

# **The Carbon Implications of Western Forest Health and Wildfire Conditions.**

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*Common Sense Solutions for  
Natural Resource Challenges*

# Outline

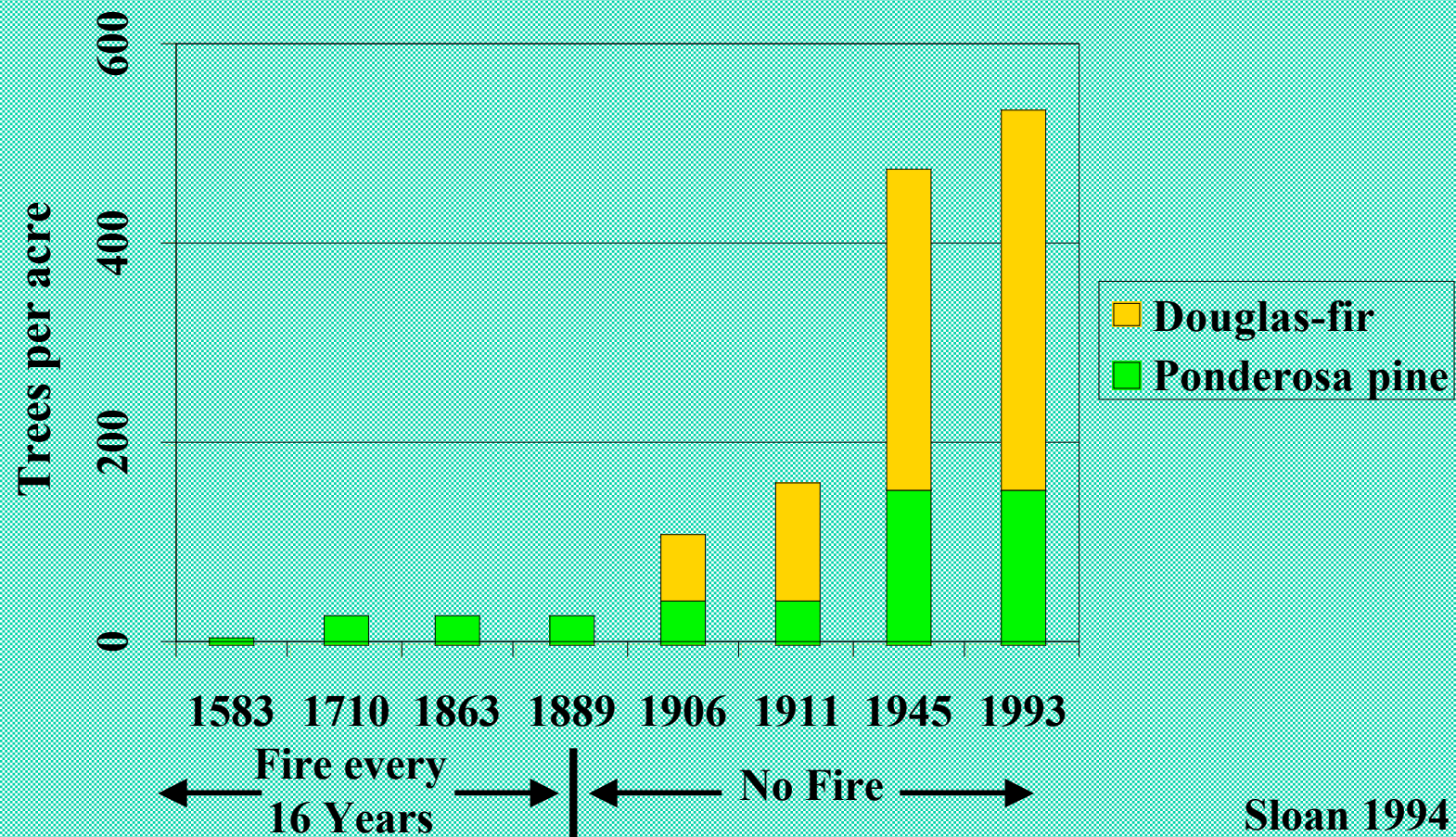
- Western Forest Health Situation
- Western Wildfire Situation
- Estimate of Carbon Emissions in 2000
- Relation to National Targets
- Effect on Human Populations
- Effect on Future Carbon Sequestration

# Western Forest Health

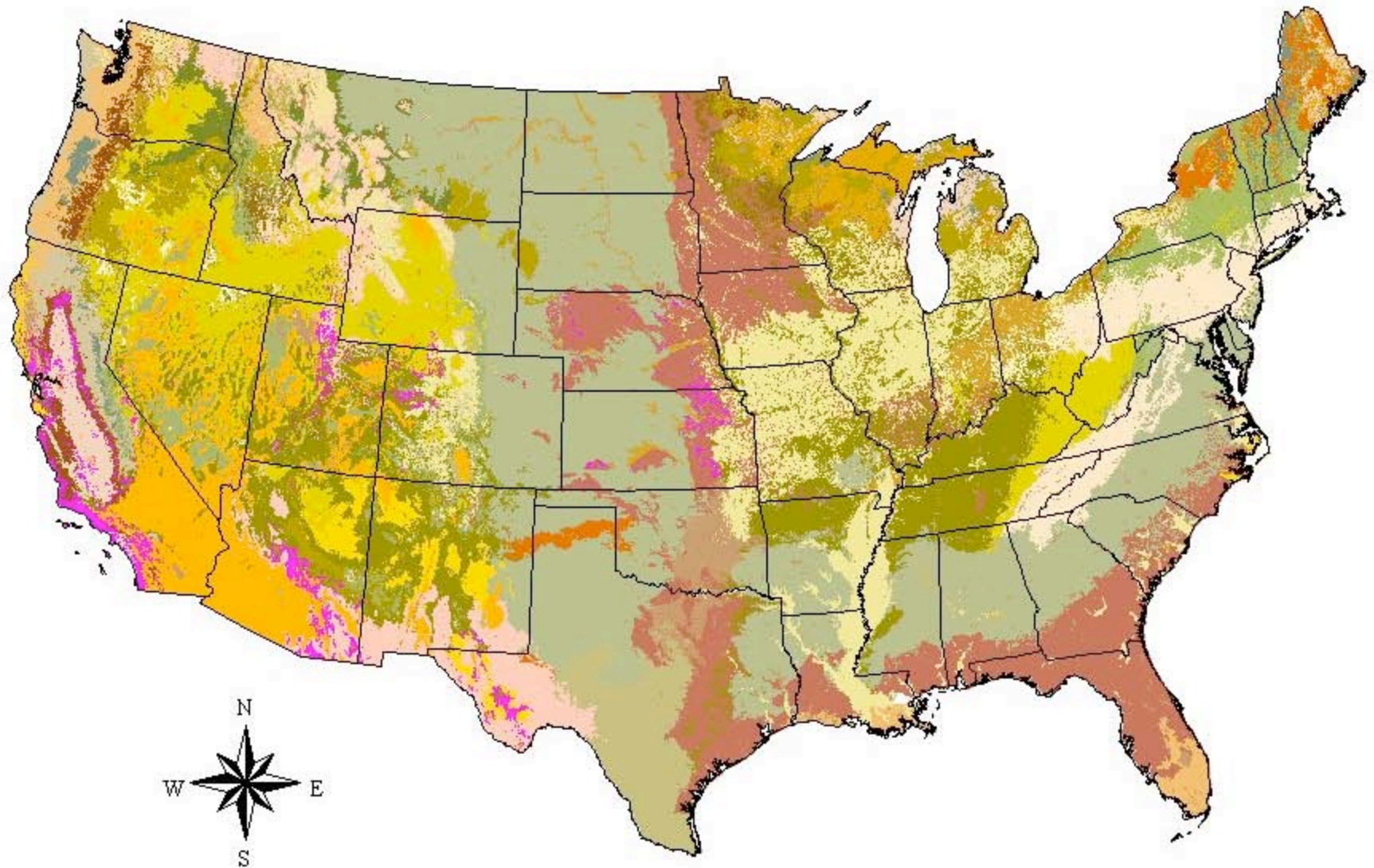
- Species and Density Change
  - Ponderosa pine  $\longrightarrow$  Douglas-fir  $\longrightarrow$  True Firs
  - $< 100$  per acre  $\longrightarrow$  500 – 1200 per acre
- Ecosystems at Risk
  - Definition
  - Coarse-filter study

