

# CHANGING WILDFIRE AND CLIMATIC REGIMES IN THE 21<sup>ST</sup> CENTURY WESTERN US

1936



2012



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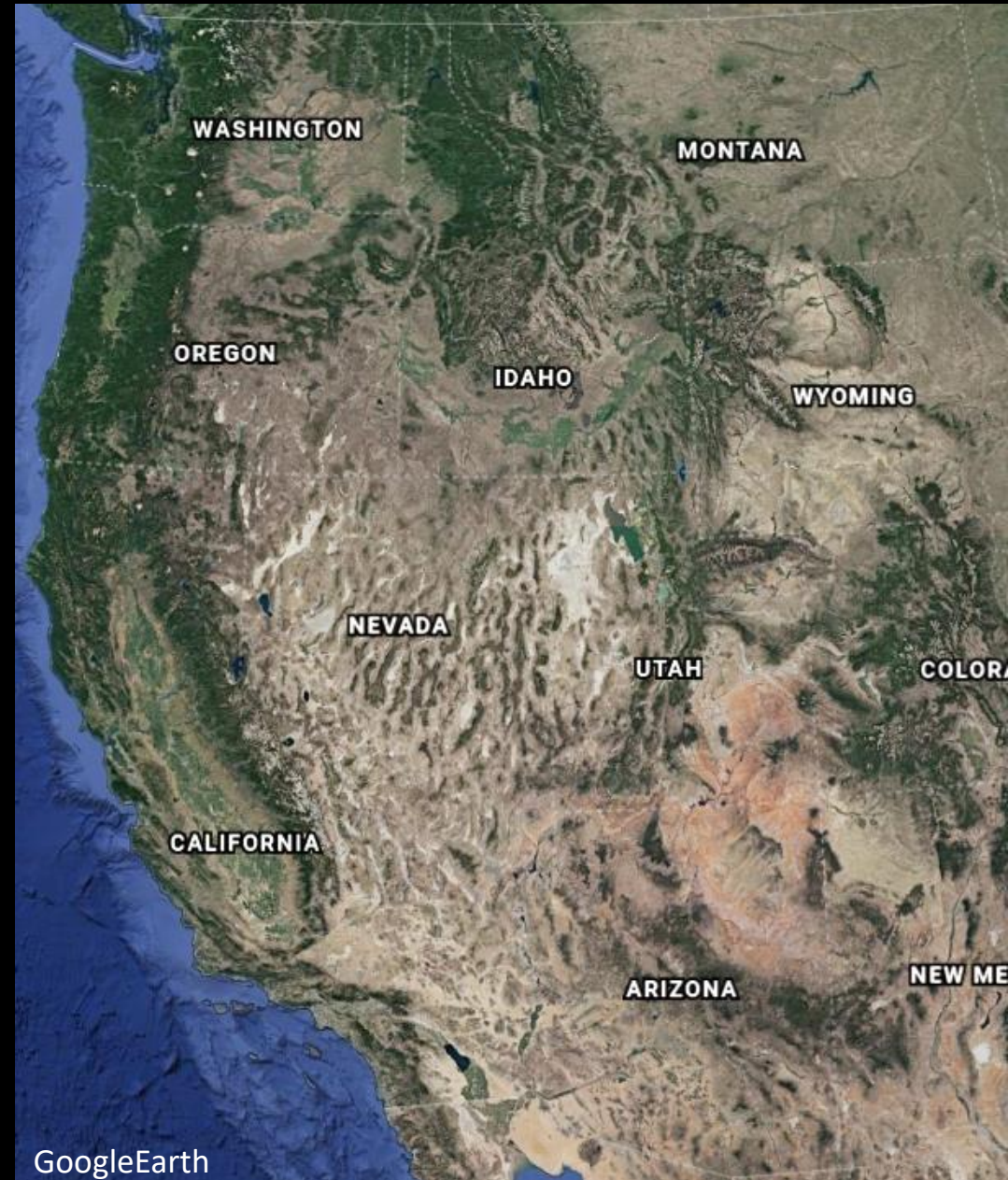
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## The Interior West:

