

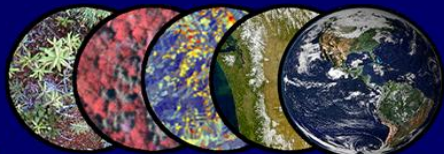
# Land cover change in national parks of the western U.S.

Robert E. Kennedy<sup>1</sup>, Zhiqiang Yang<sup>1</sup>, Justin Braaten<sup>1</sup>,  
Peder Nelson<sup>1</sup>, Warren B. Cohen<sup>2</sup>, Eric Pfaff<sup>1</sup>

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Oregon State University*

<sup>2</sup> *USDA Forest Service Pacific Northwest Research Station*

*Landsat Science Team Meeting, January 19-21 2010*



## Take home messages

- To detect potential impacts of climate change on vegetation we need to:
  - Detect landcover changes that are both abrupt (fire, etc.) and slow (drought, insects, encroachment)
  - Distinguish between anthropogenic and natural processes
  - Use natural weather experiments at large scales to improve inference based on robust hypotheses
- *The Landsat archive can help in all three areas*

# Themes

- Abrupt and slow processes
- Attribution
- Climate cycles

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# Detecting abrupt and slow processes

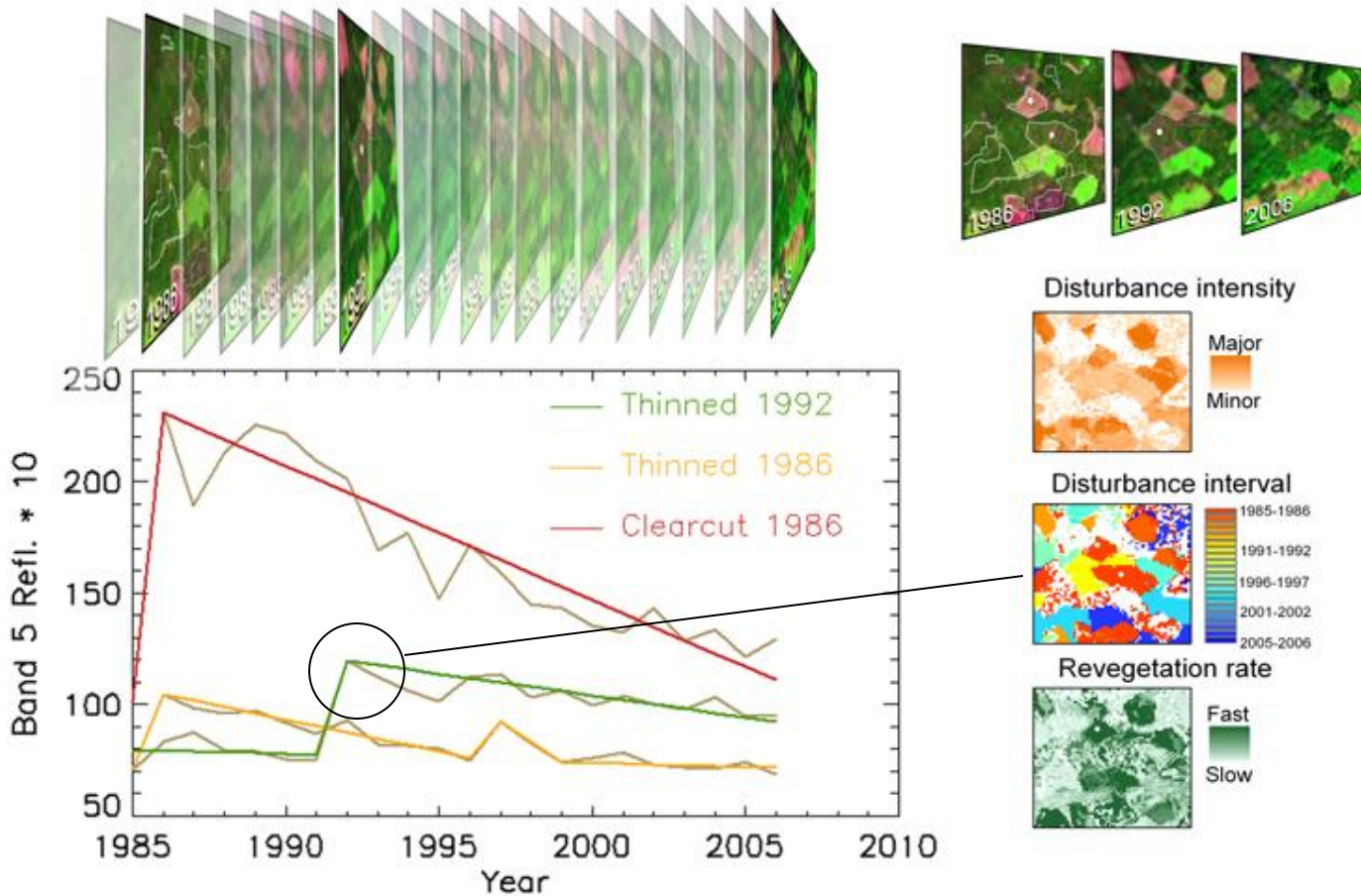
State Change

Cyclical Change

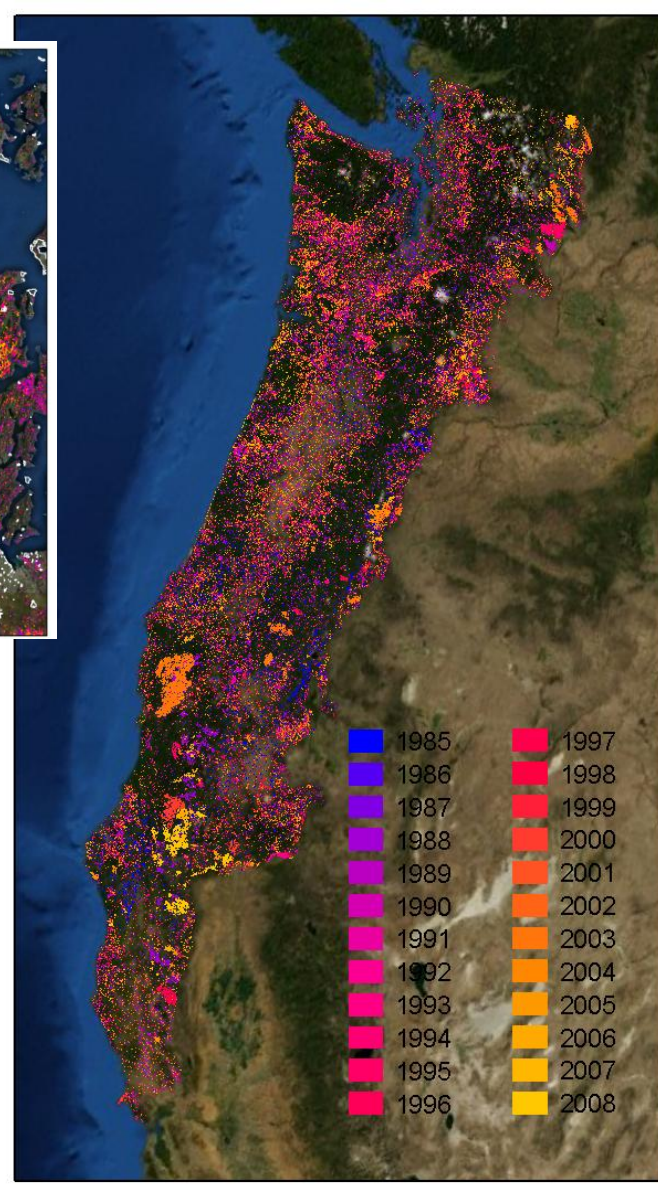
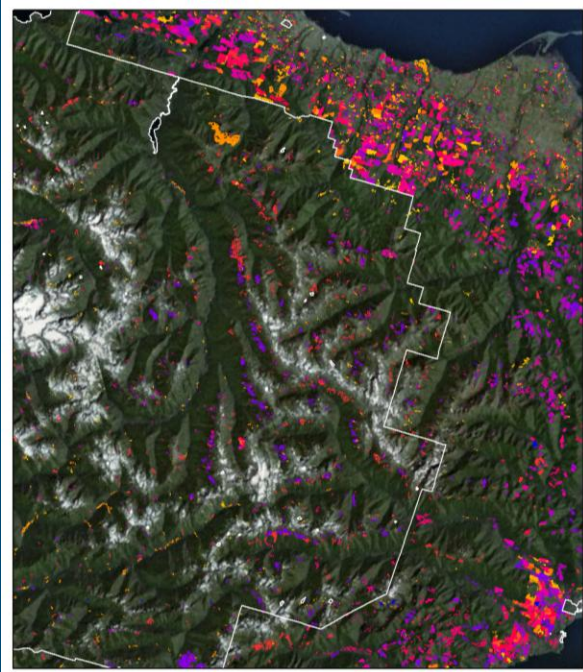
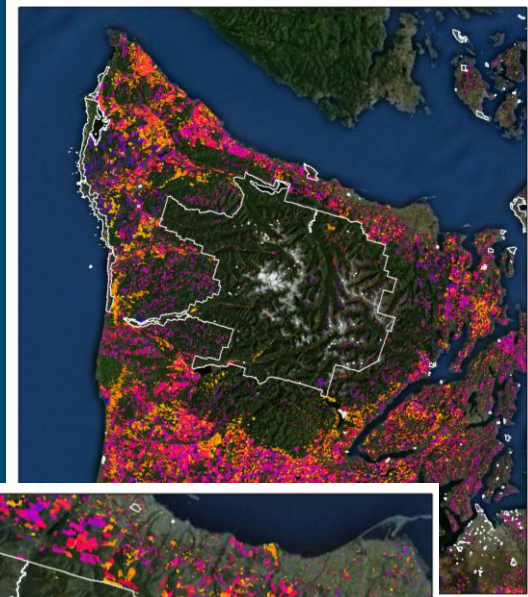
Condition change

Forest  
Succession

Forest



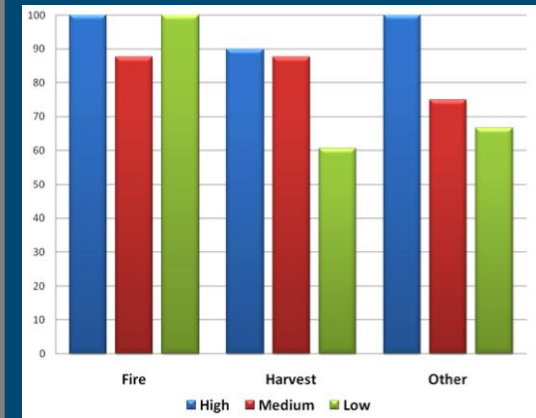
# Arbupt process: Harvest, fire



Project: Region 6  
Effectiveness  
Monitoring Program  
for the Northwest  
Forest Plan (NWFP)

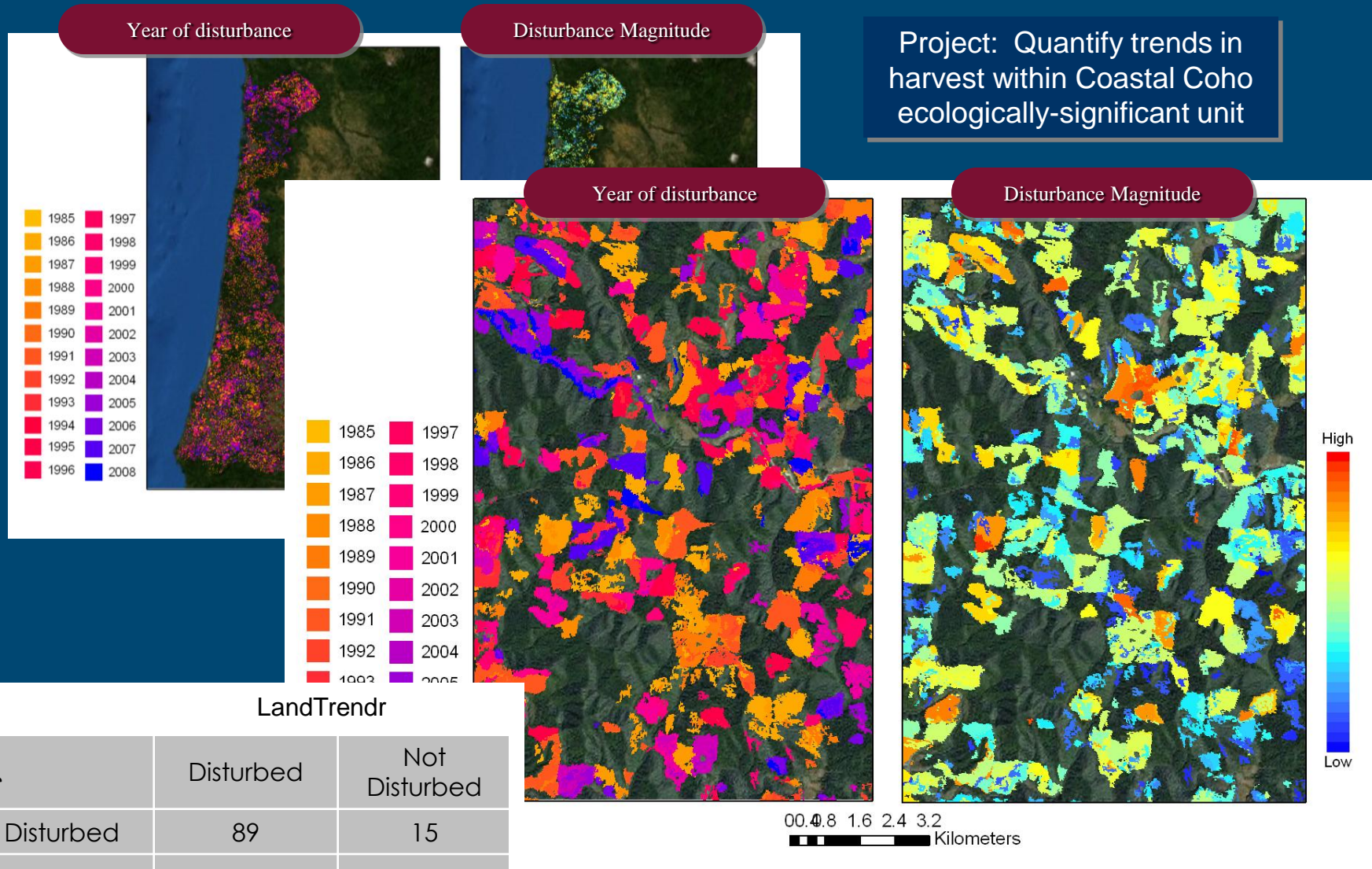
Data: > 500  
individual Landsat  
scenes

