Understanding and Managing the Effects of Climate Change on Northwest Landscapes

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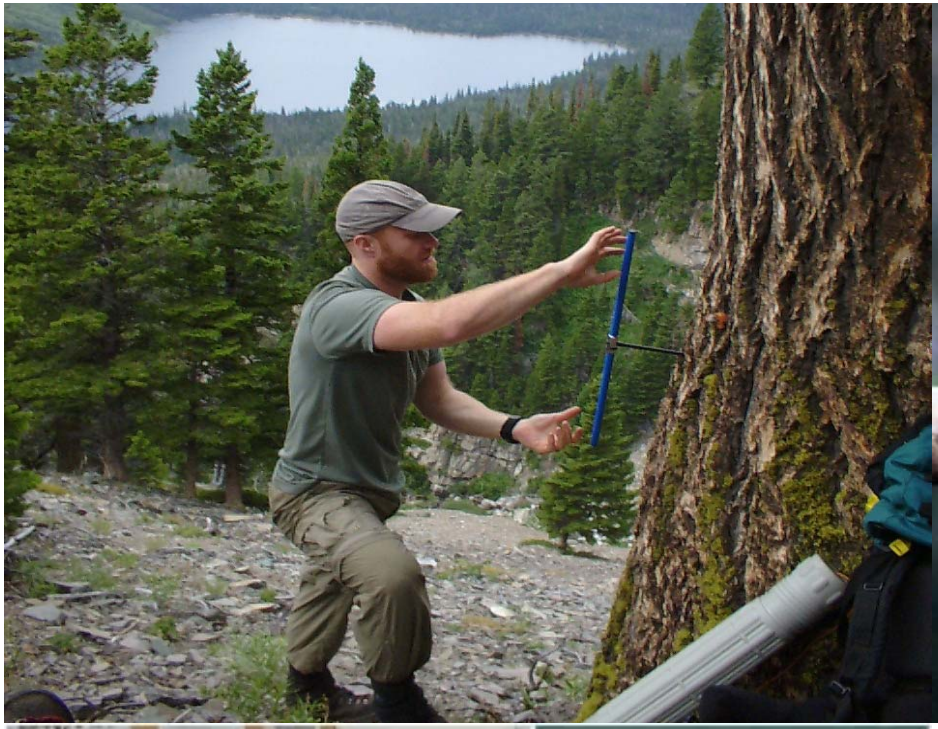
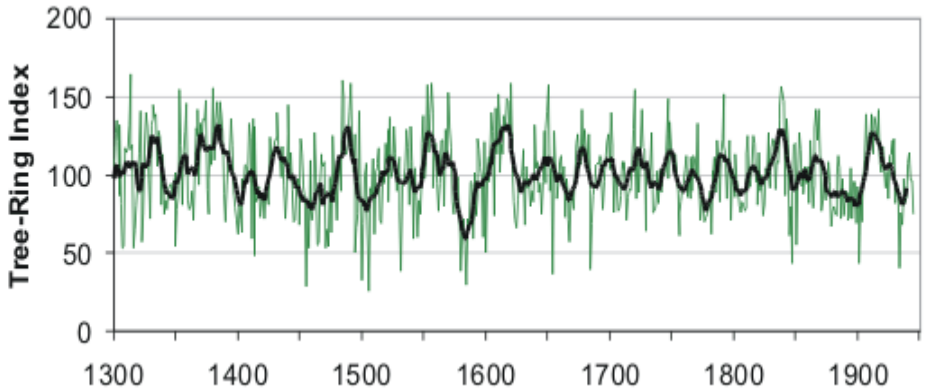
Pacific Northwest Research Station


TREE
FARM
STIHL




Tree-Ring Index
200
150
100
50
0
1300
1400
1500
1600
1700
1800
1900

How will trees grow in a warmer climate?

Low elevation, westside forest

Moisture limited

Growth will decrease:

- Douglas-fir
- Western hemlock
- Western redcedar
- Sitka spruce

How will trees grow in a warmer climate?

Eastside coniferous forest

Moisture limited

Growth will decrease:

- Ponderosa pine
- Douglas-fir
- Western larch

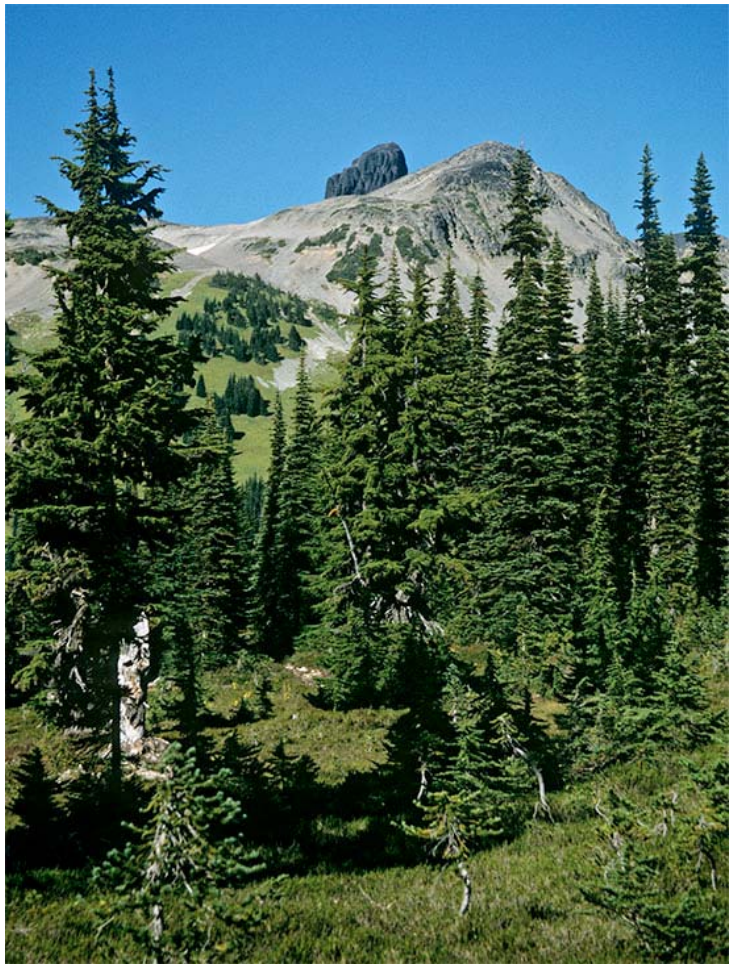
How will trees grow in a warmer climate?