# Tree Species and Density

## Boise Basin, Idaho



# Potential Natural Vegetation



900

0

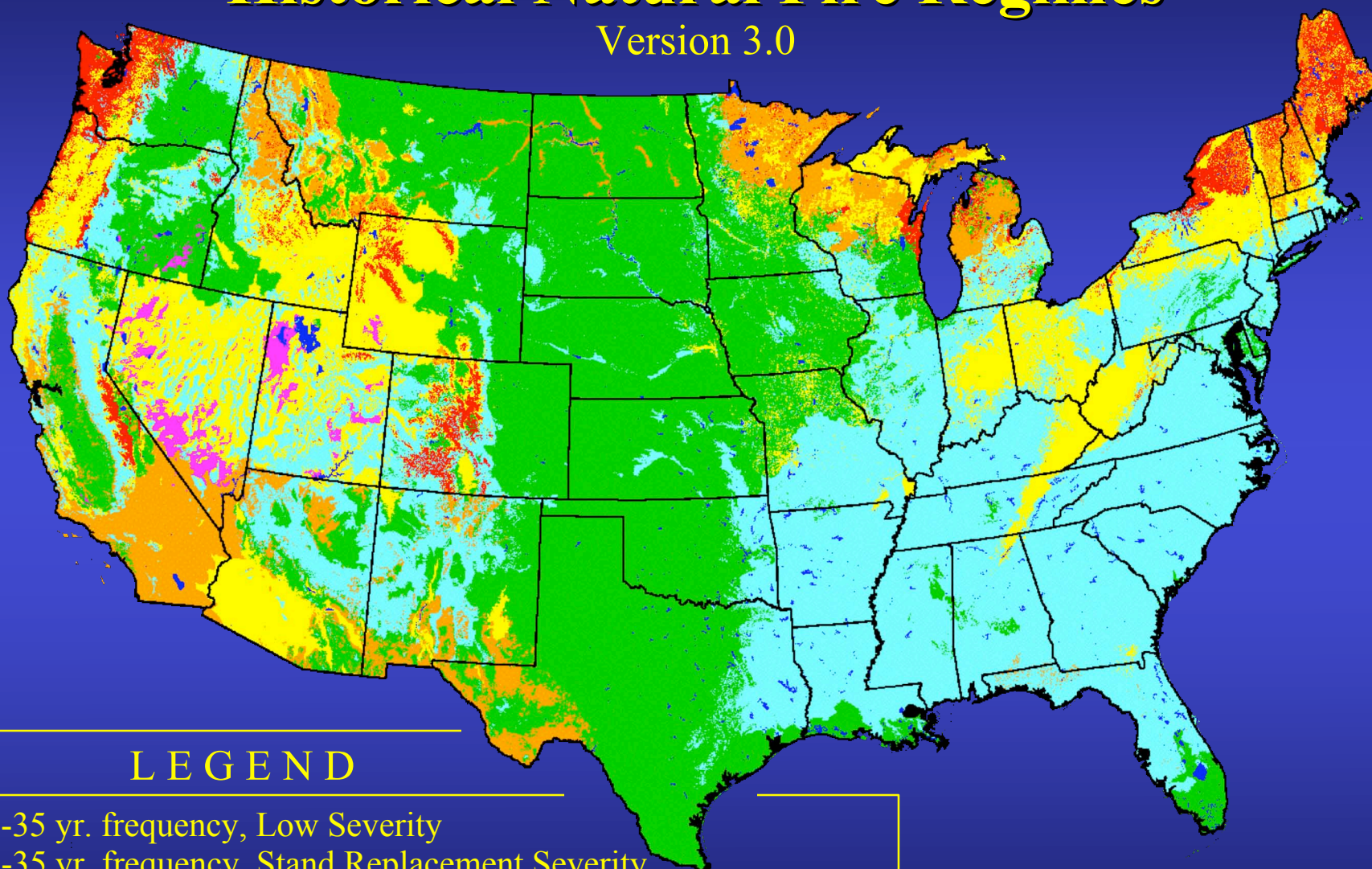
900

1800 Miles



# Historical Natural Fire Regimes

Version 3.0



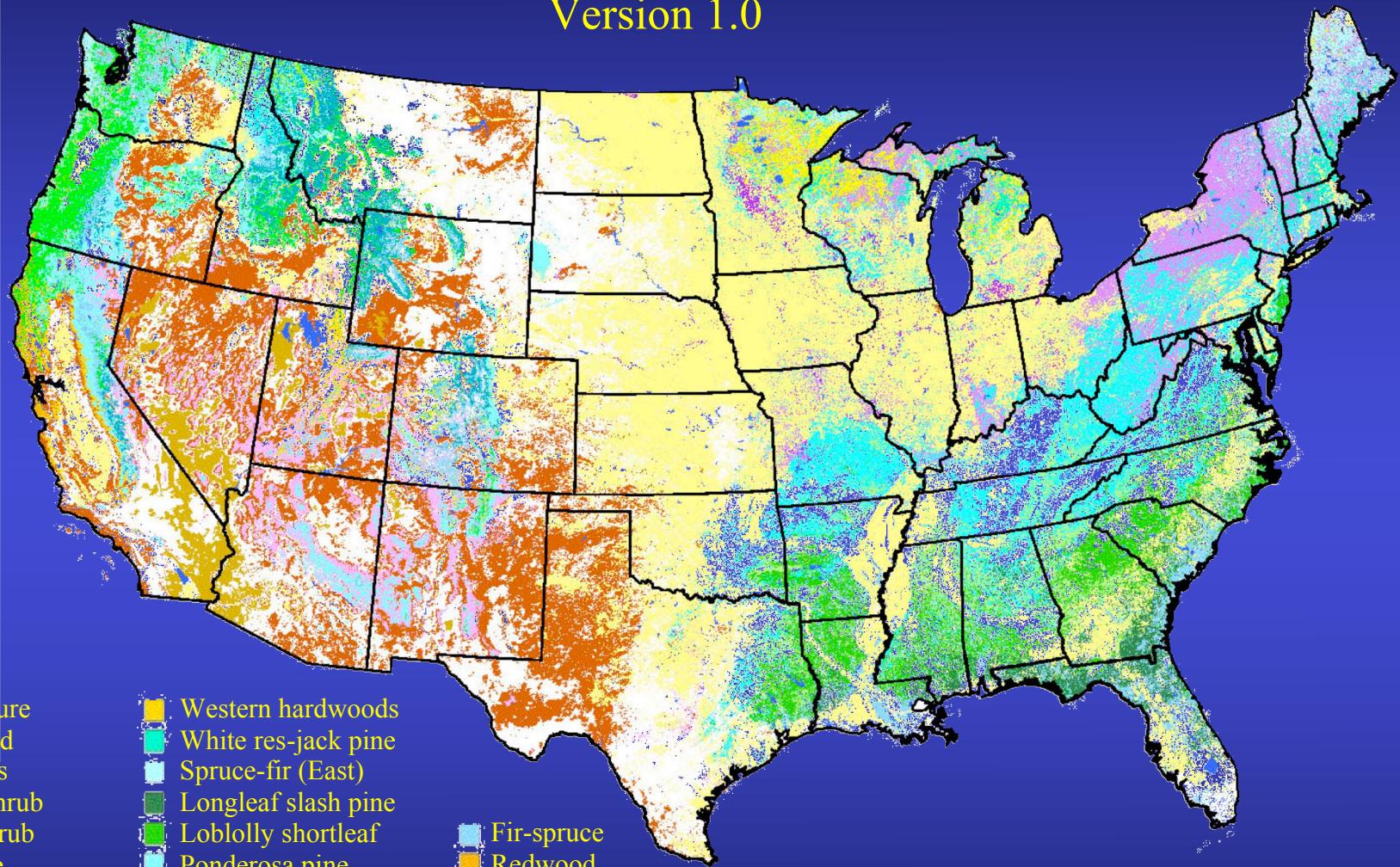
## LEGEND

- |   |  |
|---|--|
|  0-35 yr. frequency, Low Severity                  |  |
|  0-35 yr. frequency, Stand Replacement Severity    |  |
|  35-100+ yr. frequency, Mixed Severity             |  |
|  35-100+ yr. frequency, Stand Replacement Severity |  Barren |
|  200+ yr. frequency, Stand Replacement Severity    |  Water  |



# Current Cover Types

Version 1.0



- |                      |                        |                          |
|----------------------|------------------------|--------------------------|
| ■ Agriculture        | ■ Western hardwoods    | ■ Fir-spruce             |
| ■ Grassland          | ■ White res-jack pine  | ■ Redwood                |
| ■ Wetlands           | ■ Spruce-fir (East)    | ■ Pinyon juniper         |