A region of great biotic, cultural, and environmental diversity

...but it is greatly changed over the last 2 centuries





# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

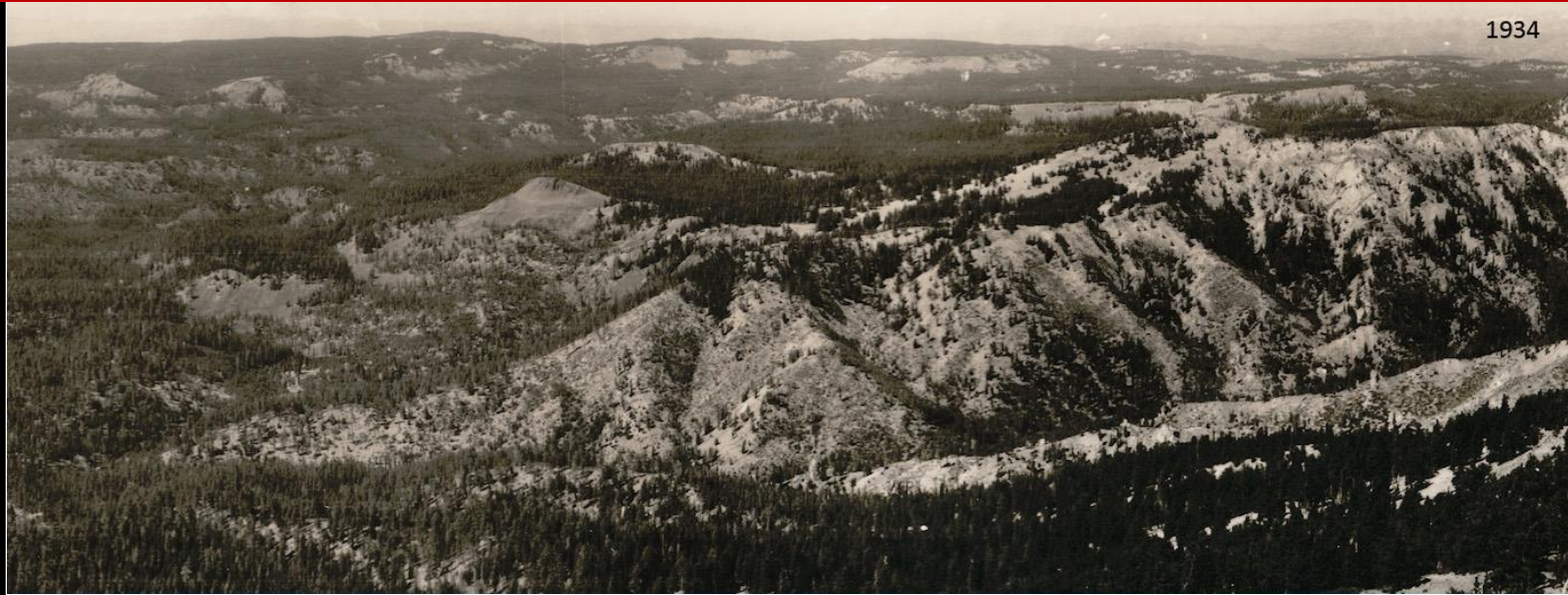


Grass and shrublands decreased...

...forests increased



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



Dry slopes and ridgetops...

...filled in with trees



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

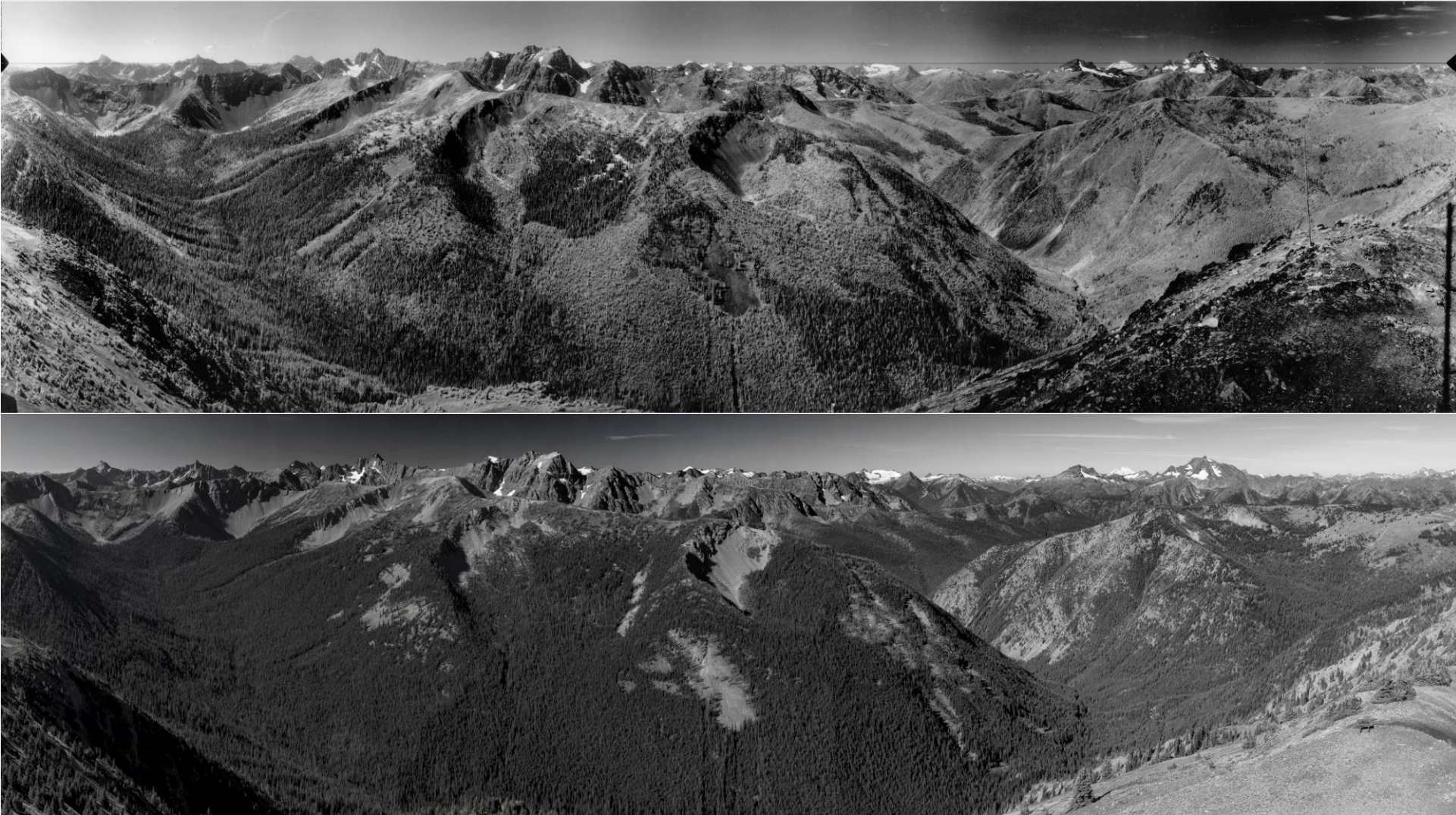


Complex forest age/density patchworks...