TimeSync Interpretation  
ongoing



# Disturbance mapping: Time and magnitude

Project: Quantify trends in harvest within Coastal Coho ecologically-significant unit

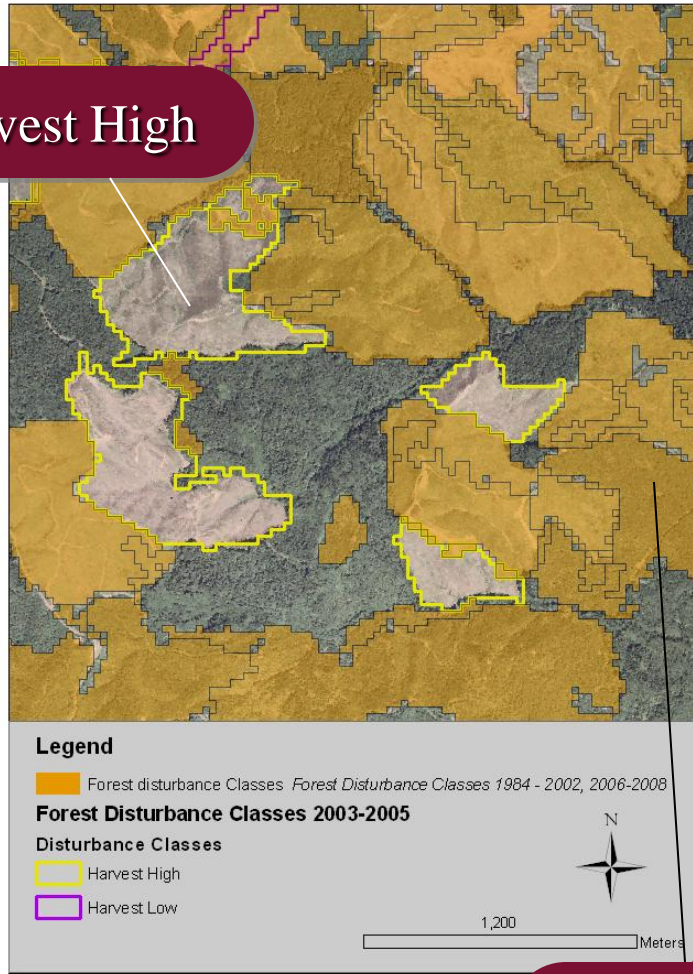


LandTrendr

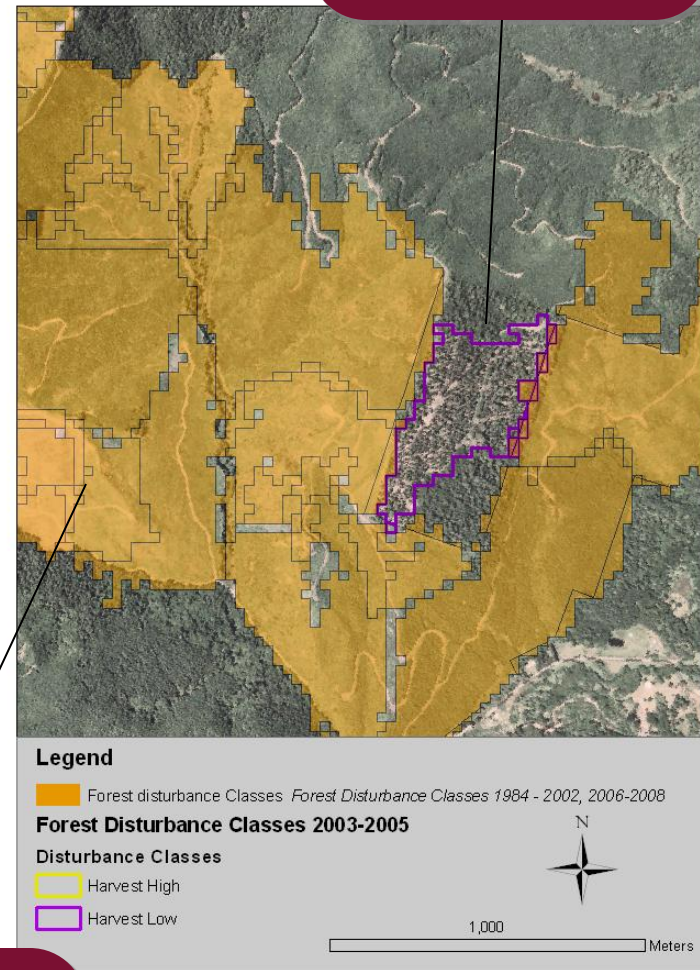
TimeSync	Disturbed	Not Disturbed
Disturbed	89	15
Not Disturbed	13	157

