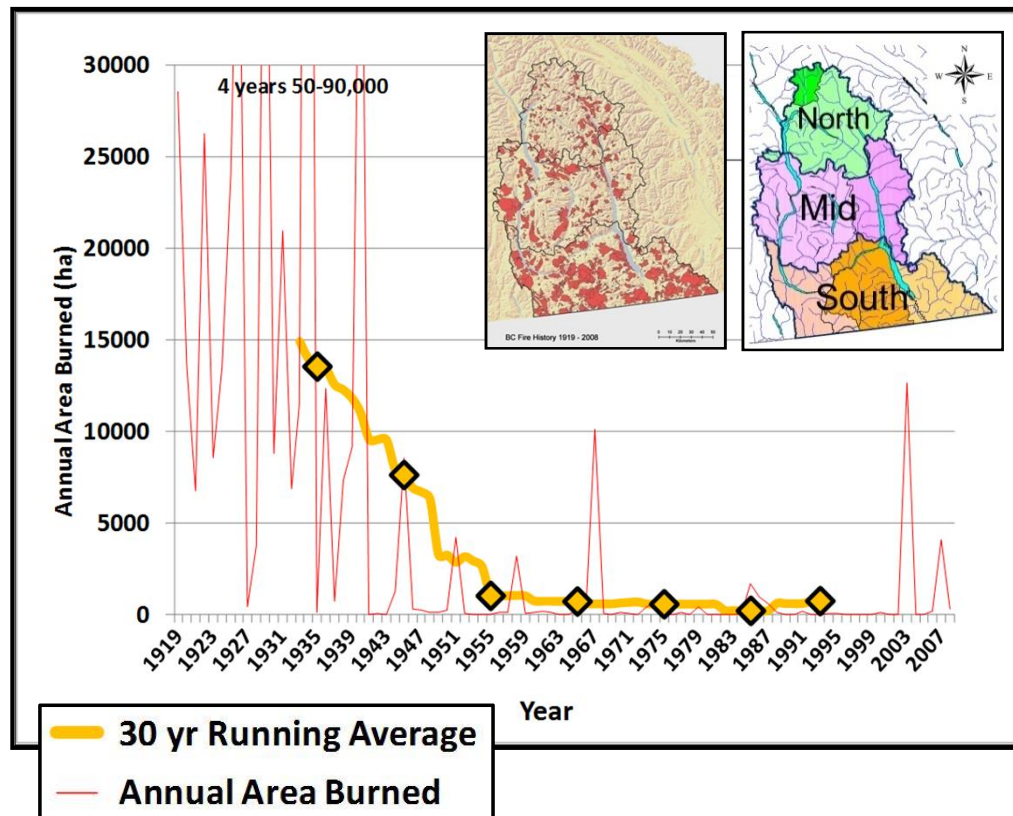
From: CBT i average of A1B scenarios

Regional Landscapes

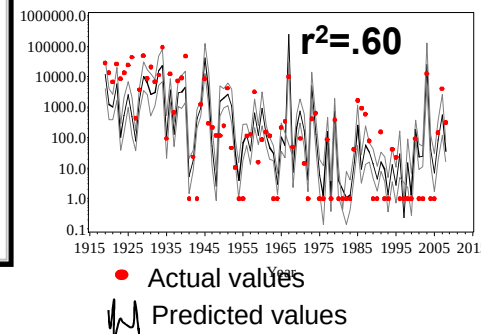


Adapted from:
Darkwoods Fire
Assessment i
Nature
Conservancy
Canada