...became uniform



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



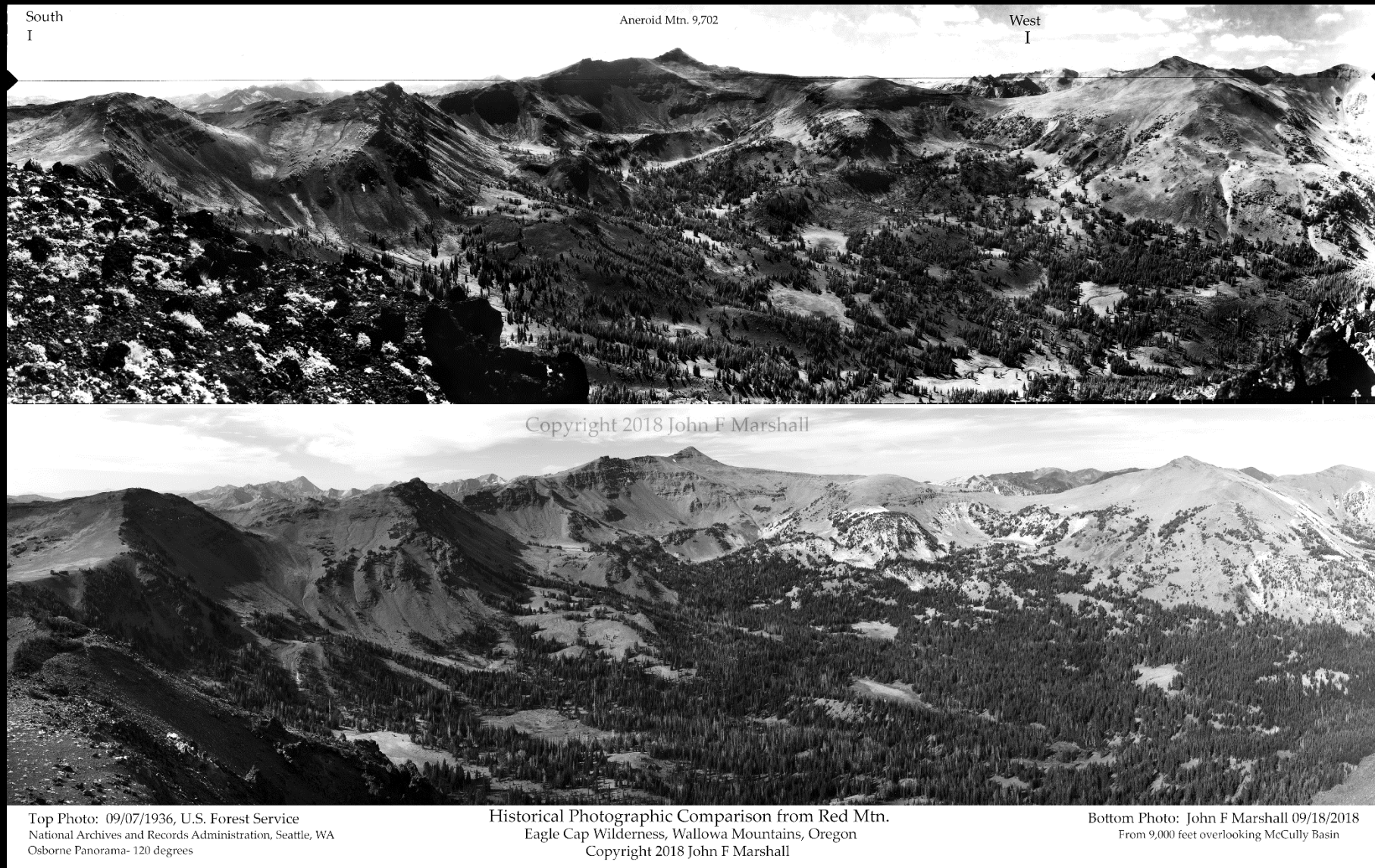
Patchworks of burned and recovering forest...

...gave way to continuous forest

Wildfire Resiliency & Timber Innovation, WoodWorks Symposium, November 2020



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



Abundant high meadows...