| ■ Desert shrub       | ■ Longleaf slash pine  | ■ Alpine Tundra          |
| ■ Other shrub        | ■ Loblolly shortleaf   | ■ Barren                 |
| ■ Oak pine           | ■ Ponderosa pine       | ■ Water                  |
| ■ Oak hickory        | ■ Douglas-fir          | ■ Urban/Development/Agr. |
| ■ Oak gum cypress    | ■ Larch                |                          |
| ■ Elm ash cottonwood | ■ Western white pine   |                          |
| ■ Maple beech birch  | ■ Lodgepole pine       |                          |
| ■ Aspen birch        | ■ Hemlock Sitka spruce |                          |

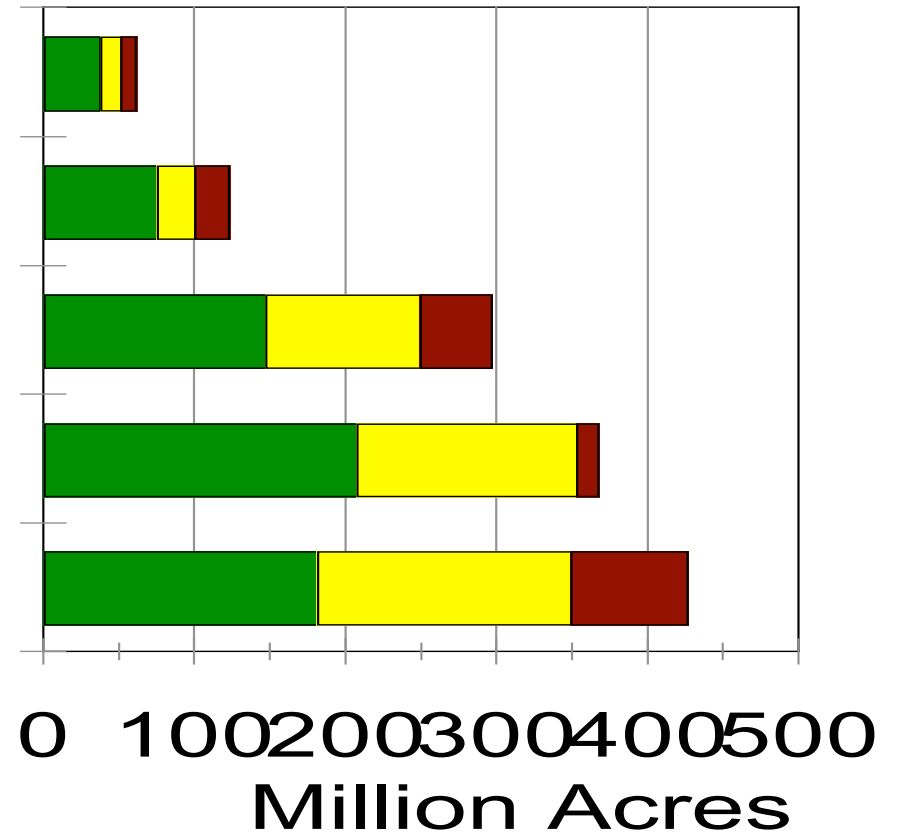
# Condition Classes

- **Class#1** –Ecosystem is largely intact and functioning.
- **Class#2** – Ecosystem has undergone moderate changes. Conditions have shifted towards a less resilient system
- **Class #3**– The disturbance regime has been significantly altered. **Condition predisposes the system to major changes, including the possible loss of key components or processes.**