High-elevation coniferous forest

Energy limited

Growth will increase:

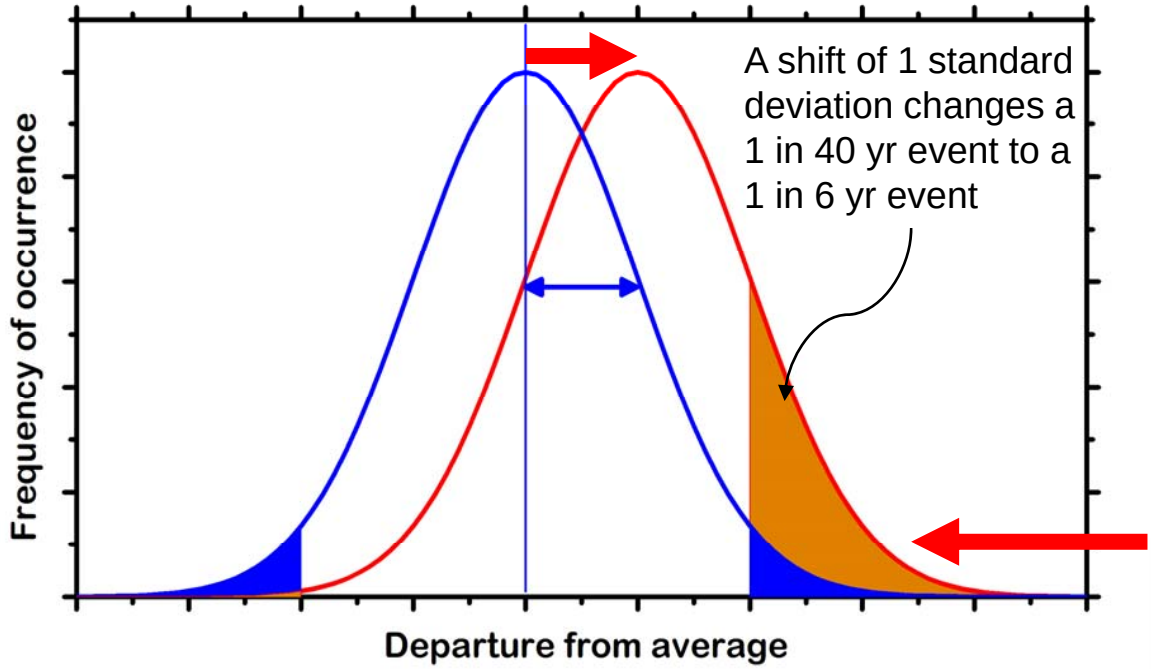
- Subalpine fir
- Mountain hemlock
- Lodgepole pine



Extreme weather + increased disturbance: Our primary challenge

Extremes matter

Frequency, extent, and severity of disturbances may be affected by climate change, altering the mean and *variability* of disturbance properties.



A shift in *distribution* of disturbance properties has a larger relative effect at the *extremes* than near the mean.

It's all about the tail!

Climate change affects insects

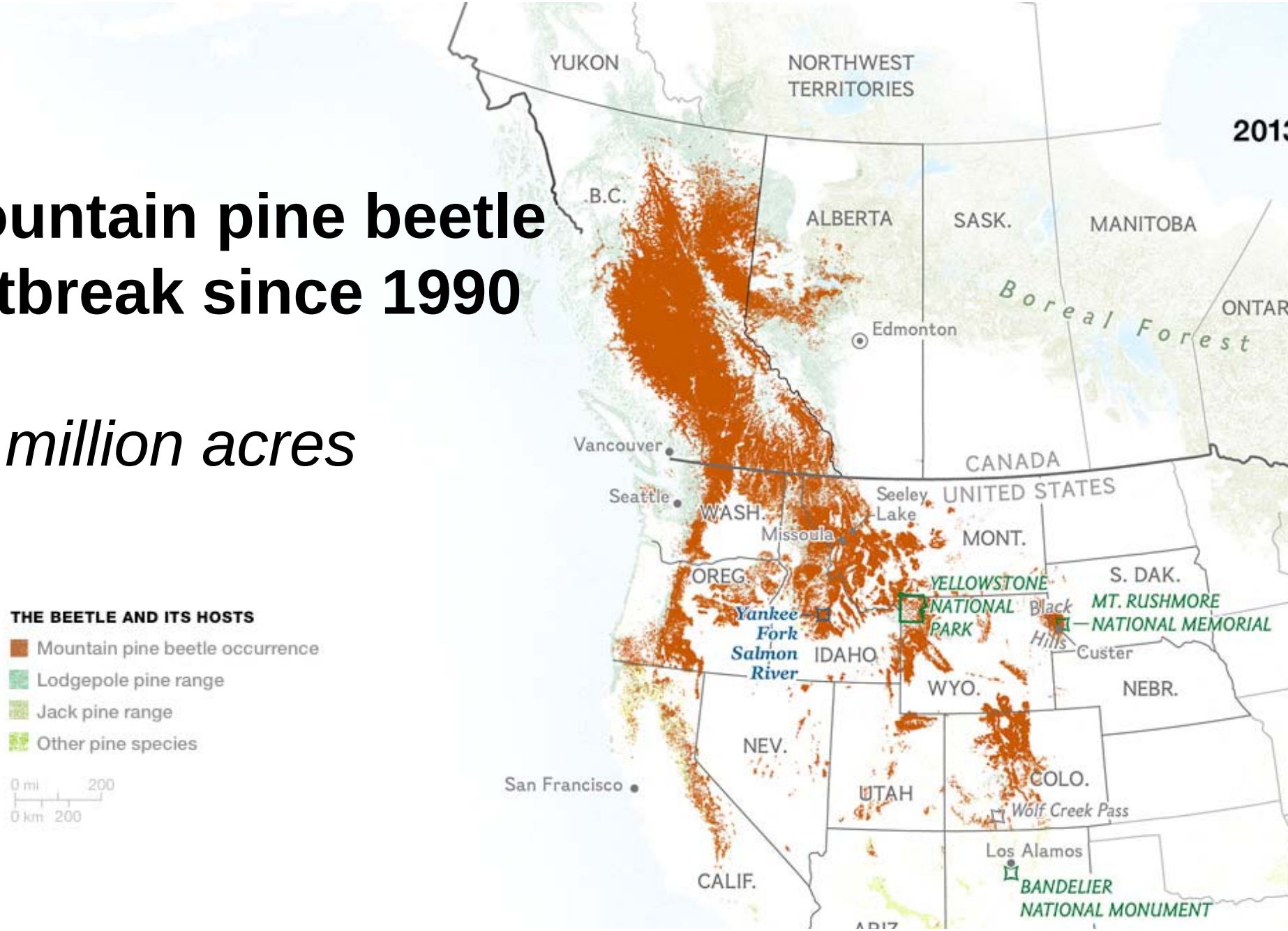
Mountain pine beetle

Warmer temperature has favored MPB by:

- Increasing its reproductive rate
- Allowing an expanded geographic range

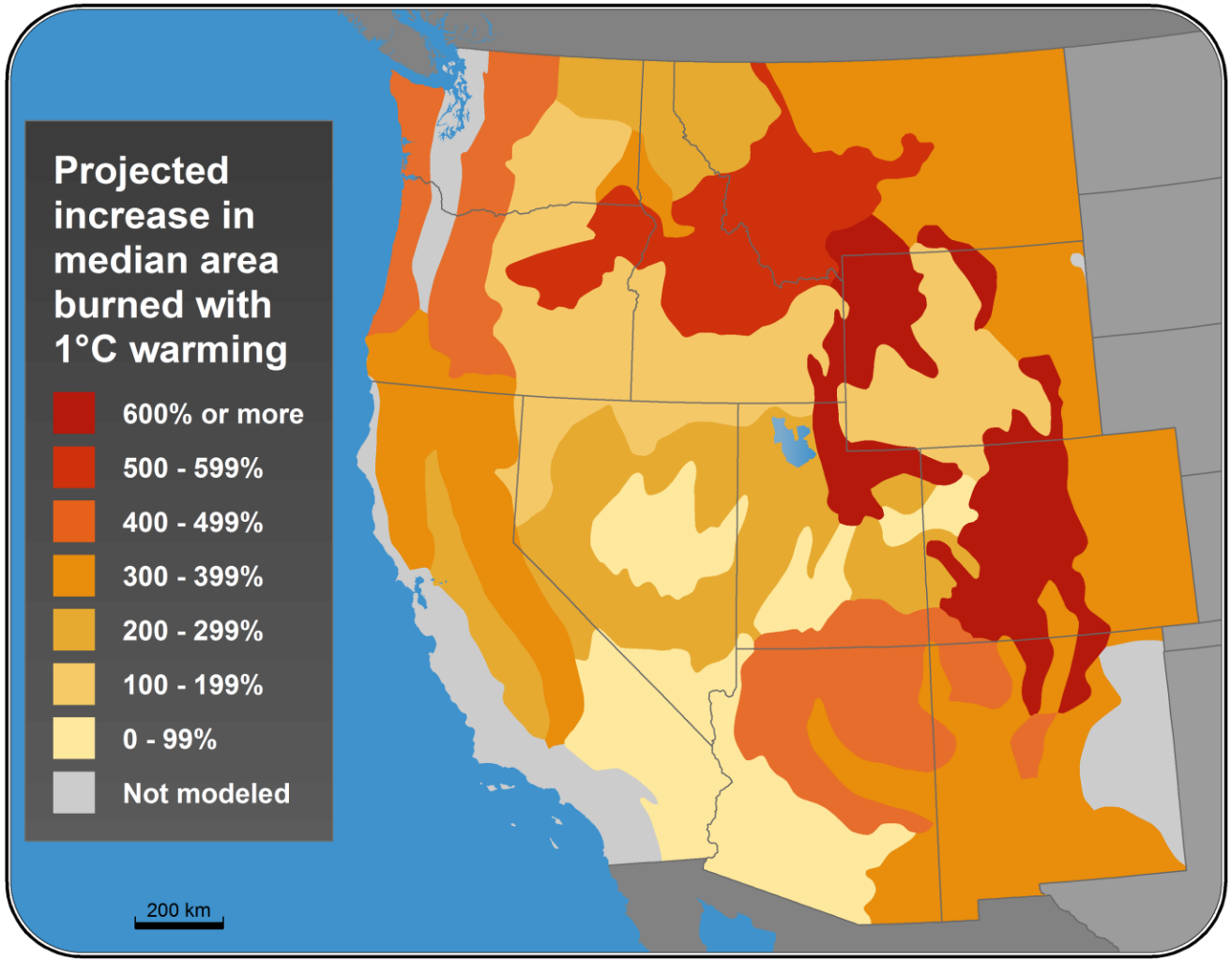
Mountain pine beetle outbreak since 1990

50 million acres



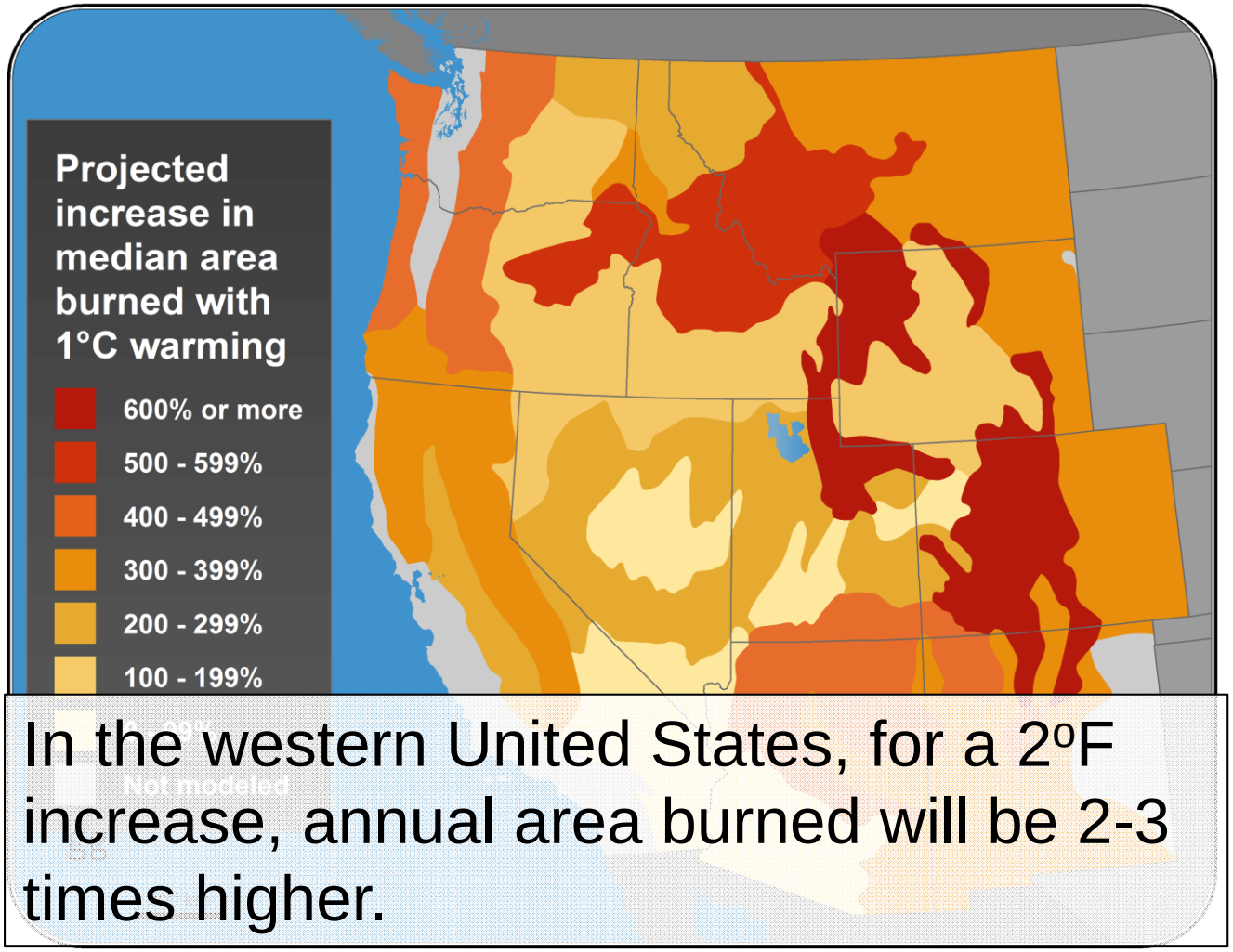
How will climate change affect wildfire?