...gave way to dense forest



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

## CLOSE UP OF THE CHANGES



Top: U.S. Forest Service 1936  
National Archives

McCully Creek, Wallowa Mtns.  
Eagle Cap Wilderness, Oregon

Bottom: John F Marshall 2018



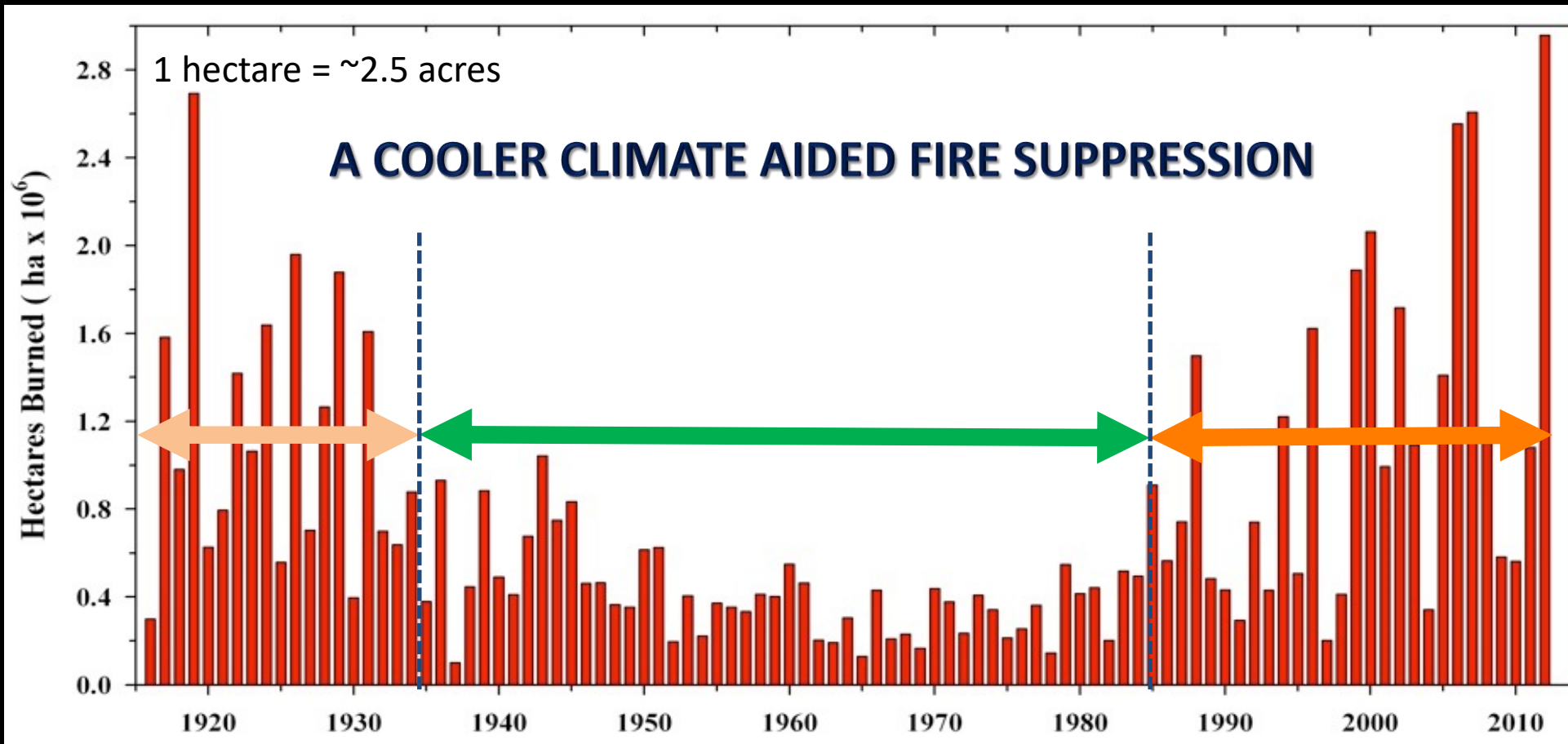
## Primary Change Agents

1850

2020

Timber harvest – Clearcut & selective logging  
Fire exclusion – grazing, development, suppression  
Climate change – warmer, drier, windier





Warm/dry  
climate

Cool/wet climate, active fire  
suppression, burned area declines

Warm/dry climate  
Burned area increases



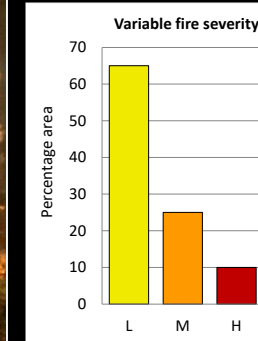
# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



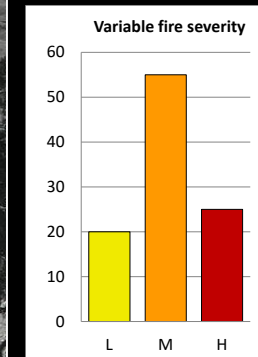
Leecher Mtn SW 1930



## Historical



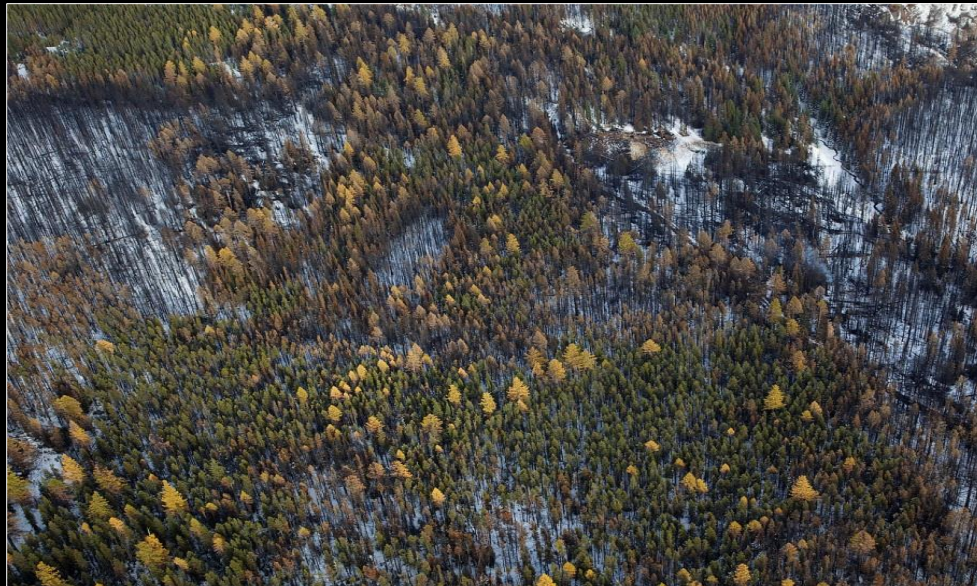
## Current



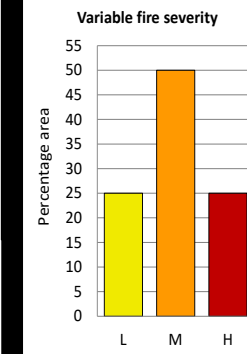
- ✓ Low severity fire <20-25% of the tree cover killed
- ✓ **Common in seasonally dry forests**
- ✓ Fires every 5-25 yrs, reinforced low severity
- ✓ **More extreme climate/weather drove more extreme fires**



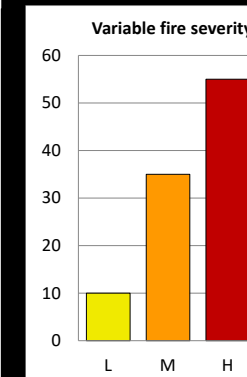
# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



## Historical



## Current



- ✓ Moderate severity, 25-75% of the tree cover killed
- ✓ Common in seasonally dry mixed conifer forests, more snowpack
- ✓ Intermediate frequency, every 20-50 yrs
- ✓ Milder & more severe fires occur, climate driven