# Abrupt disturbance: Subtle and Not So Subtle

Harvest High



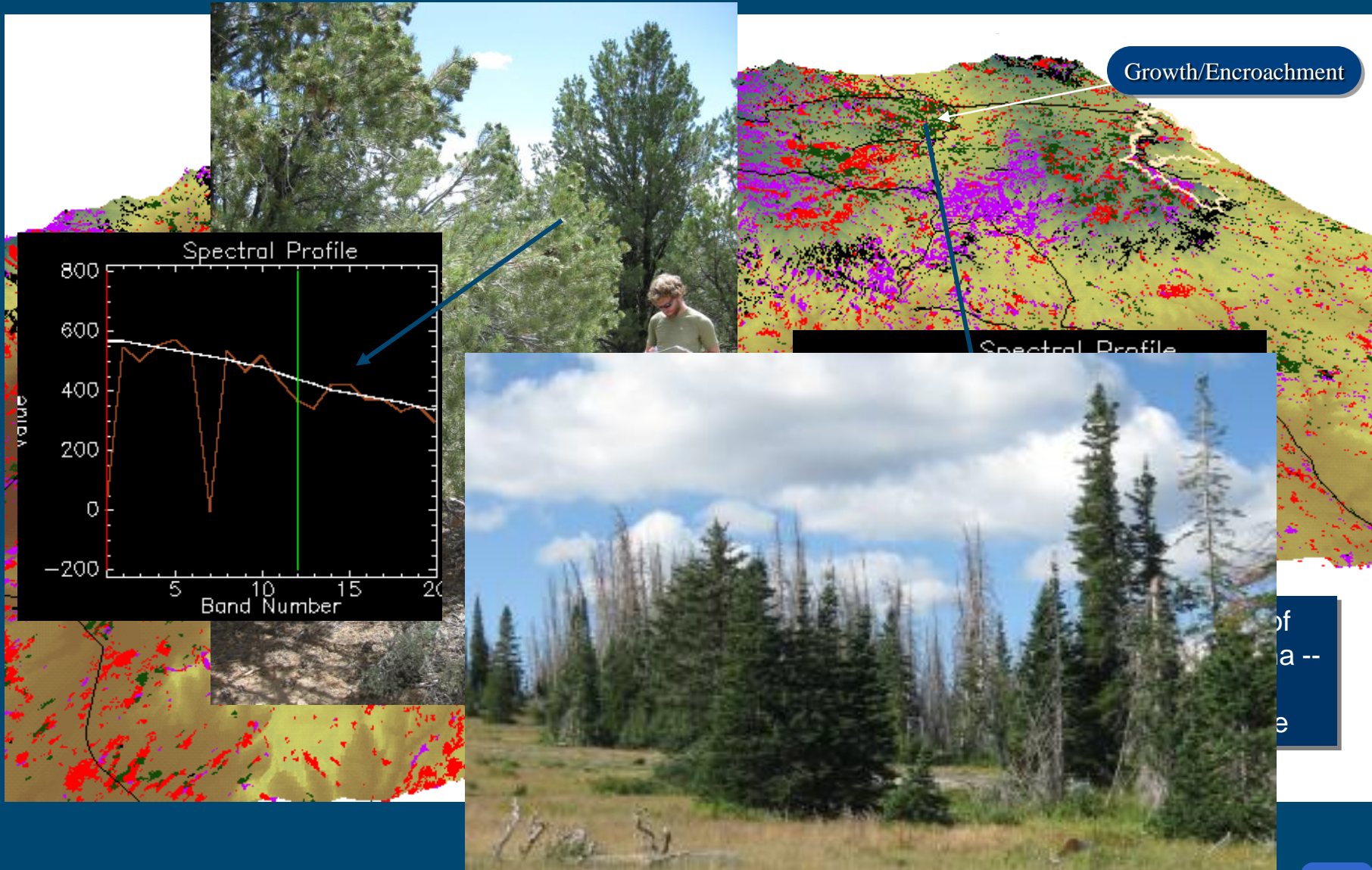
Harvest Low



Prior Harvest



# Landscape dynamics on the Colorado Plateau

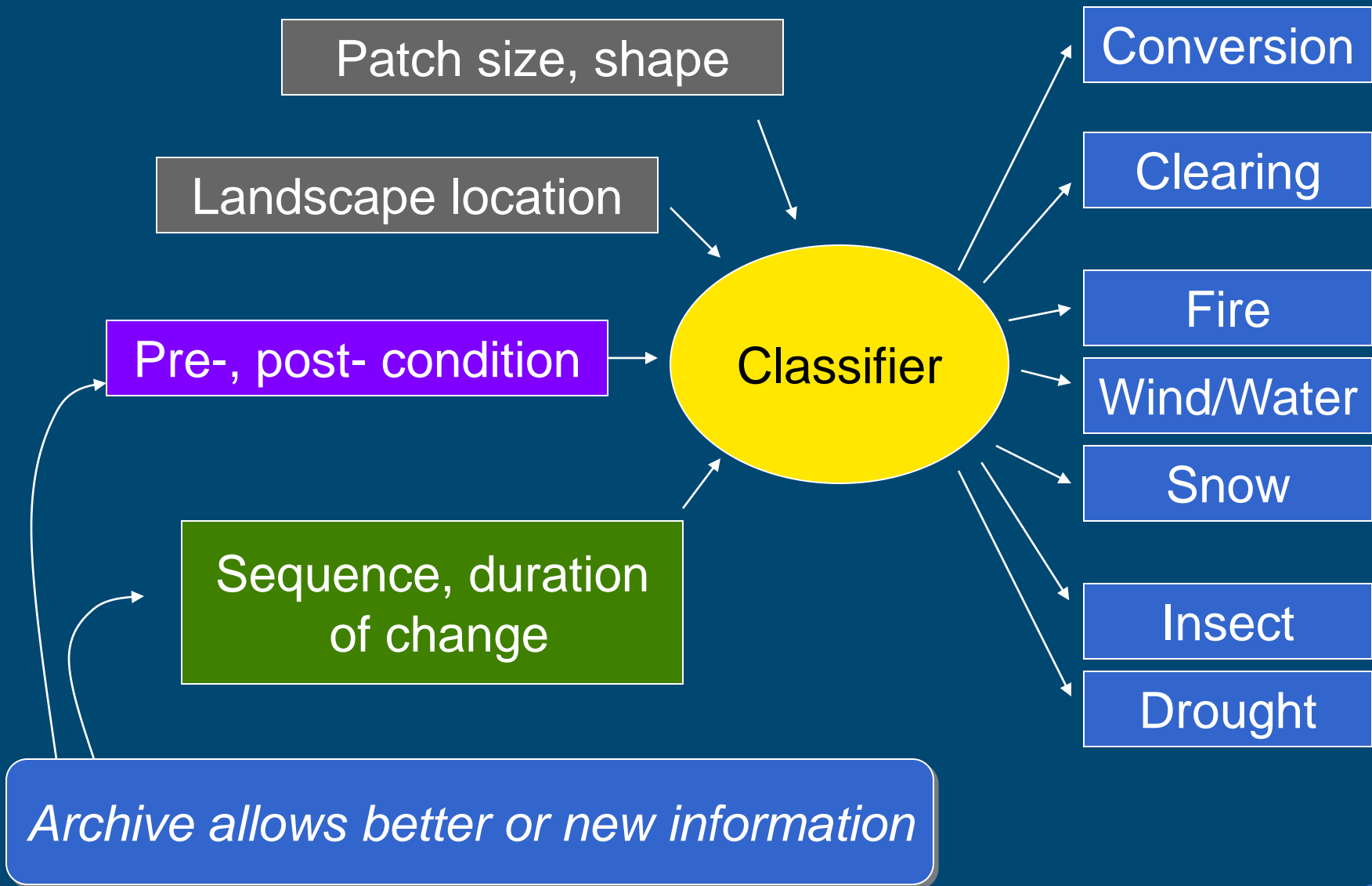


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# Themes

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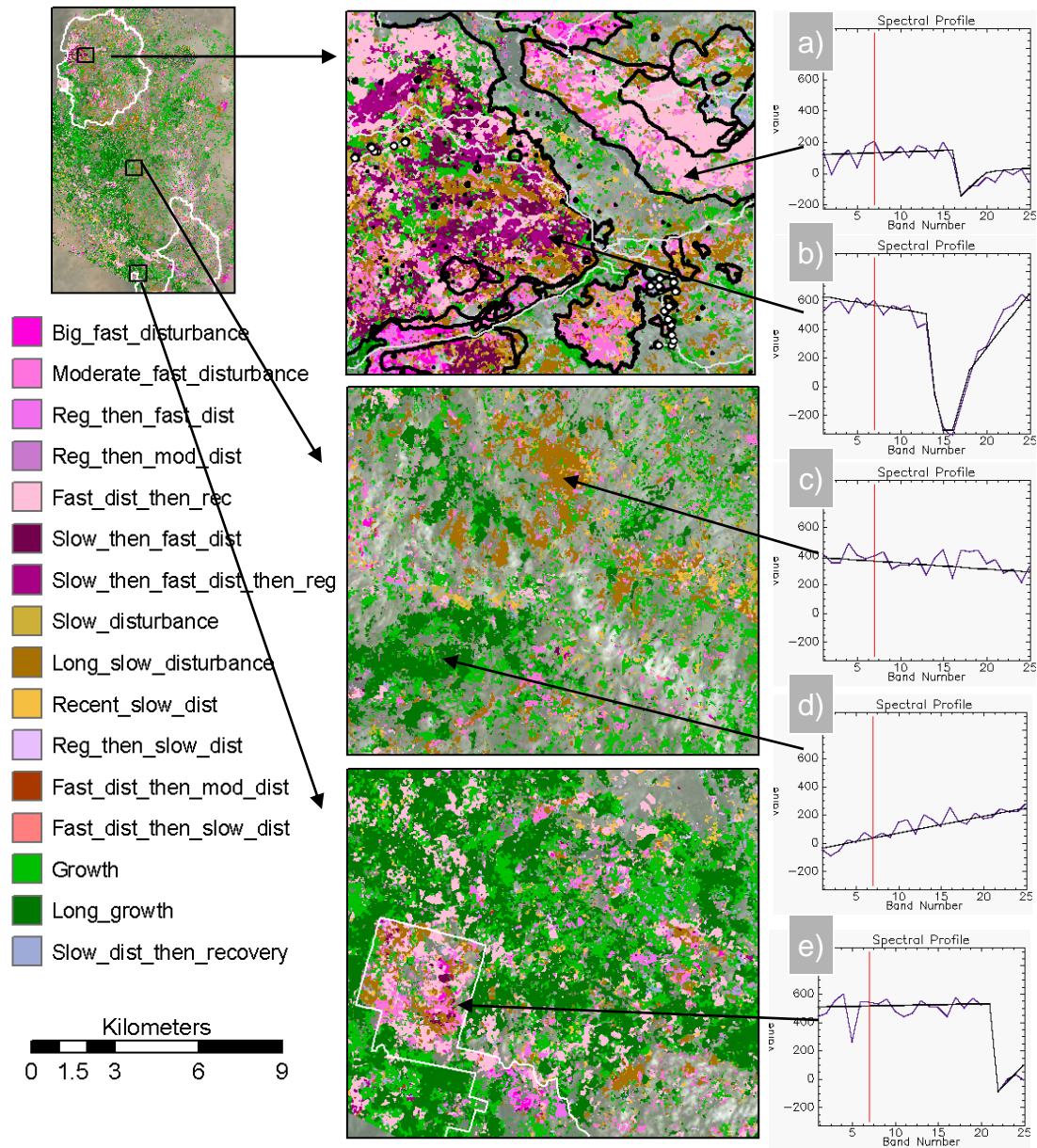
# Natural vs. anthropogenic