# Fire Regime and Cond

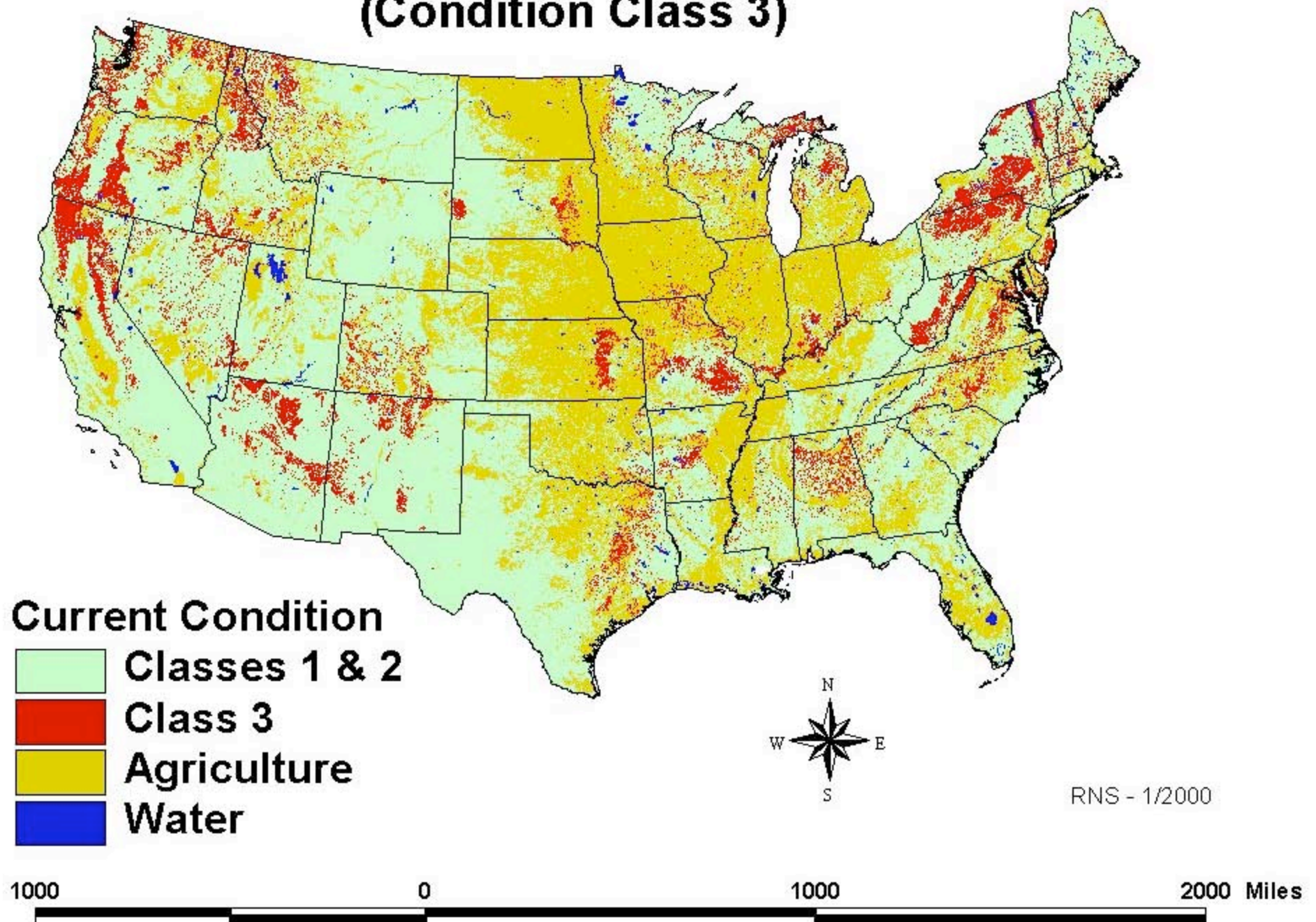
yrs; Stand Replacement  
 yrs; Stand Replacement  
 00+ yrs; Mixed Severity  
 yrs; Stand Replacement  
 0-35 yrs; Low Severity



Wildland vegetation cover (excludes water, agriculture, barren)

Class 1
  Class 2
  Class 3

# Highest Ecological Risk from Wildfire (Condition Class 3)



# Results

- 148 million acres (22%) of U.S. forests are in Condition Class #3. Over half of those lands (82 million acres) are in the low elevation, 0-35 year Fire Regime Groups.
- 47 million acres (25%) of the National Forest System is in Condition Class #3.
- 29 million acres on the NFS are in low elevation, short fire return interval systems.

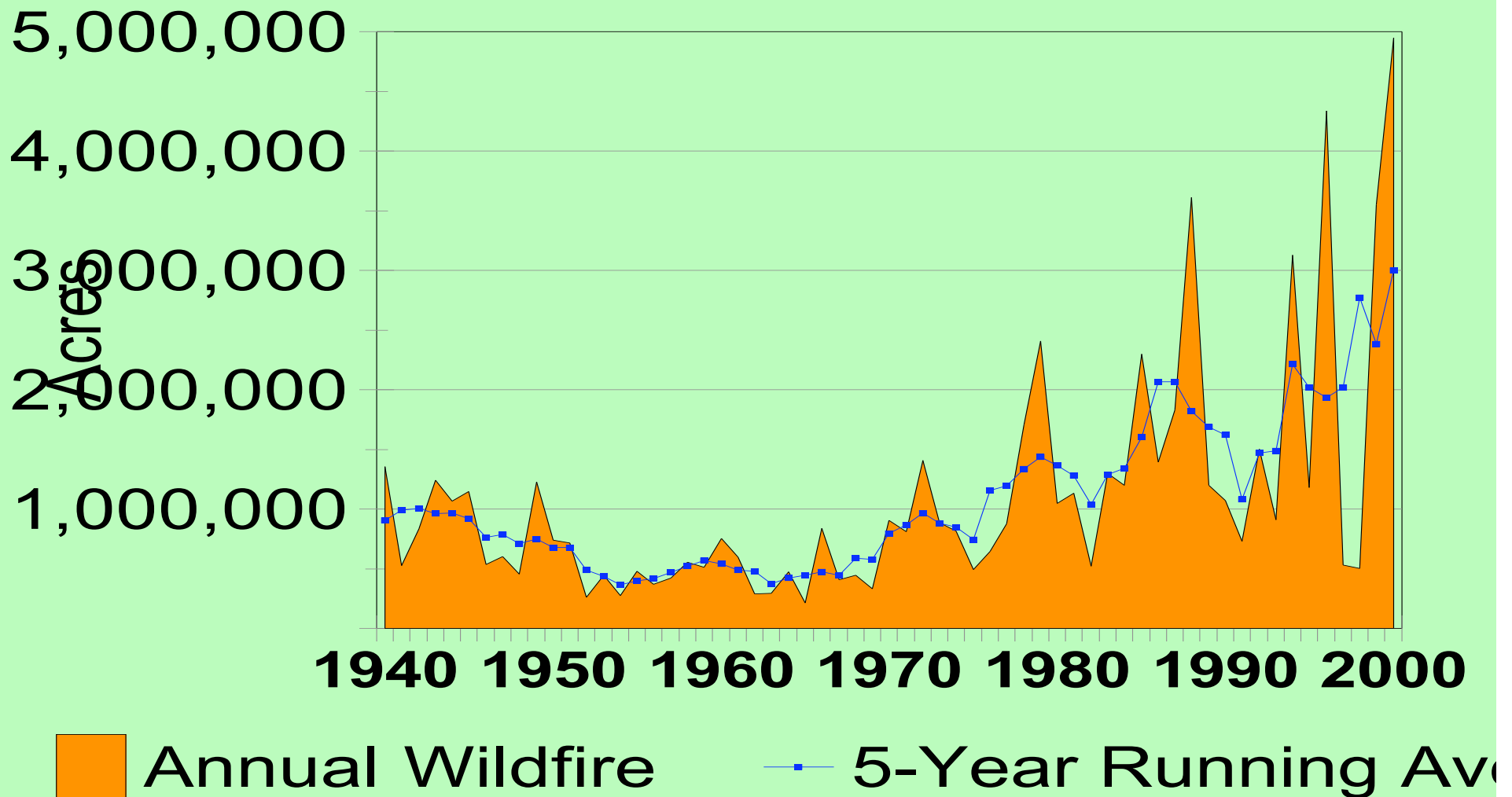


# Western Wildfire Situation

- Recent Trends in Wildfire Area
- Trends in Wildfire Severity
- Implications of Severity
  - Soil Impact
  - Watershed Impact
  - Human Health