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

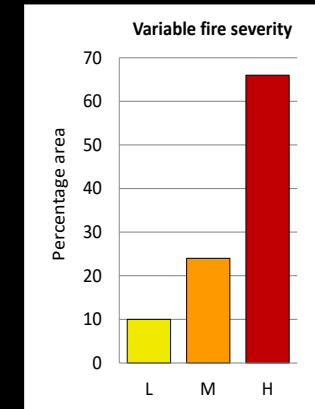


Bethel Ridge 1936

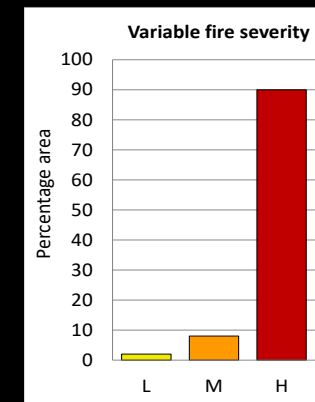


- ✓ High severity > 75% of the tree cover killed
- ✓ Common in wet & cold forests, infrequent (every 75-200+ yr)
- ✓ Mild climate/weather conditions favored milder fires
- ✓ Created variation in fire severity and event patch sizes

## Historical



## Current





## Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

Locally, fires continually thinned forest patches, reducing density & fuels

IMPORTANT  
FEEDBACKS

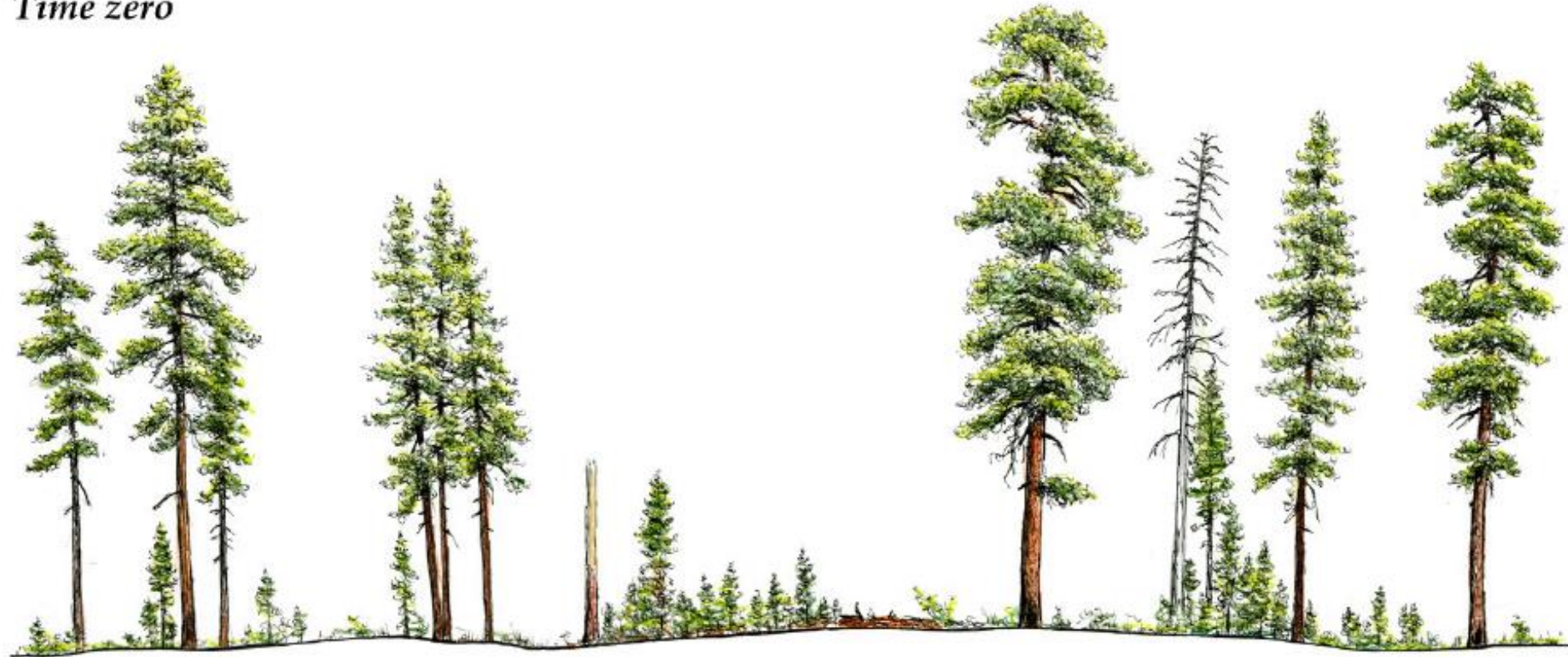


Seasonally  
dry forests



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

*Time zero*



How these patch-level feedbacks worked...

Bob Van Pelt drawings...

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# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