Wildfire area burned, 2050



From J. Littell

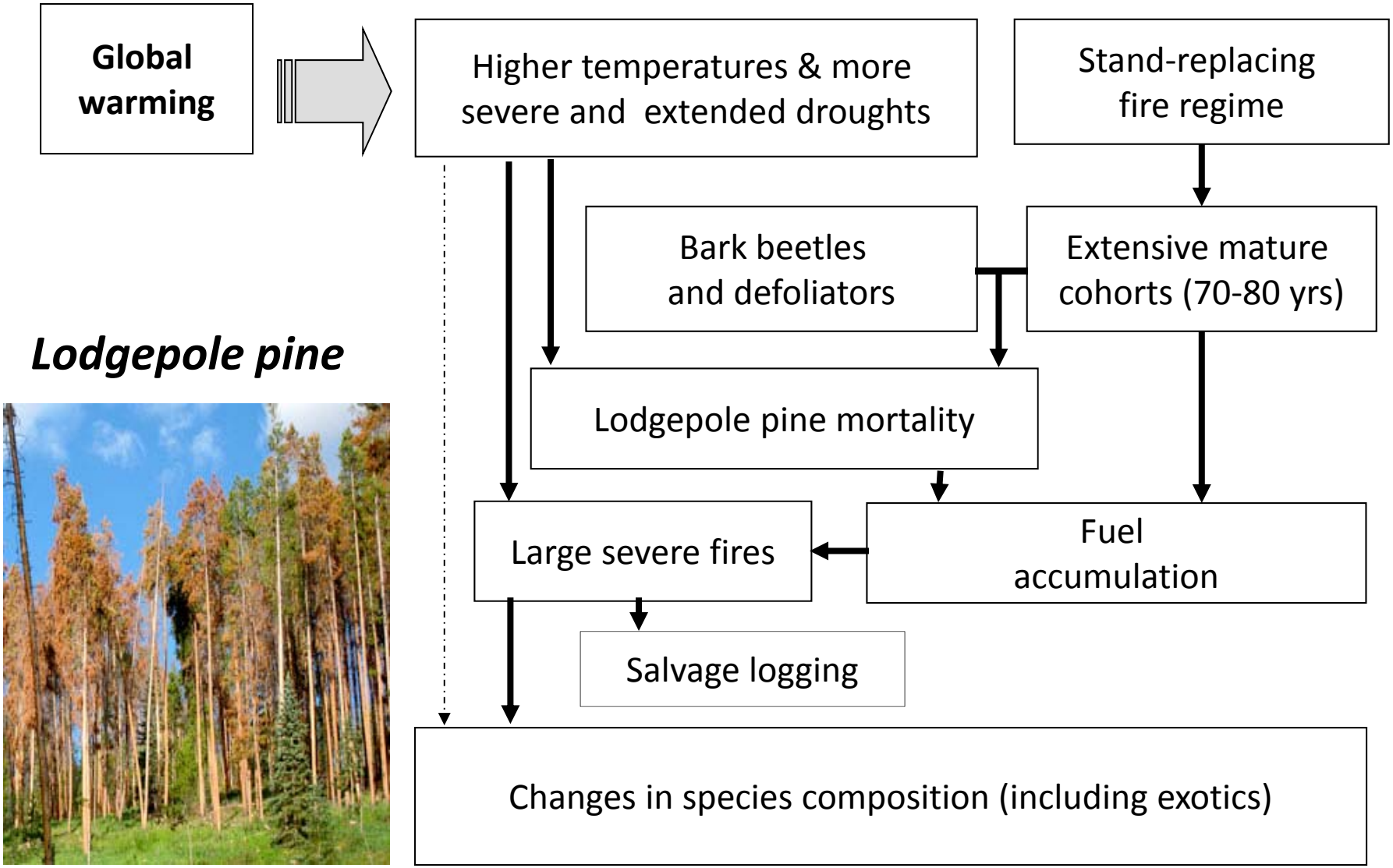
Wildfire area burned, 2050



In the western United States, for a 2ºF increase, annual area burned will be 2-3 times higher.

From J. Littell

Warming affects stress complexes



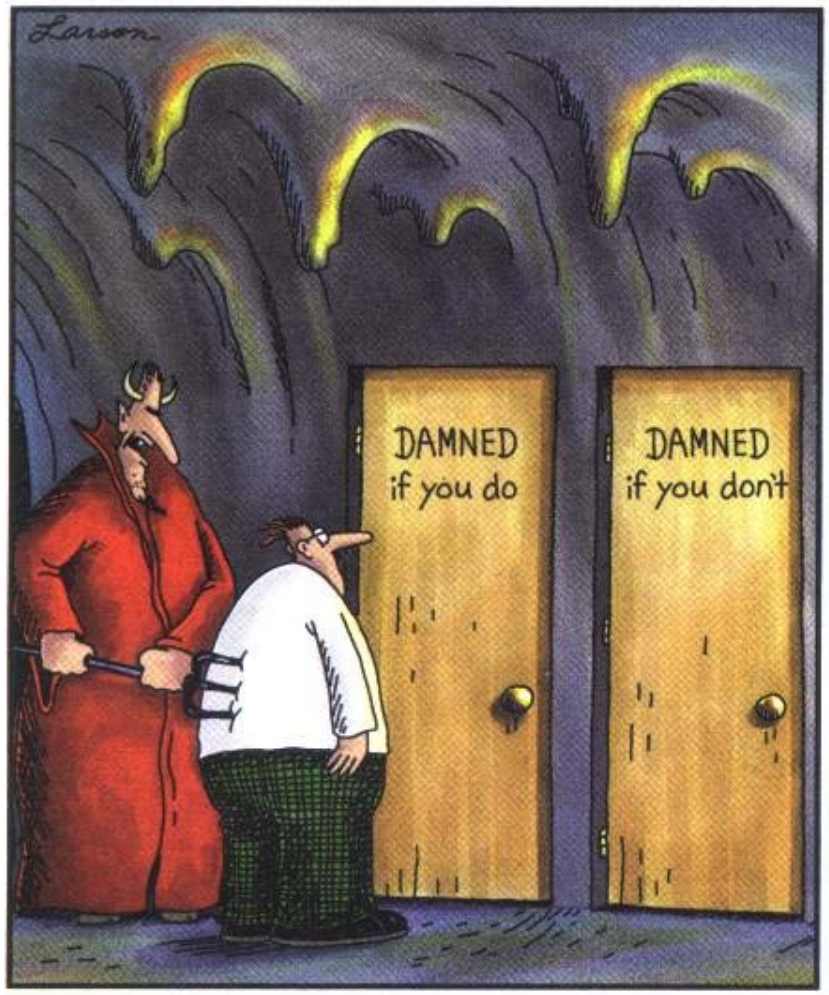
Lodgepole pine

McKenzie et al. (2009)

What is climate change adaptation?