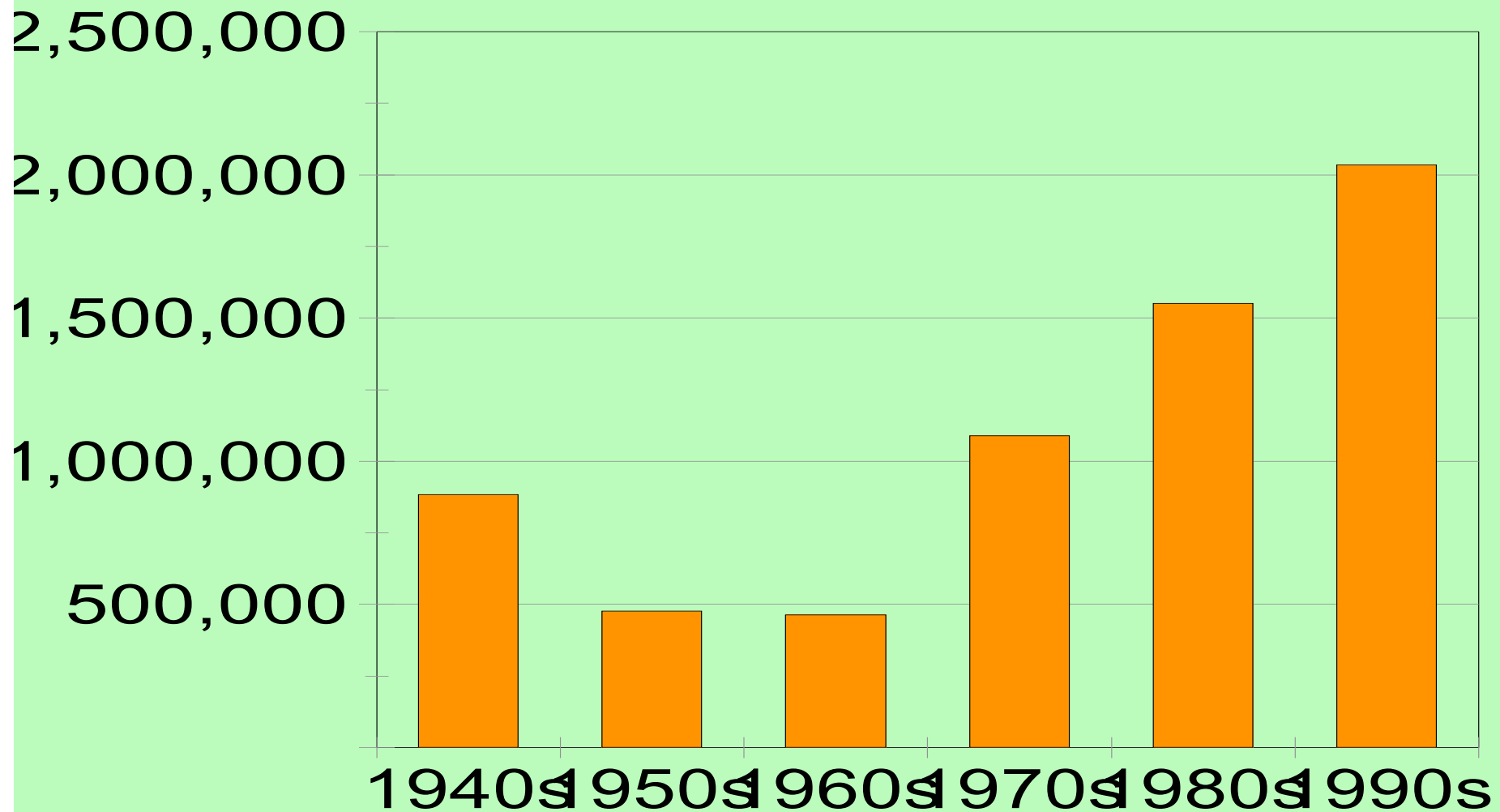
# Wildfire Acreage

## 11 Western States



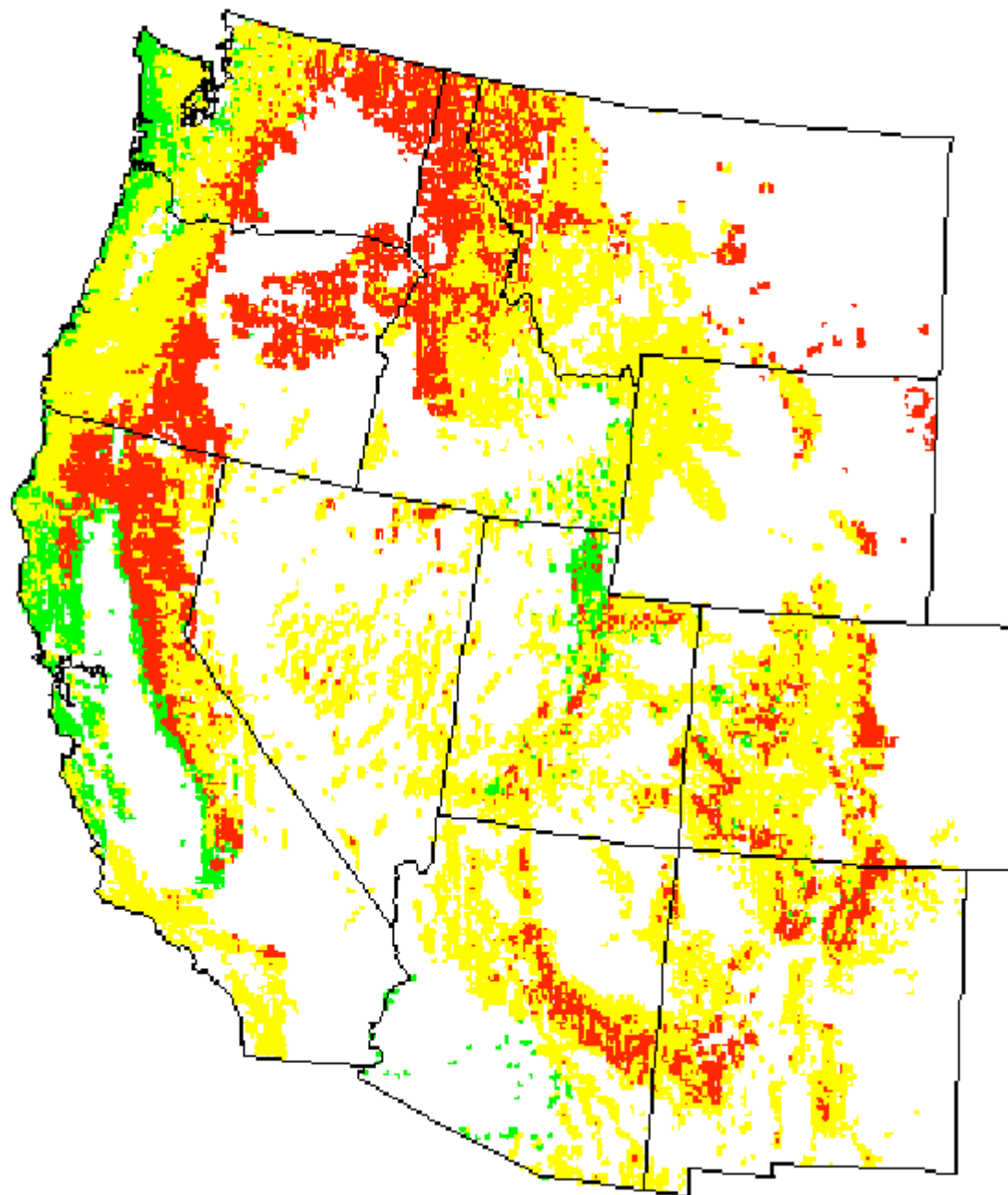
# Average Annual Wildfire b

## 11 Western States





## Western Forests at Wildfire Risk



High



Moderate



Low

# Wildfire Risk Defined

- Current conditions are defined in terms of **departure from the historic fire regime** as determined by the number of missed fire return intervals and the