## Without fire suppression





# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

*+ 40 years*





## Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West





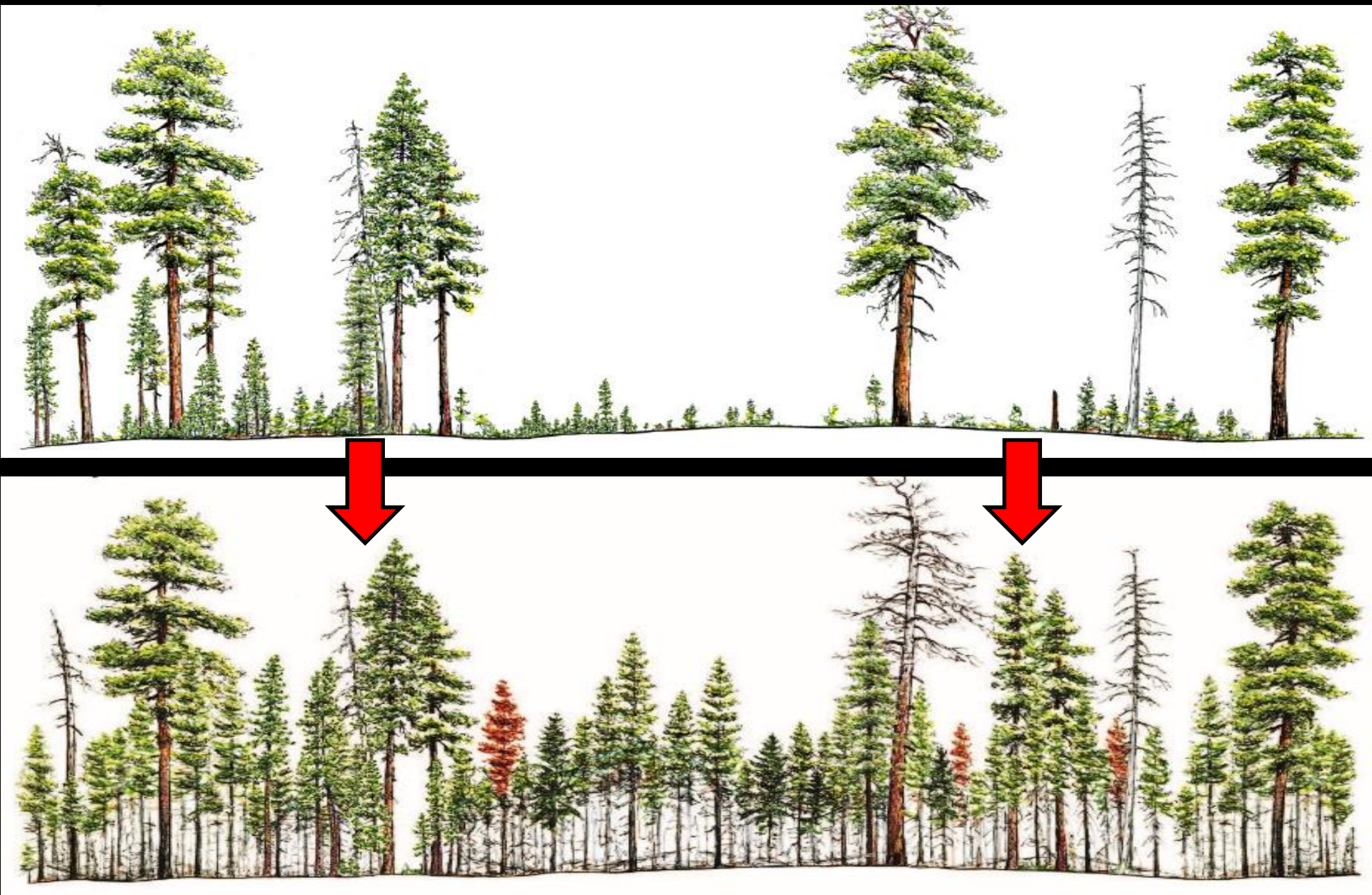
# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

*+ 80 years*





# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



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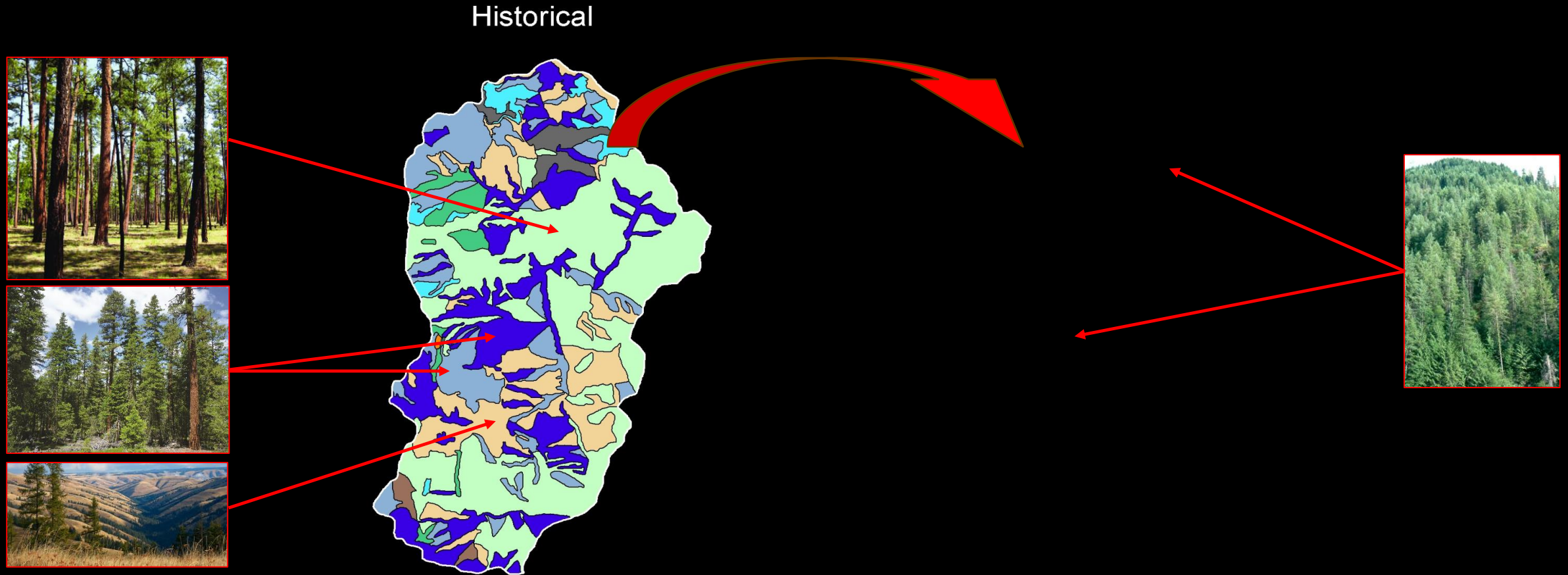
## IMPORTANT FEEDBACKS

Regionally—fires created patchworks of grassland, shrubland, young, middle-aged and older forest conditions, these patterns controlled future fire size & severity