Southern West Kootenay Area Burned



Jordan 2007



Multiple Regression Analysis

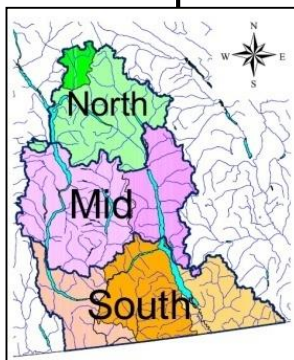
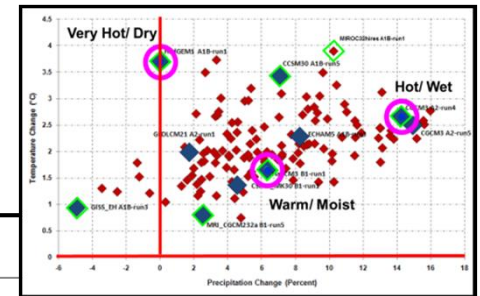
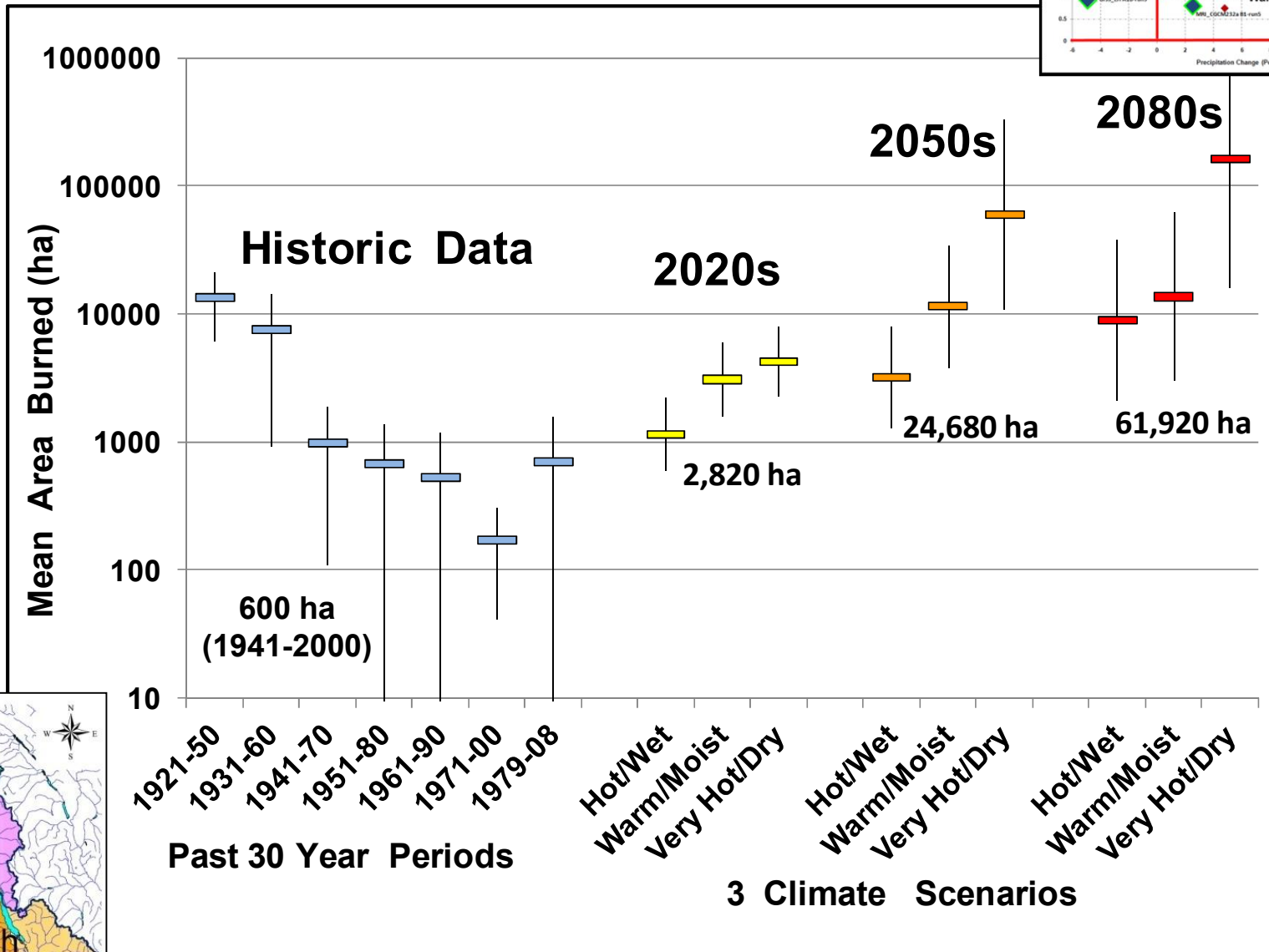
Predictor Variables