current structure and composition of the system resulting from changes in the disturbance system.









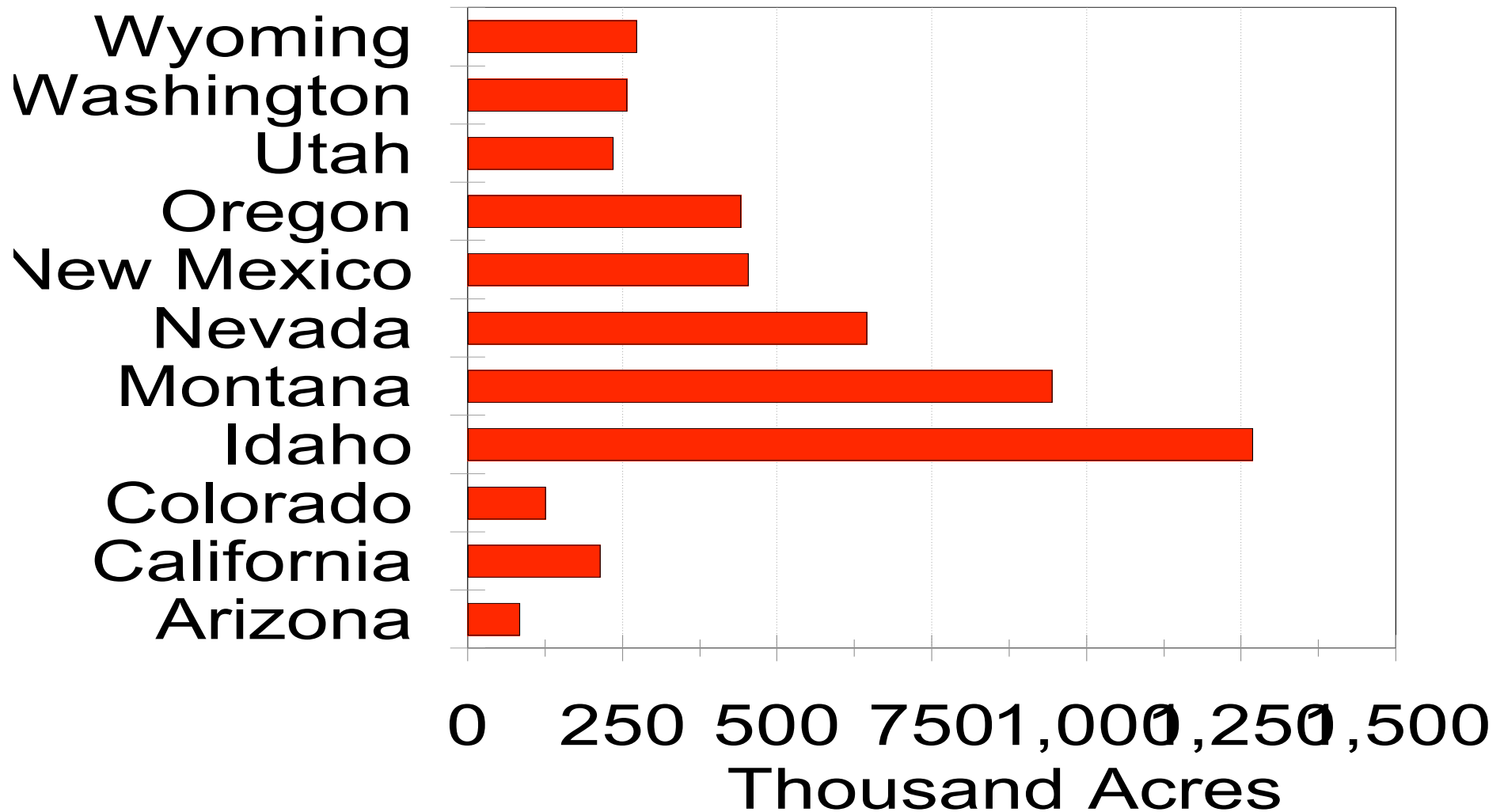




# Wildland Fires 2000

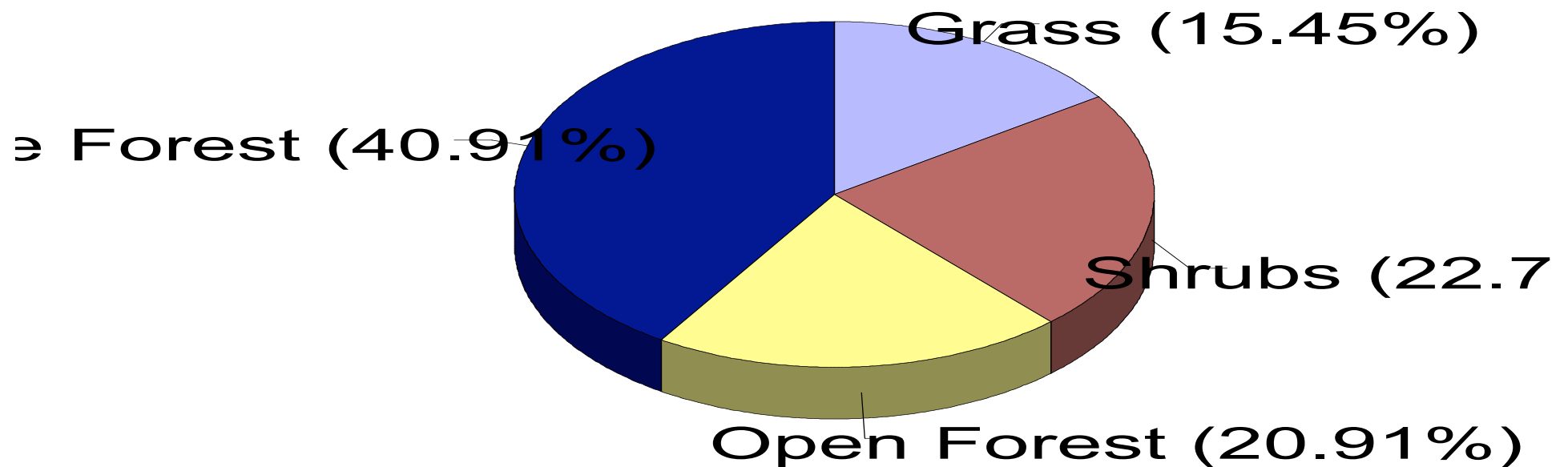
- Estimated wildfire as of 11/20/00
  - 5,082,172 acres (2.1 mha)
- Other high years in the decade
  - 1996 – 4,334,650 acres (1.8 mha)
  - 1999 – 3,551,668 acres (1.5 mha)
  - 1994 – 3,130,000 acres (1.3 mha)