An effort to reduce the potentially negative consequences of climate change

AND transition ecosystems and natural resources to a warmer climate.



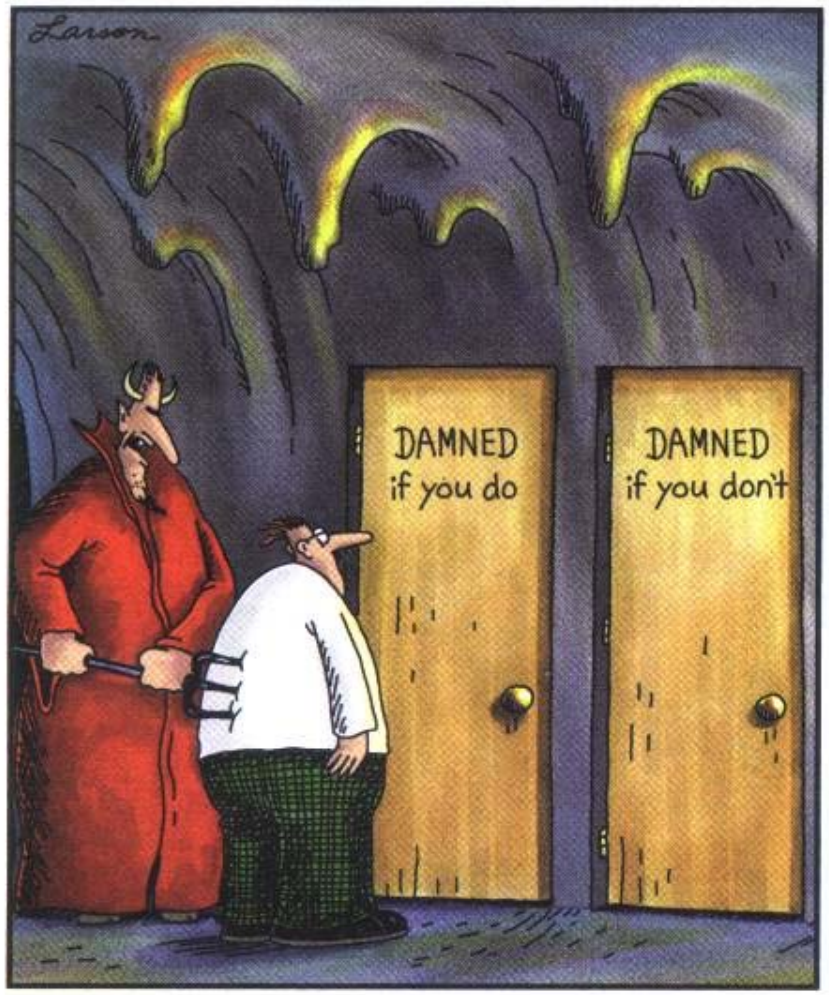
"C'mon, c'mon – it's either one or the other."

What is climate change adaptation?

Fine tuning and prioritizing current planning and management

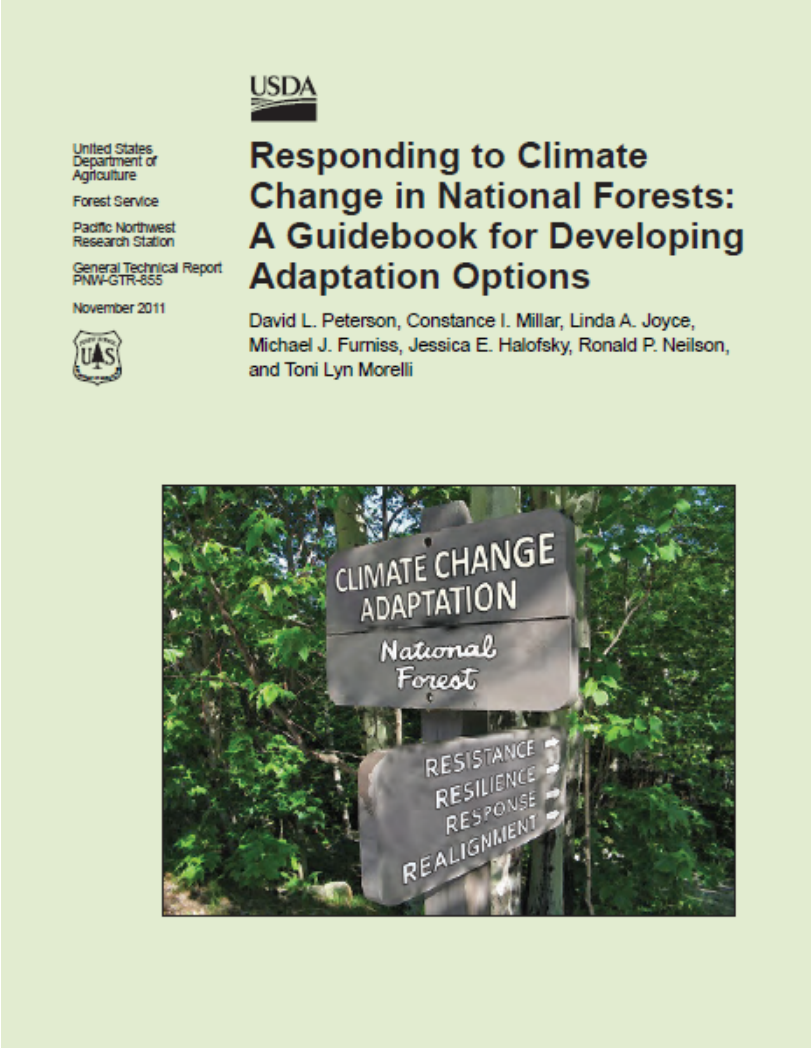
Component of *sustainable resource management*