- ❑ Mean maximum temperature of hottest month (+)
- ❑ Climatic moisture deficit (+)
- ❑ June precipitation(-)
- ❑ Precipitation of month before/after hottest month (-)



Touchstones Archives, Nelson

Historic and Projected Area Burned Southern West Kootenays



Insects/ Pathogens /Decline Syndromes

Å Tree decline – drought/ resistance

Å Bark Beetles

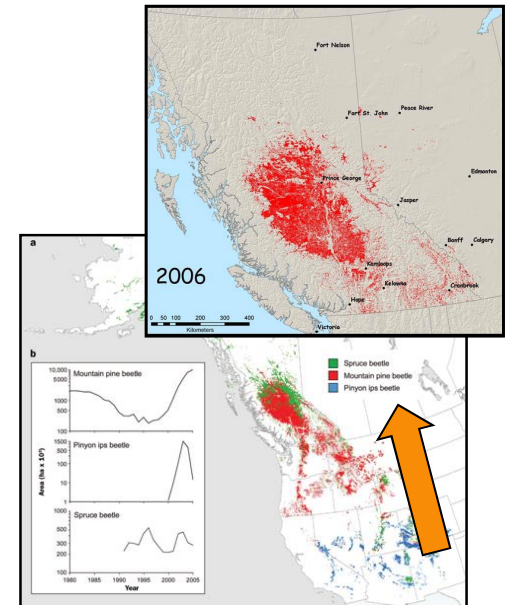
- ï Mountain pine beetle, spruce bark beetle, Ips beetles, Douglas-fir beetle

Å Defoliators, blights, pathogens

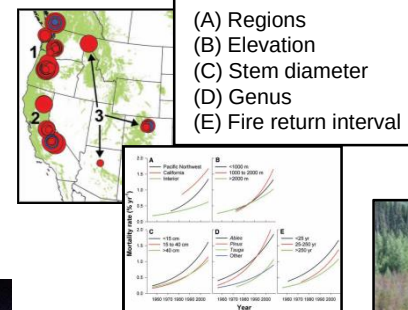
- ï Spruce budworm, dothistroma, larch needle cast, root disease