# Sequence, duration of change

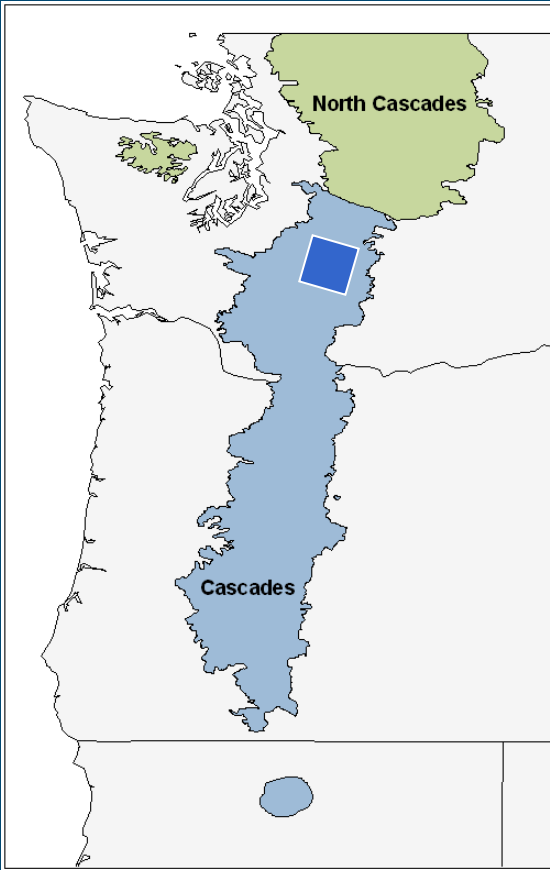
Change Labels:  
A map of the  
dynamic  
landscape

The sequences  
of change may  
provide clues  
about agent

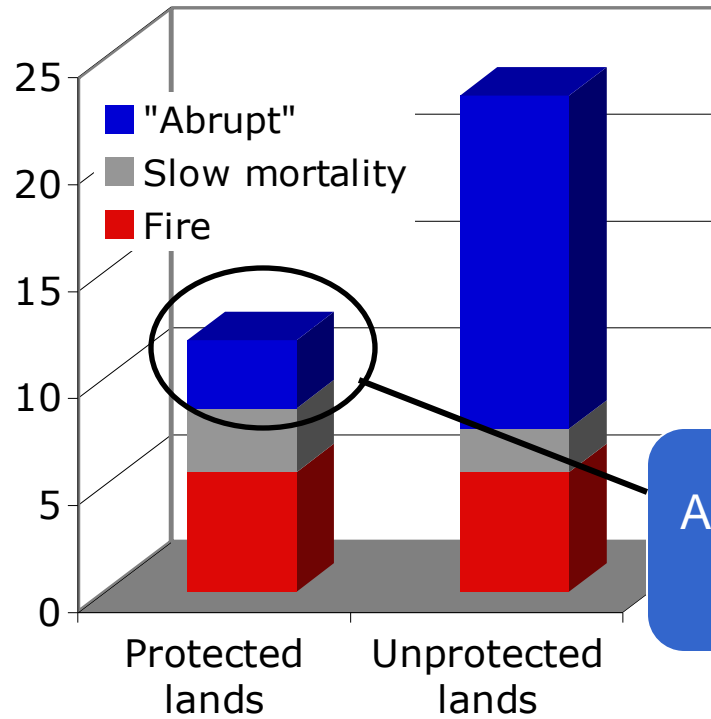


# First stabs at attribution

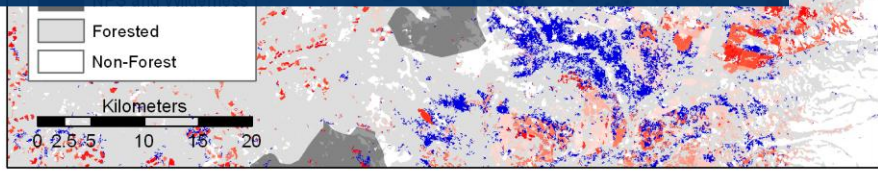
Separate by duration and known fire occurrence