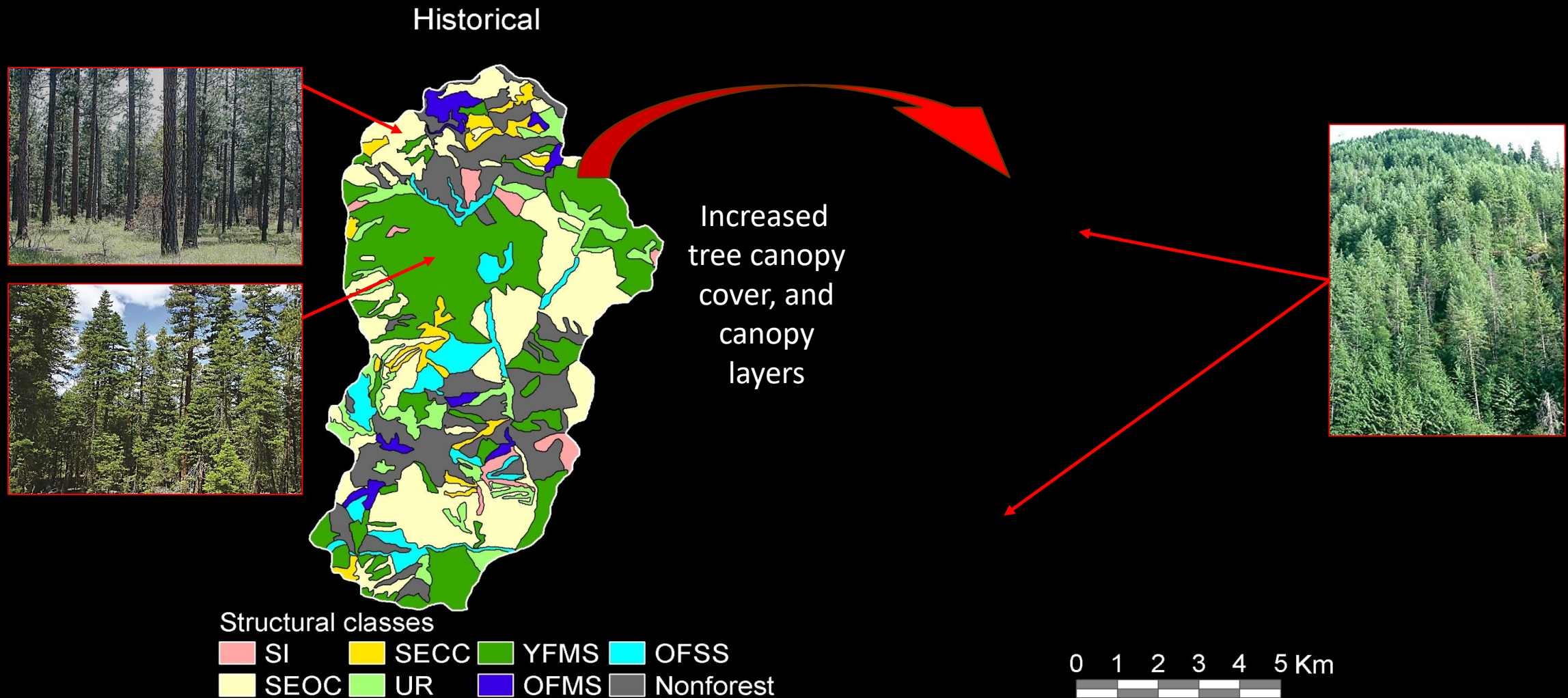
# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



Fire-tolerant tree species abundance decreased; intolerant species increased.  
Ponderosa pine cover gave way to Douglas-fir and grand fir.