Å Complex Interactions

- ï Birch die-back, yellow cedar, 5-needle pines



From: Raffa et al. 2008



Climatic Extremes – 2013 Example

High Precipitation Event

Precipitation June 18-21, 2013

Upper Elk River



Buhl Creek



Fry Creek



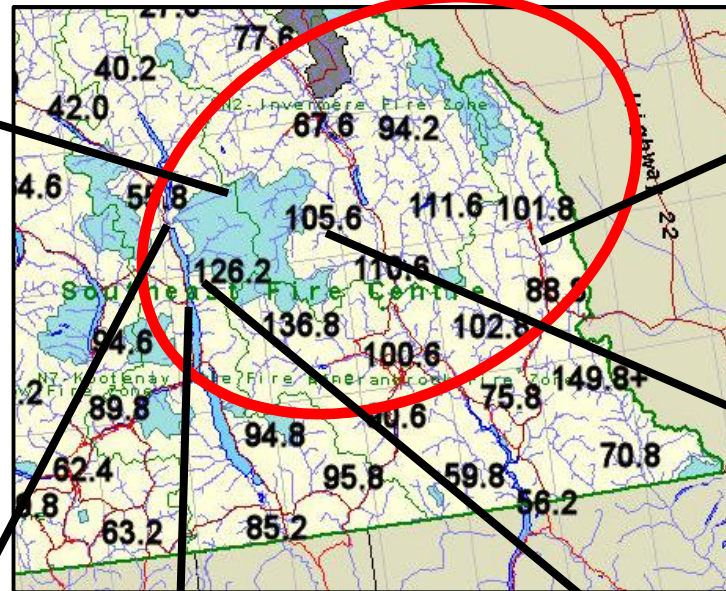
Upper Hamill Creek



Lower Hamill Creek

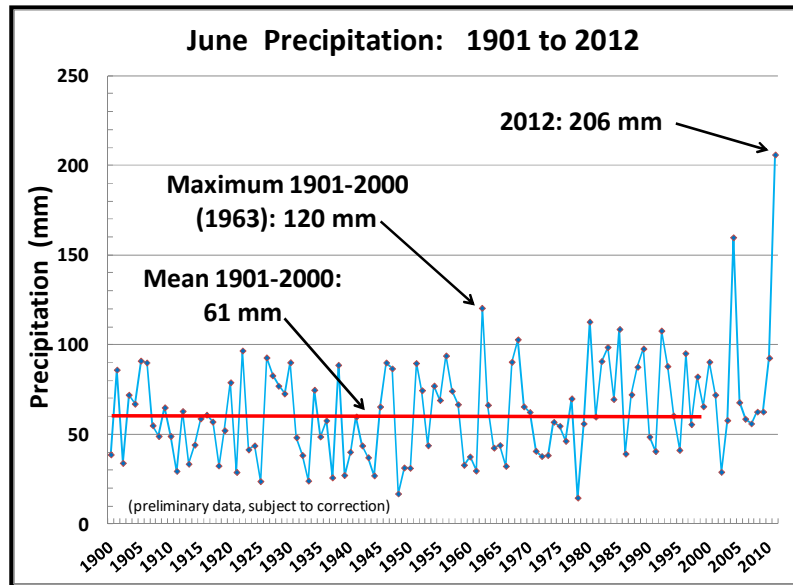


Schroeder Creek



Climatic Extremes – 2012 Example

Monthly Precipitation/ Rapid Snowmelt - Johnson's Landing