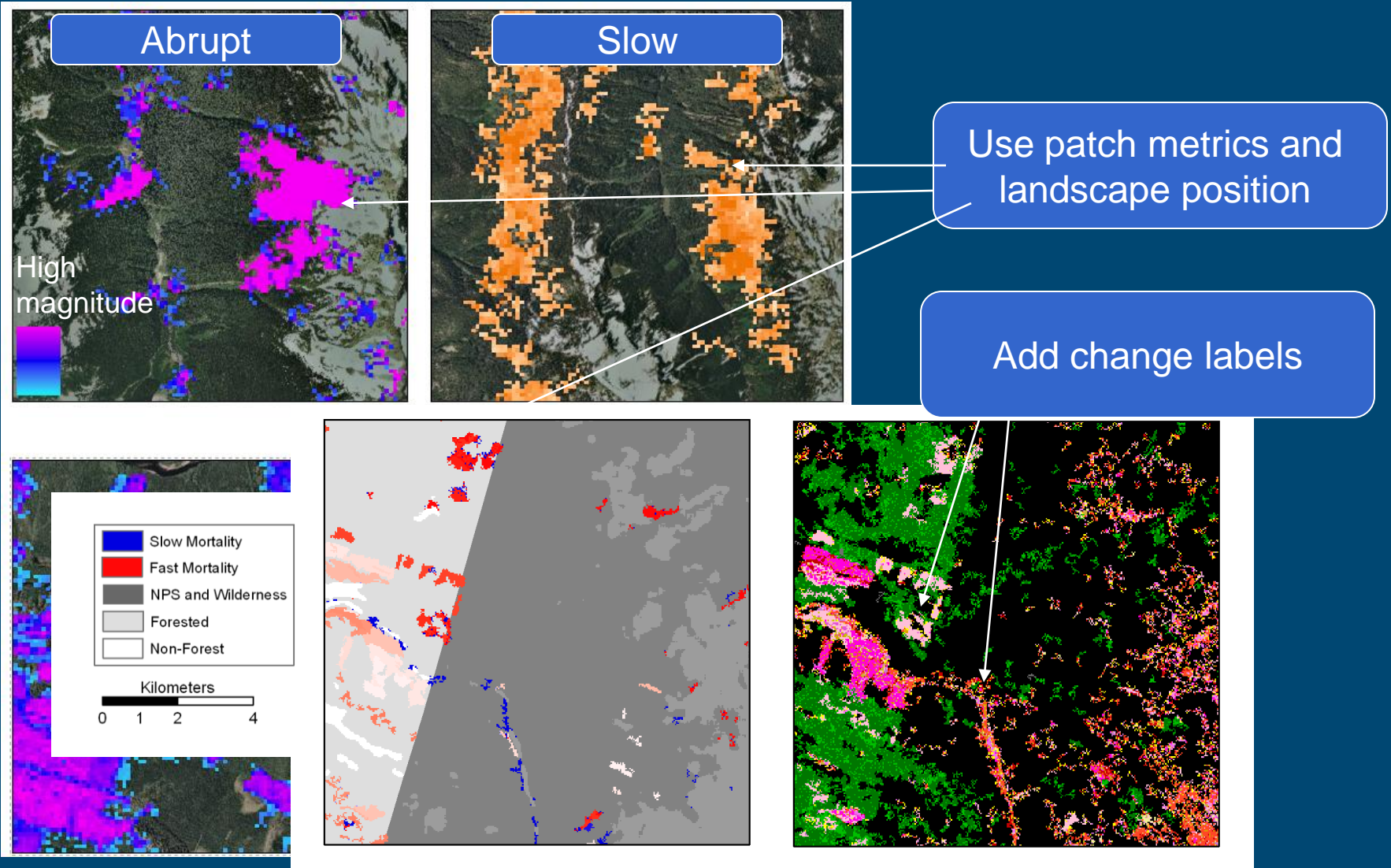
### North Cascades Province: Percent Area Disturbed 1985-2008



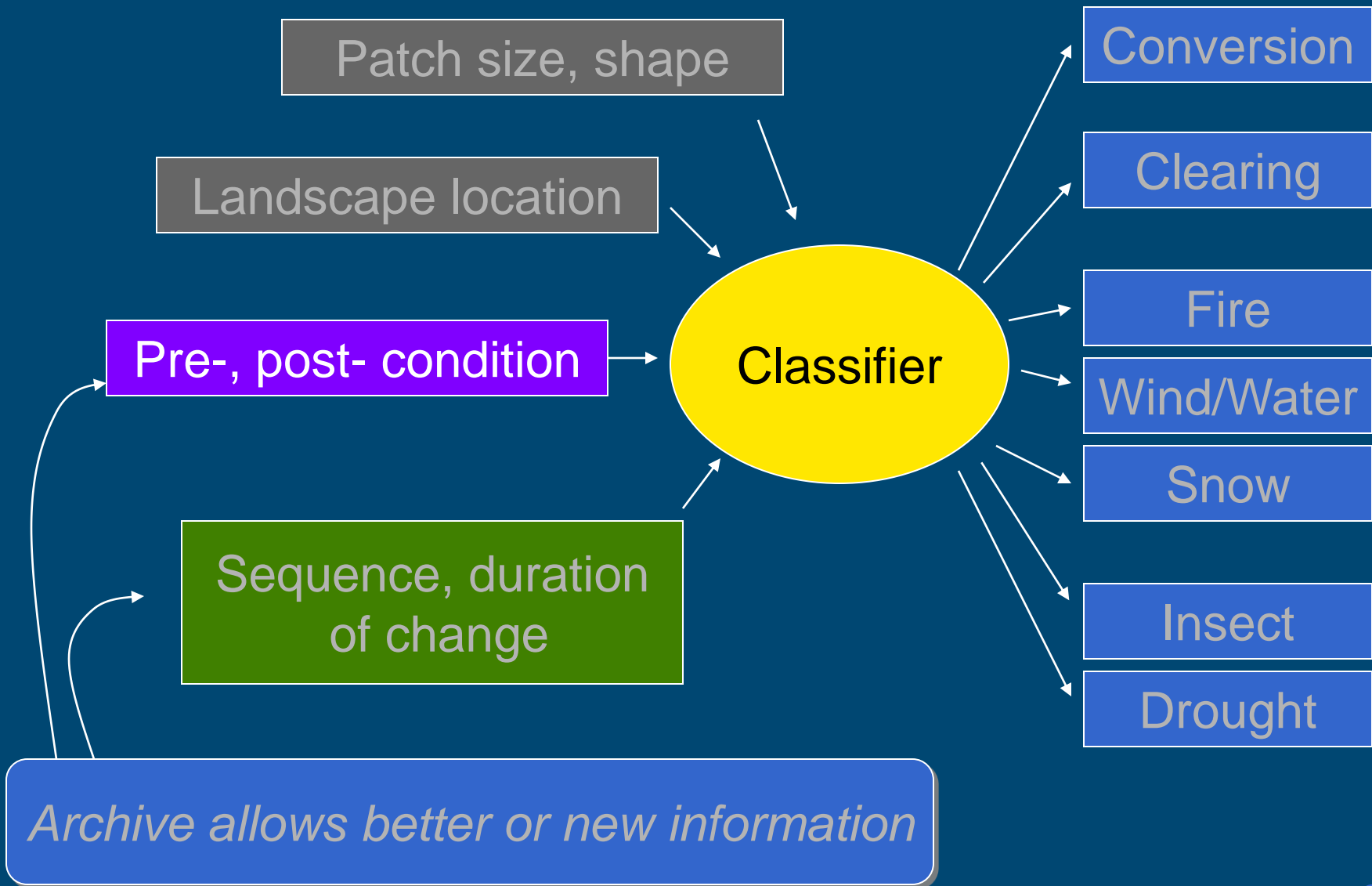
Abrupt, but presumably natural processes



# We can bring more to bear...



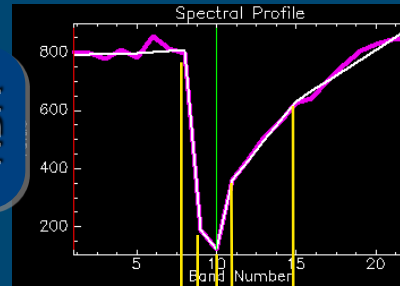
# Natural vs. anthropogenic



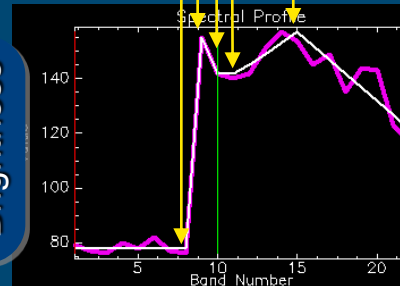
# LandTrendr: Temporal fitting

- Use segmentation of one band to identify “vertices” in time series
- Smooth between vertices in other bands
- Result: “Pseudo-images” with year-to-year noise removed, but actual change retained