A form of *risk management*

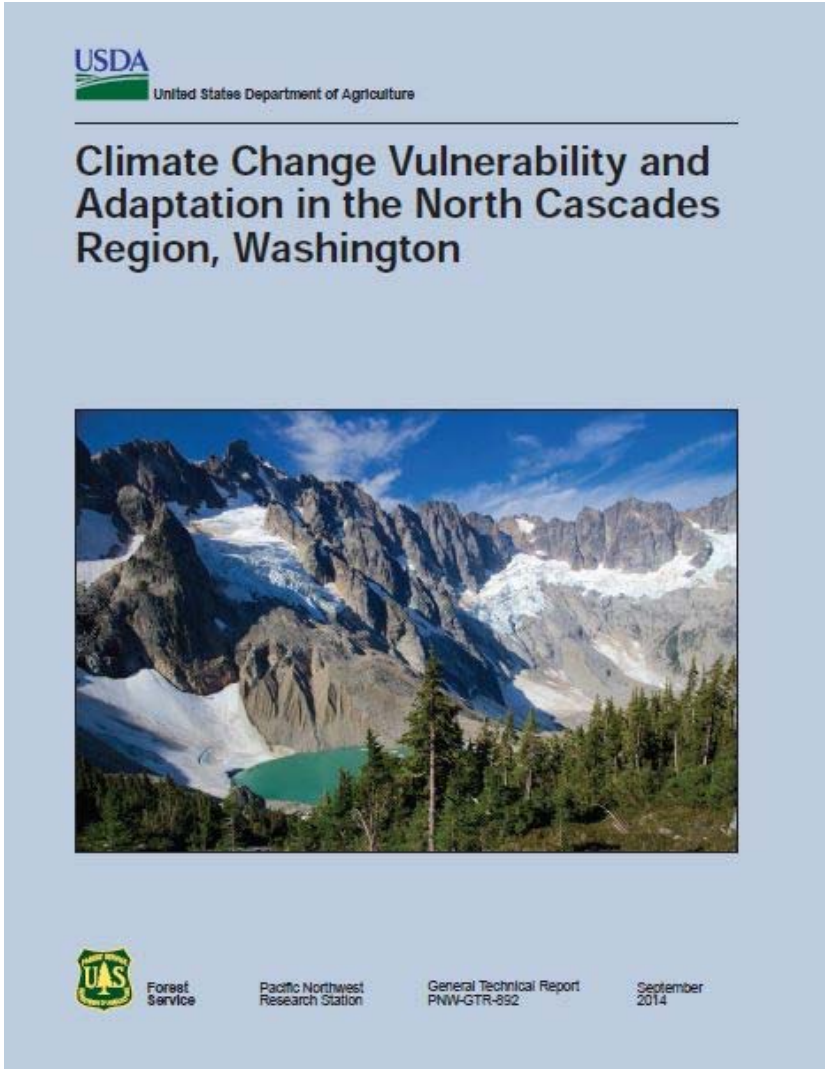


"C'mon, c'mon – it's either one or the other."

Adapting to climate change – Information & tools



Adapting to climate change – Information & tools




How do we manage for resilient landscapes in a warmer climate?

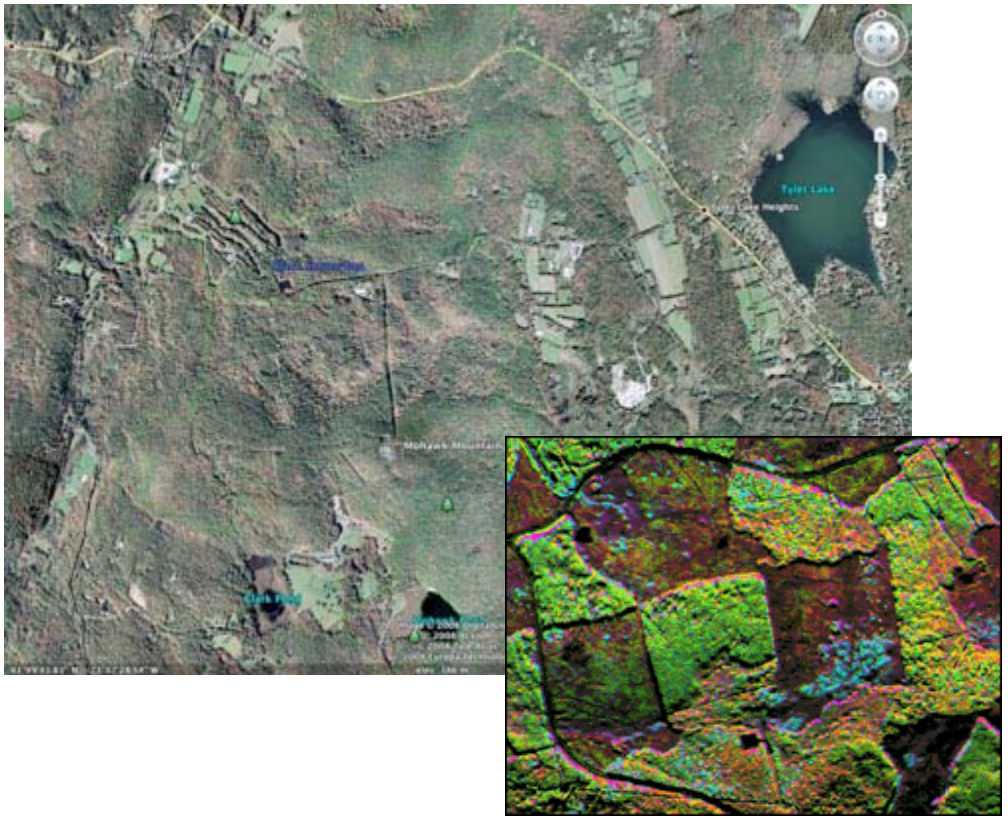
Adaptation strategy

Increase landscape diversity

Diversify spatial distribution of forest age and structure

Implement thinning and fuel treatments across large landscapes.

Orient the location of treatments in large blocks to modify fire severity and spread.



Adaptation strategy

Reduce non-climatic stressors

Detect and eradicate non-native plant species.

Encourage rapid tree establishment after wildfire.

Keep cattle out of riparian areas.

Manage roads to reduce erosion.

Vulnerabilities and adaptation
VEGETATION

Vulnerabilities and adaptation
VEGETATION

Vulnerability

- Wildfire will burn more area and over a longer fire season

Vulnerabilities and adaptation VEGETATION

Vulnerability

- Wildfire will burn more area and over a longer fire season

Adaptation strategy

- Increase resilience of forest ecosystems to more frequent fire

Vulnerabilities and adaptation VEGETATION

Vulnerability

- Wildfire will burn more area and over a longer fire season

Adaptation tactics

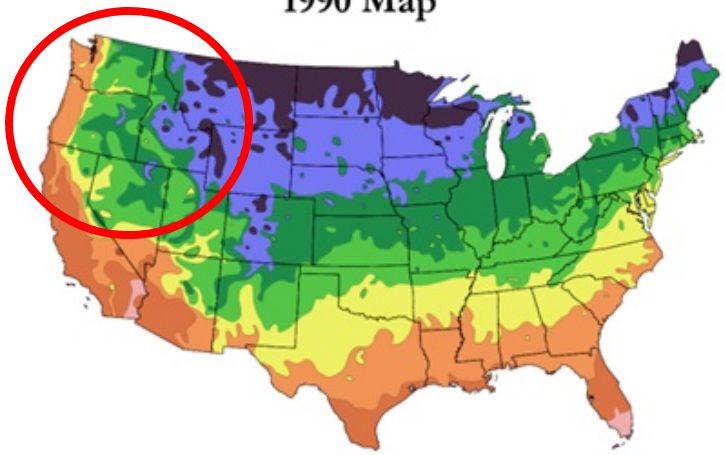
- Reduce stand densities
- Accelerate hazardous fuel treatments
- Manage for diversity of stand ages

MANAGING URBAN LANDSCAPES IN A WARMER CLIMATE

Northwest landscaping 2100?