Increased Soil Moisture



Decreased Soil Strength

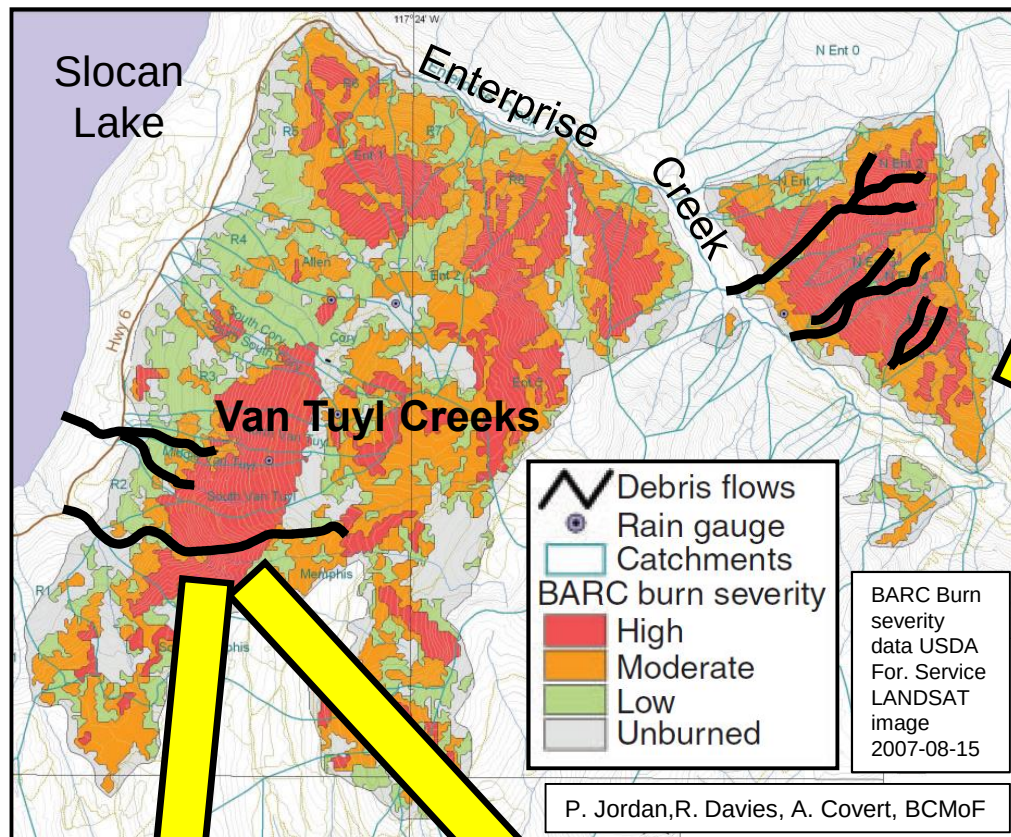


Landslide (July 12, 2012)

Impacts

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





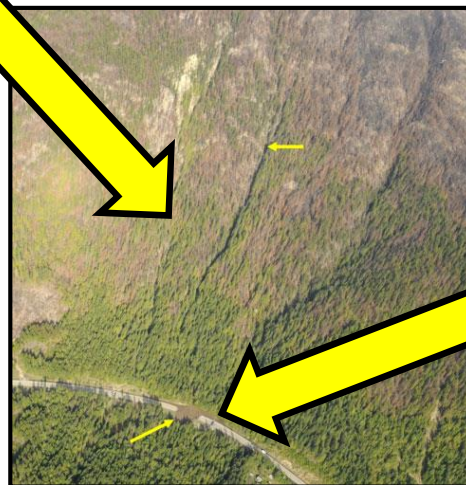
Springer Creek Fire 2007 Debris Flows 2008-10



P. Jordan, 6 September 2007



P. Jordan, 22 June 2010

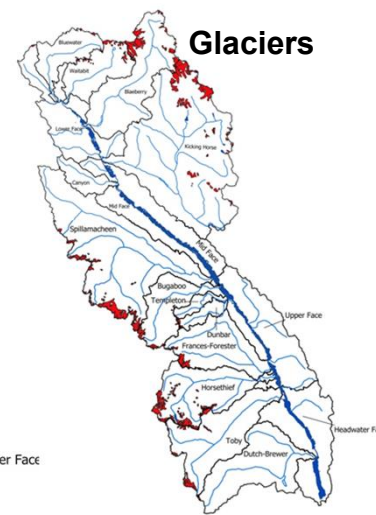
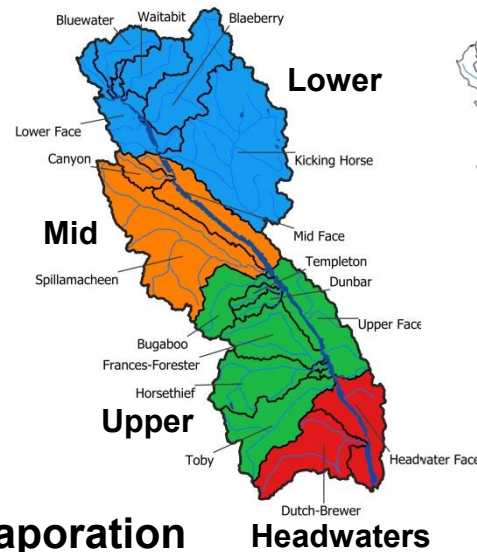
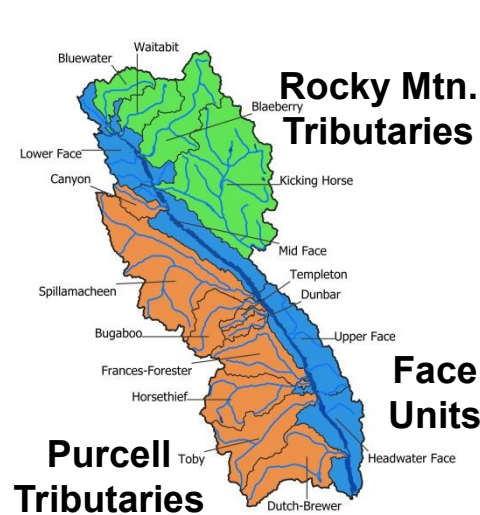