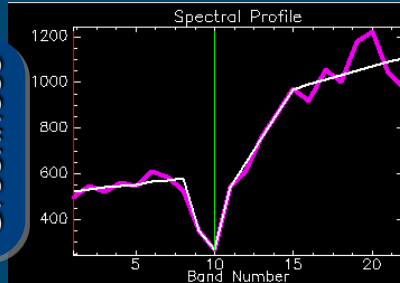
NBR



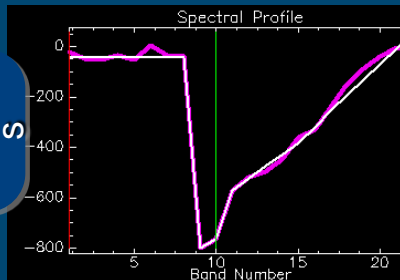
Brightness



Greenness



Wetness





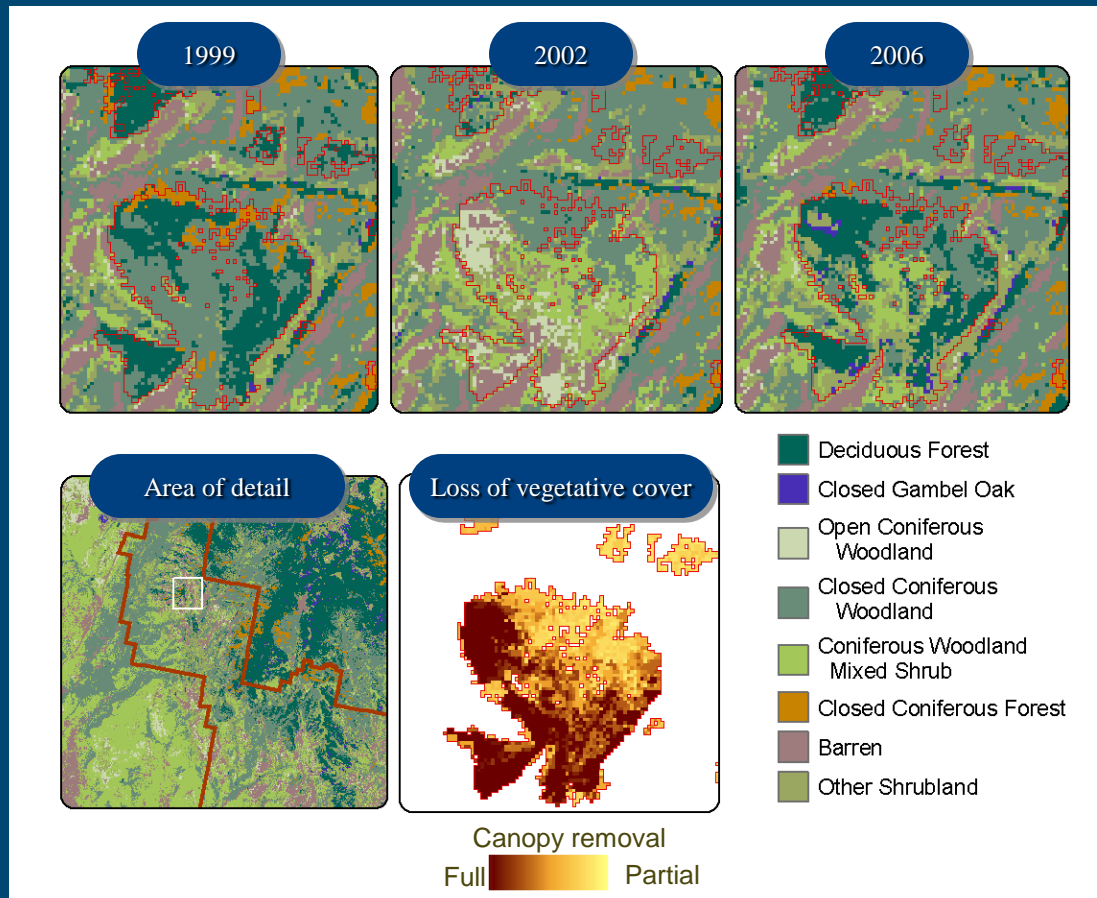
# Temporally consistent “pseudoimages”

QuickTime™ and a  
YUV420 codec decompressor  
are needed to see this picture.

- Consistent spectral space minimizes effects of noise, phenology, atmosphere, etc.
- Allows development of yearly landcover maps

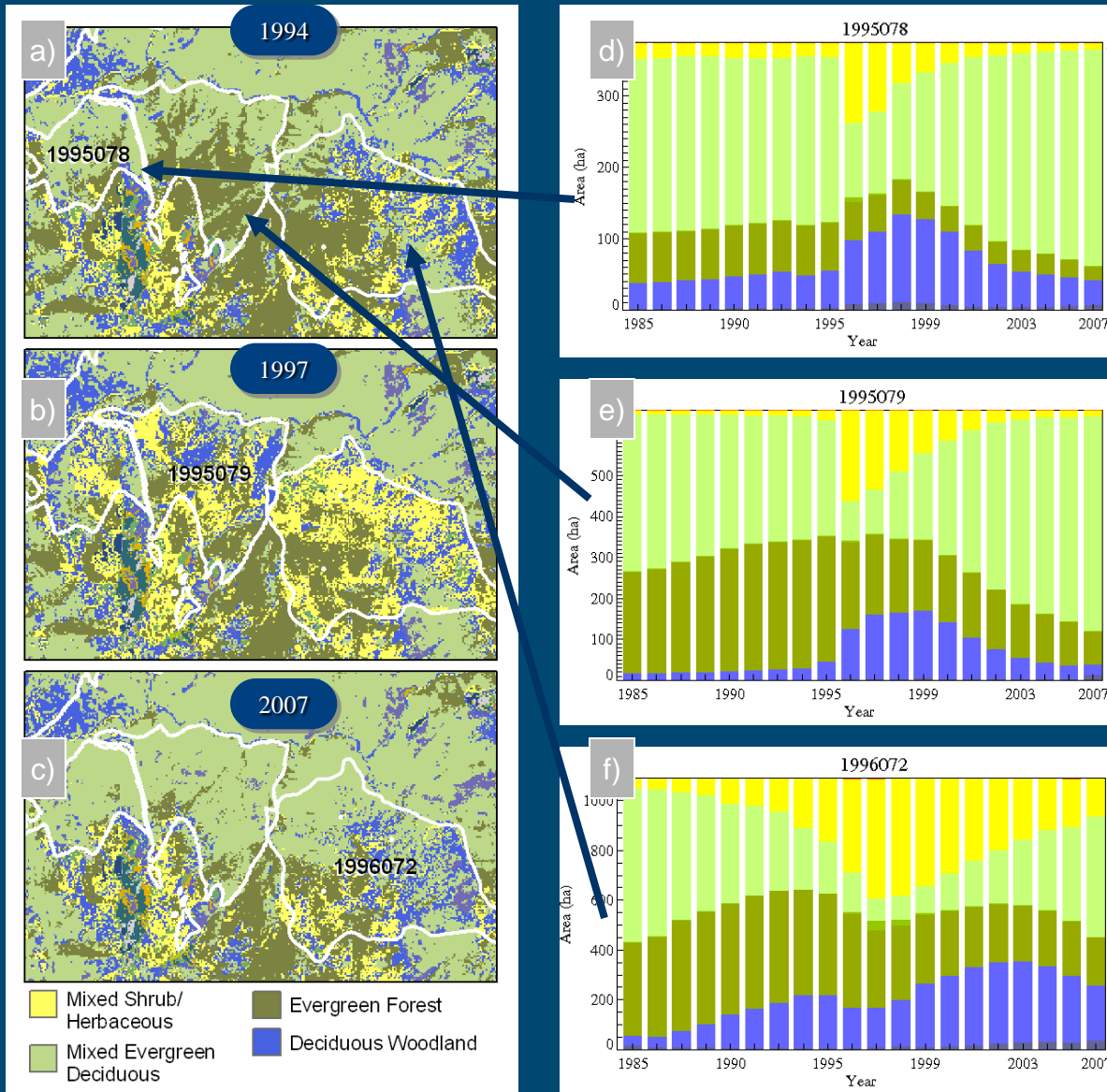
*See “Features” block at [landtrendr.forestry.oregonstate.edu](http://landtrendr.forestry.oregonstate.edu)  
for more fun movies*