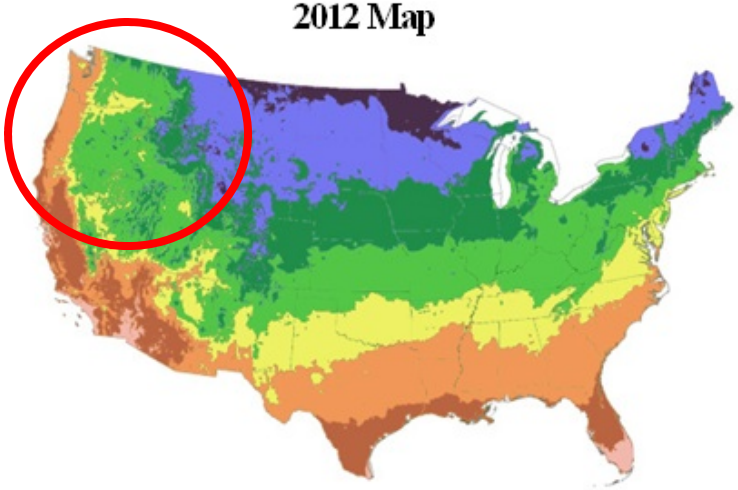
USDA plant hardiness zones

1990 Map



After USDA Plant Hardiness Zone Map, USDA Miscellaneous Publication No. 1475, Issued January 1990

2012 Map



Re-colored version of the 2012 USDA Plant Hardiness Zone Map (available at: http://planthardiness.ars.usda.gov/PHZMWeb/)