# Wildland Fires, 2001

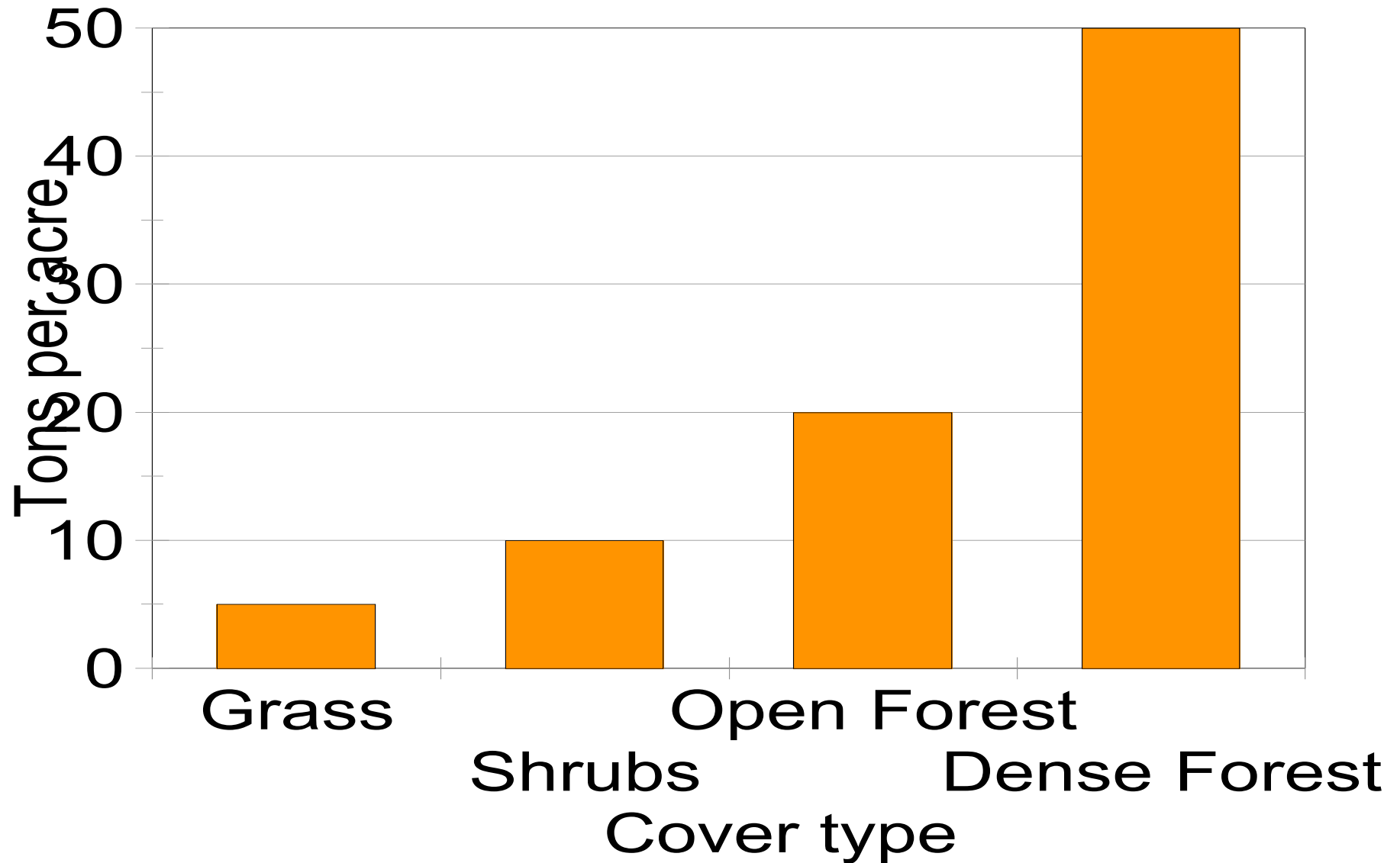


# Estimated Cover Type for 2000 Wildfires

11 Western States, United States



# Average Fuel Cons



# Estimated C Emissions Wildland Fires, 2000

- Grass – 729,000 acres – 1.6 million tons C
- Shrubs – 885,000 acres – 4 million tons C
- Open Forest – 925,000 acres – 8.3 million tons C
- Dense Forest – 2.42 million acres – 54 million tons C
- Total Estimate – 5 million acres -- 65-75 million tons C emitted



# Relationship to National Estimates

- U.S. currently estimates that its managed forests remove between 278 and 341 MMTCE per year, or around 310 as a central estimate.
- This is projected to decline to about 245-341 (288) MMTCE by 2010 as Eastern forests mature and growth rates decline.

# 2000 Wildland Fires

## 11 Western States

- Delayed Release: 10-20 Million Tons C, from slow decay of dead wood and increased soil exposure.
- Reduced Future Sequestration: Will it affect future national estimates? Again, if we predict these forests to be re-growing, but they are not, that will make a difference.

# Relationship to National Targets

- Under Kyoto, the U.S. agreed to a reduction of 7% below 1990 emission levels (about 1,534 MMTCE) by 2010.
- Assuming business as usual, the 2010 emissions will be around 600 MMTCE higher than the U.S. Target.
- Western forests emitted 240 – 300 MMTCE in the decade of the 1990's, not counting soil or delayed emissions.

# Historical Fire Regimes

- Conterminous U.S. experienced fires covering an average of 85 to 210 million acres annually, according to estimates based on vegetation types and fire regimes (Leenhouts 1998).
- 580 to 1,350 million tons of fuel consumed.
- 260 to 600 MMTCE average annual emissions (Today, we emit about 1,400 MMTCE of fossil fuel emissions)