# Yearly classification: Fire effects



*Track fire effects using class labels familiar to users*

# Yearly classification: Fire effects

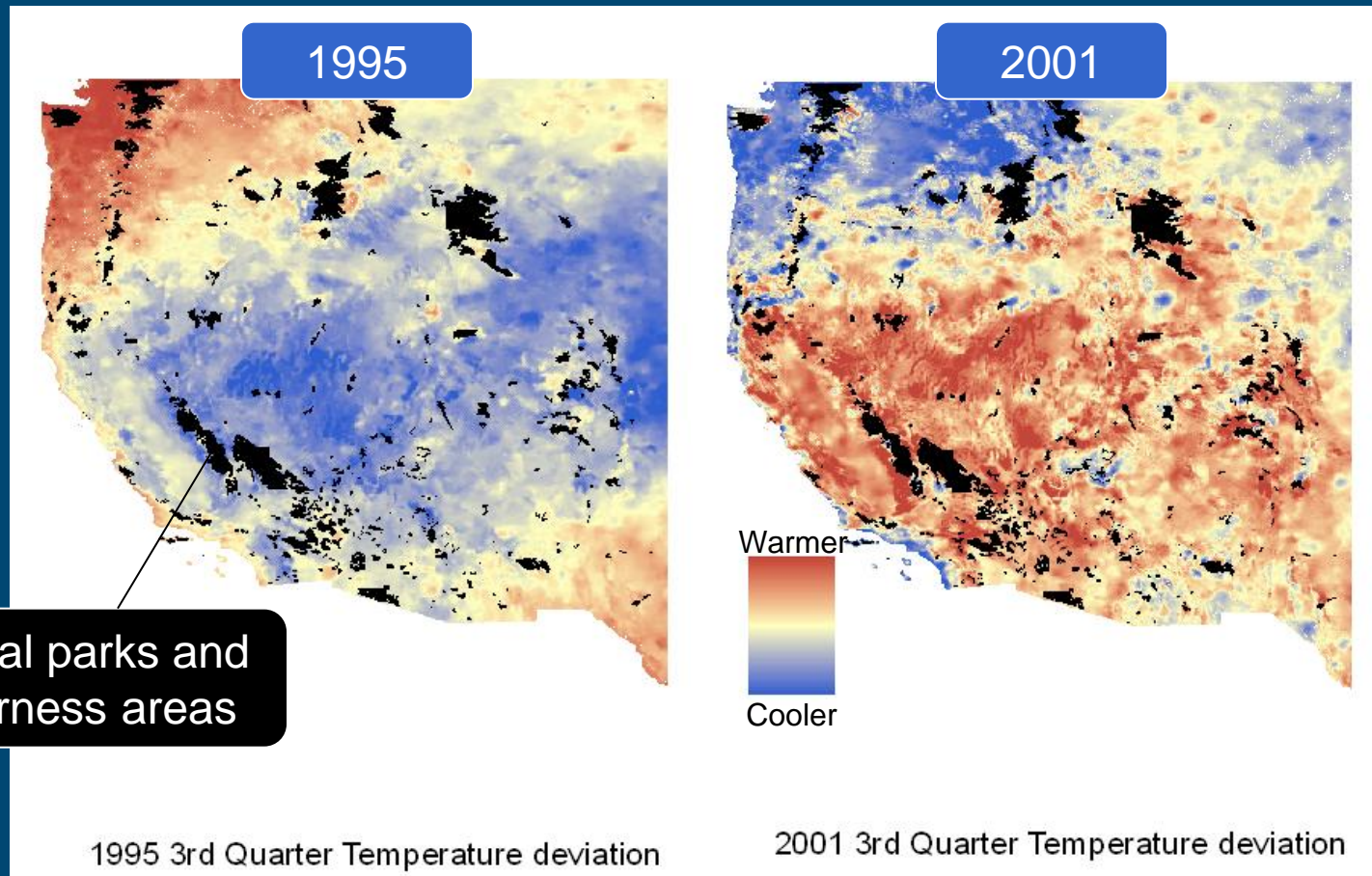


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# Climate variability

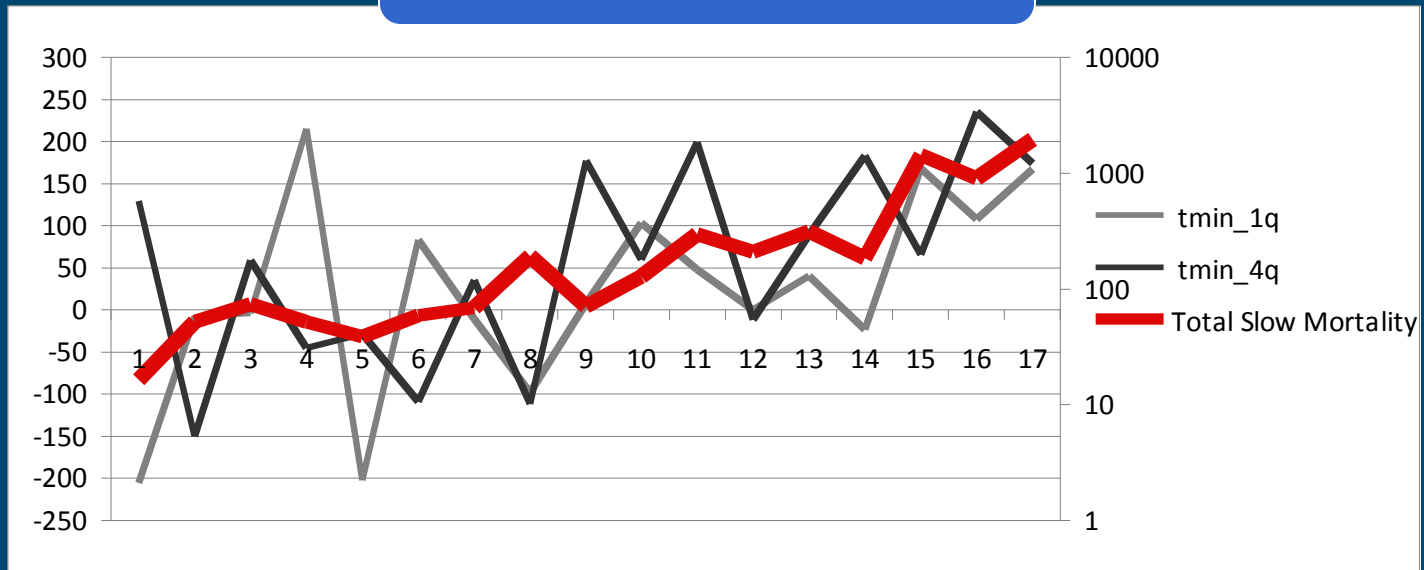
- Observing potential effects relative to cyclic weather years may improve inference



Maps show departure of PRISM data relative to 1978-2009 record

# Eventual goal: Relate attribution to climate series

## North Cascades Ecoregion



*Examine in terms of both overall trends and year over year anomalies, compare to Sierras, desert Southwest, etc.*

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Thank you.