BC MoT 17 May 2008

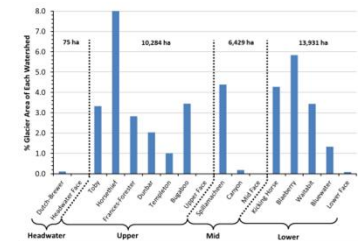


P. Bullock, 17 May 2008

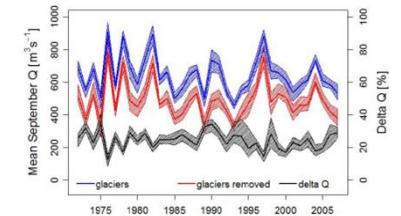
Columbia Wetlands Watershed



Glacier Area %

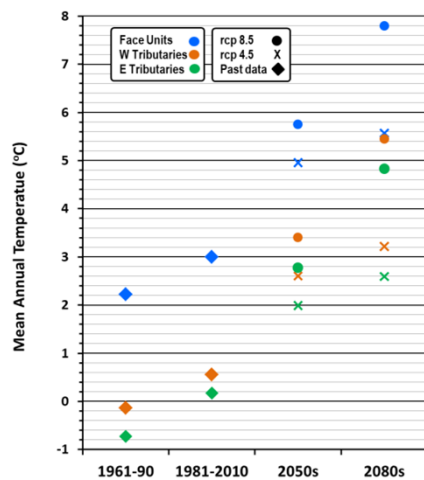


September Streamflow w/o Glacial Meltwaters

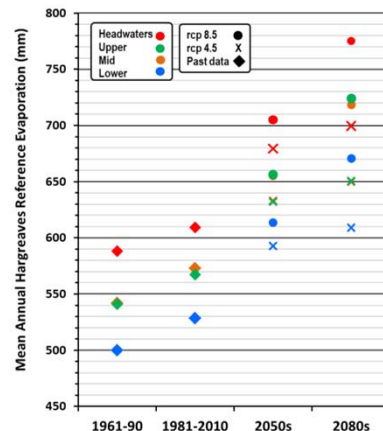


From: Jost 2012

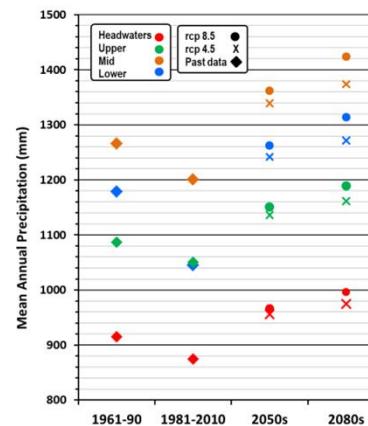
Annual Temperature



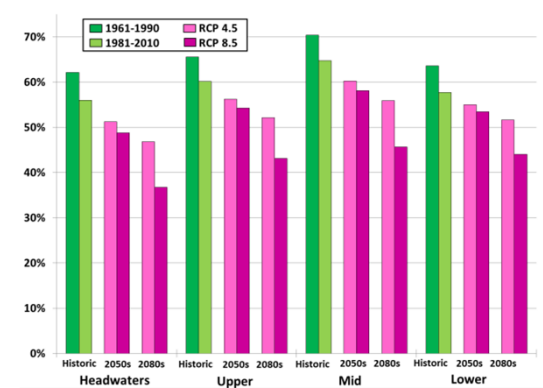
Evaporation



Annual Precipitation



Precipitation as Snow





**Eliminating
GHG emissions
is the only real answer**

**It is all about that thin
little layer of air**



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

Sauchyn and Kulshreshtha 2008, p.295

~Times have changed ì no longer is our goal sustainable
development é . our goal must now be sustainable survival~

Blackstock 2008, p.15

Acknowledgements:

BC MFLNRO –FFESC
Wildsight Y2Y
Conservation Northwest
Nature Conservancy Canada

Data sources:

Climate WNA
Univ. Alberta
PCIC
IPCC

www.kootenayresilience.org