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



All age forest mosaic was replaced by **young multi-story forest**

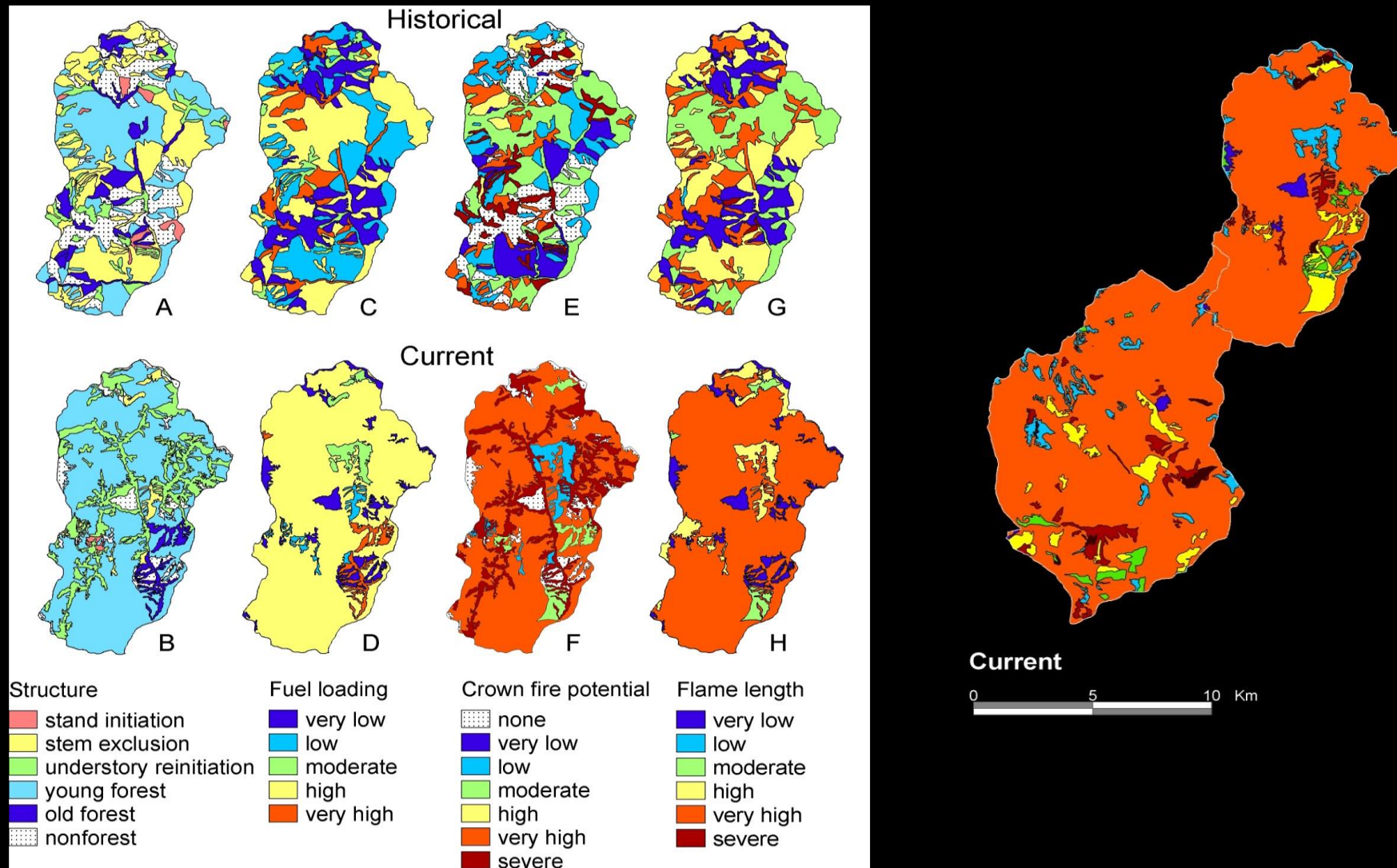


Open stands  
developed  
dense, layered  
understories





# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West



Variable fire severity replaced by severe fire w/ good connectivity



# Changing wildfire and climatic regimes in the 21<sup>st</sup>-century West

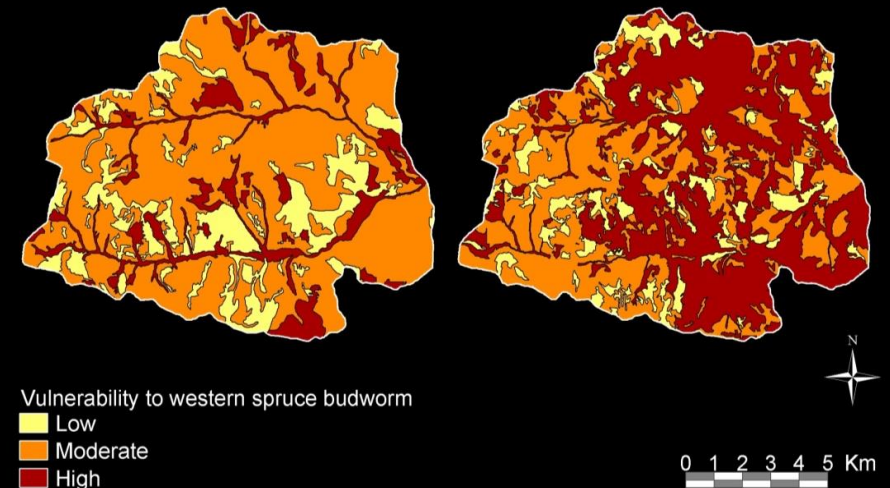


Western spruce budworm



Historical

Current





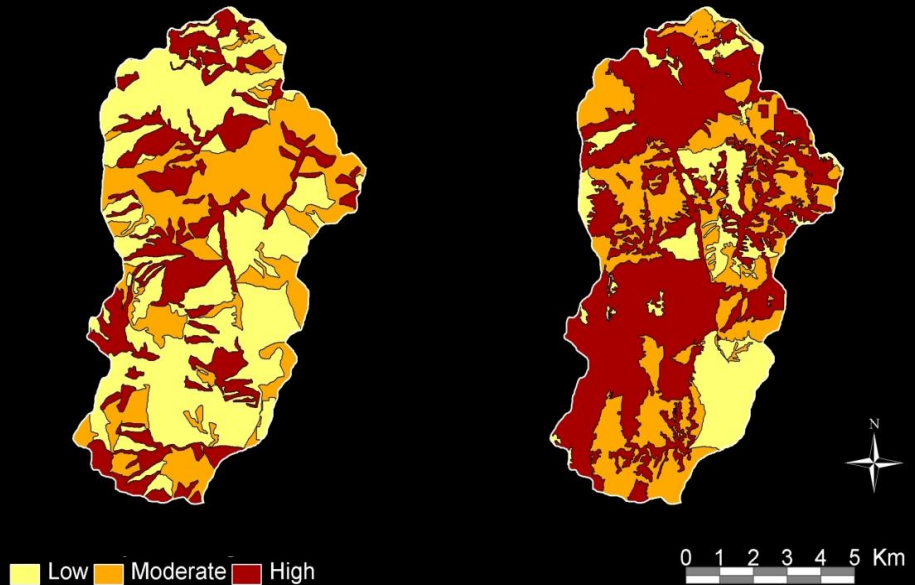
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Mountain pine beetle



Historical

Current





## SUMMARY

- Our forests need to/will burn. We can influence how often, severe, less so how large. Climate mostly drives that
- **Our climate & weather becoming more extreme; upward trend in 21<sup>st</sup> century**
- Today's wildfires burn more severely & larger than most historical fires
- **If the goal of management is to adapt landscapes to the coming climatic changes, adaptation of existing forest structure & composition is needed:**
- More open canopy forest, less forested area-more meadows
- **Vary forest age-density-layering structure—match it to the topography**
- Managed wildfire & Rx burning in backcountry, thinning-biomass utilization-Rx burning in managed forests, restore good fire, increase pace & scale
- **Social problem-ecological explanation; up to us to chart a new path**