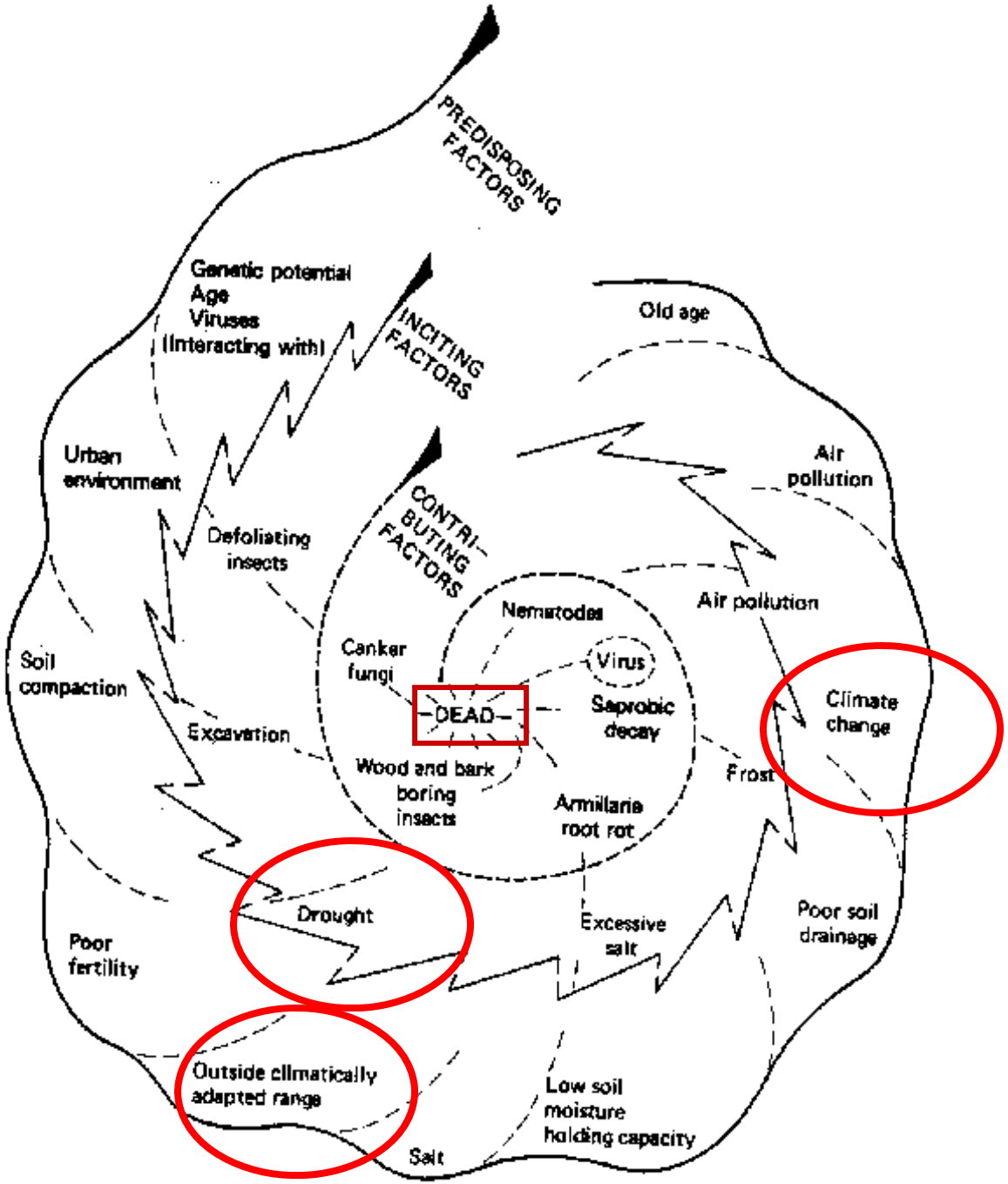
THE RIGHT PLANT

IN THE RIGHT PLACE

FOR THE RIGHT REASON

The Disease Spiral

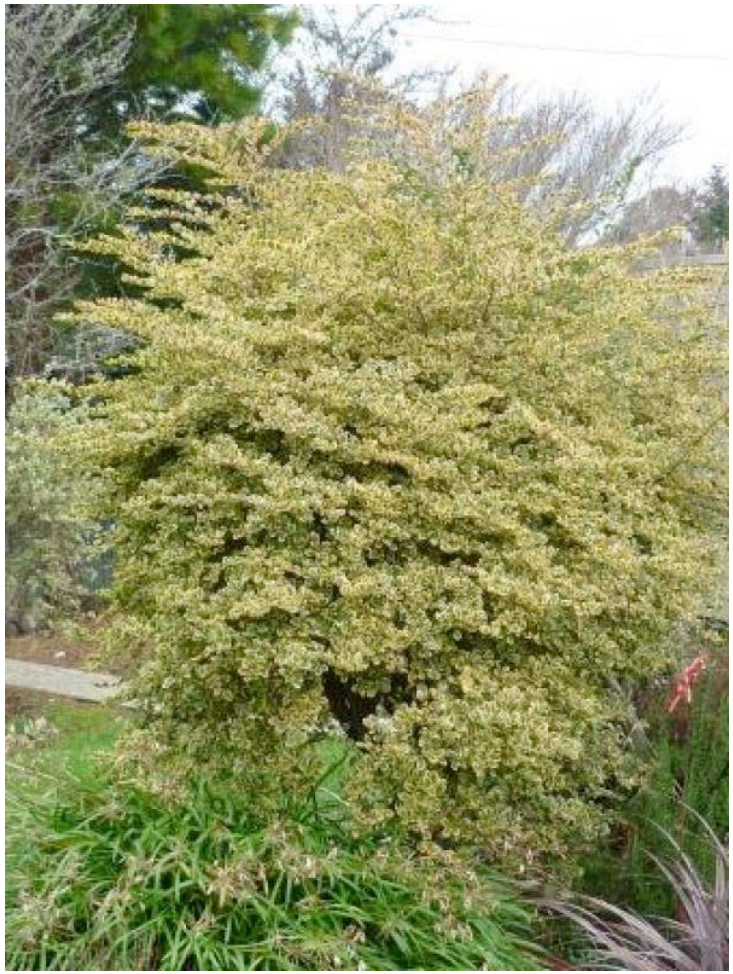
Stress complexes, mediated by climate, lead to plant mortality and other changes.



From Manion (1991)

PROBLEM
Summers will be hotter and drier

SOLUTION
Select plants from mediterranean locations



Boxleaf azara

SOLUTION
Select plants from mediterranean locations

Lavender

PROBLEM
High temperature variability

SOLUTION
Select plants that tolerate temperature extremes

Rockrose

PROBLEM
Less winter chilling

SOLUTION

Select plants that require less chilling for flowering and fruiting

Dwarf lilac
‘Boomerang’

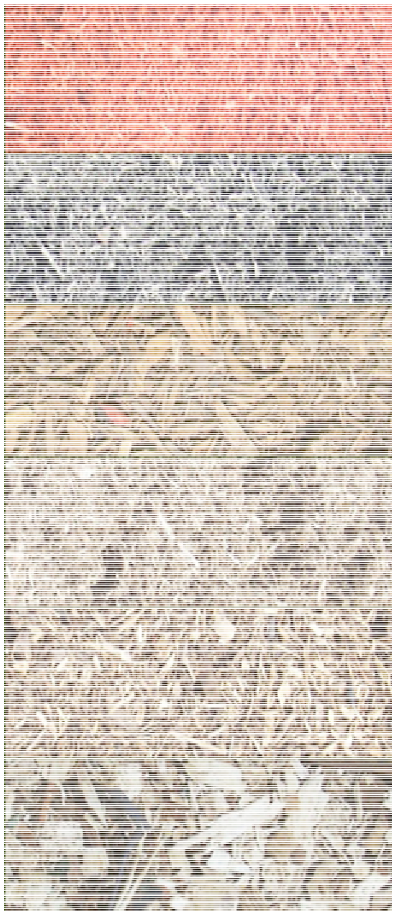
PROBLEM
There will be surprises: insects, fungi, non-natives,…

SOLUTION
Keep vegetation healthy, remove stressors quickly

GOOD PRACTICE
Maximize plant species diversity

GOOD PRACTICE
Diversify landscape pattern: partition beds by water needs

GOOD PRACTICE
Mulch and water efficiently



GOOD PRACTICE
Mulch and water efficiently

Natives to the rescue?

Natives to the rescue?

Shore pine

Natives to the rescue?

Oregon grape

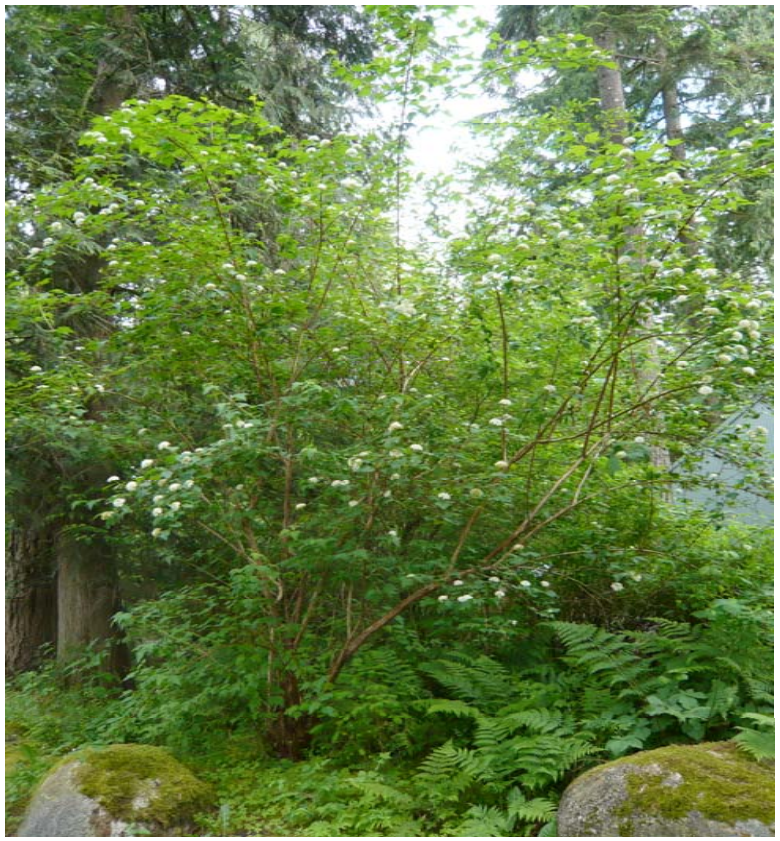
Natives to the rescue?

Salal

Natives to the rescue?

Mock orange

Natives to the rescue?



Ninebark

Natives to the rescue?

Kinnikinnick

Natives to the rescue?

Prostrate ceanothus

In summary…

- Manage for 30 years from now:
  warmer temperatures, higher extremes.
- Reduce non-climatic stress.
- Consider future maintenance requirements.
- Diversify plant species and patterns.
- Partition vegetation by water needs.
- Monitor, learn, and adjust as needed.

The best time to plant a tree was 20 years ago

The second best time is today

The best time to start planning for climate change was 20 years ago

The second best time is today