# Current Cover Types

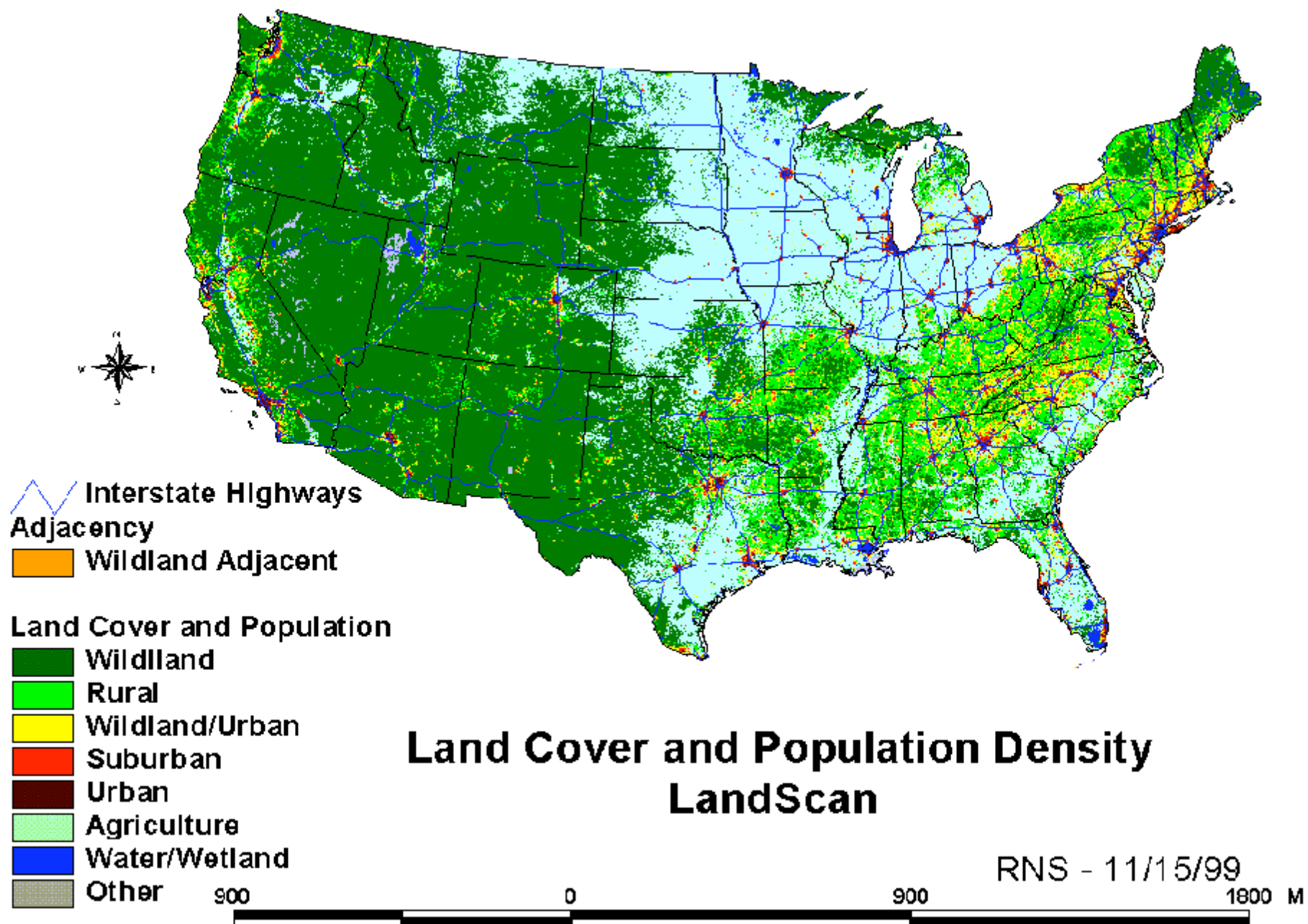
- If the current cover were returned to historic fire regimes, there would be 44-106 million acres burned on annual average (Leenhouts 1998).
- Average Annual Emissions would be 135 – 300 MMTCE
- That would add quite a load to our fossil-burdened air (and lungs).
- If someone proposes a return to “natural” fire regimes to manage U.S. wildlands, be cynical.



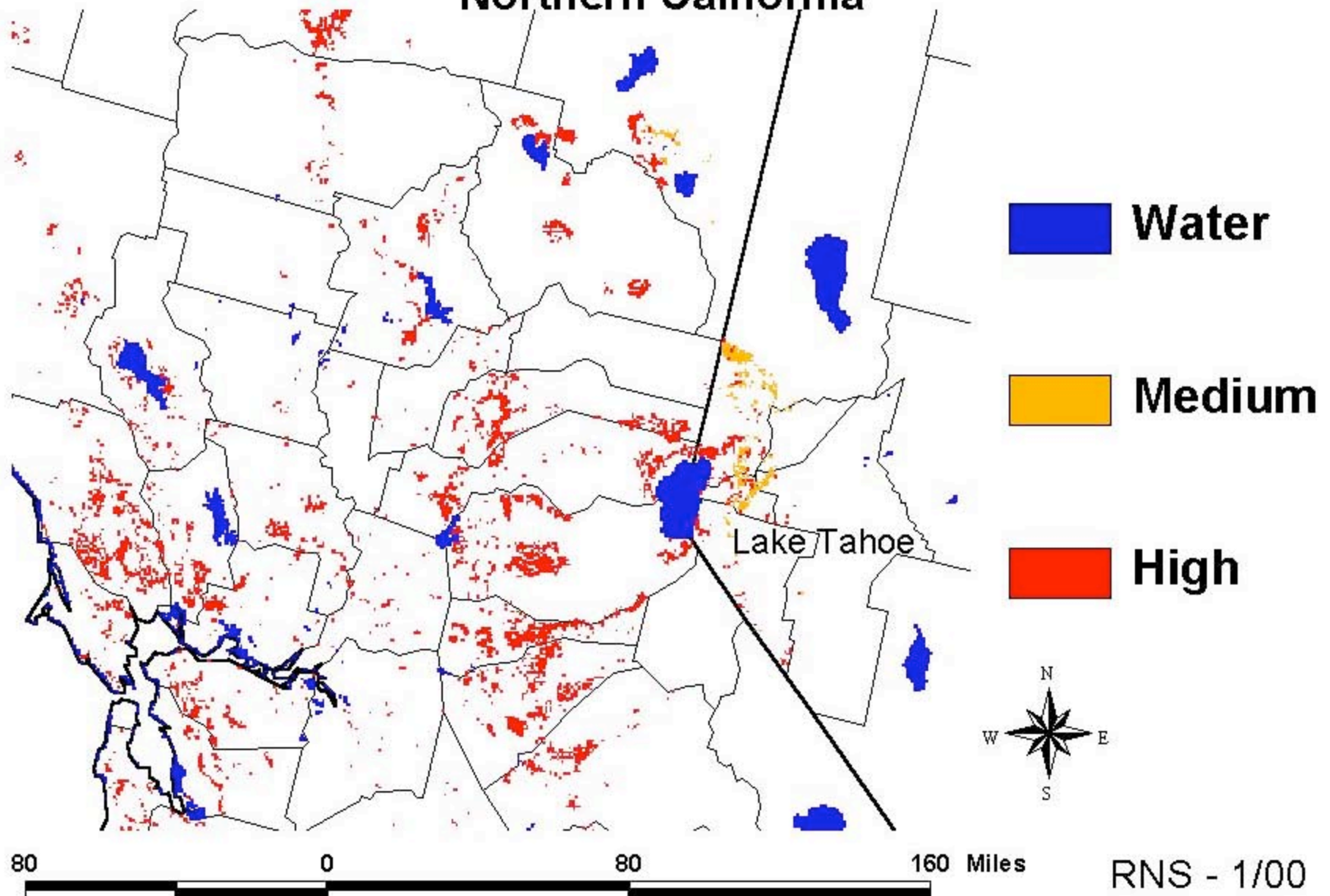
# Human Populations

- There are some 65 million people in the West today.
- Much new growth occurs in or next to wildland regions.
- That adds to the danger, while often increasing the controversy over forest treatment.



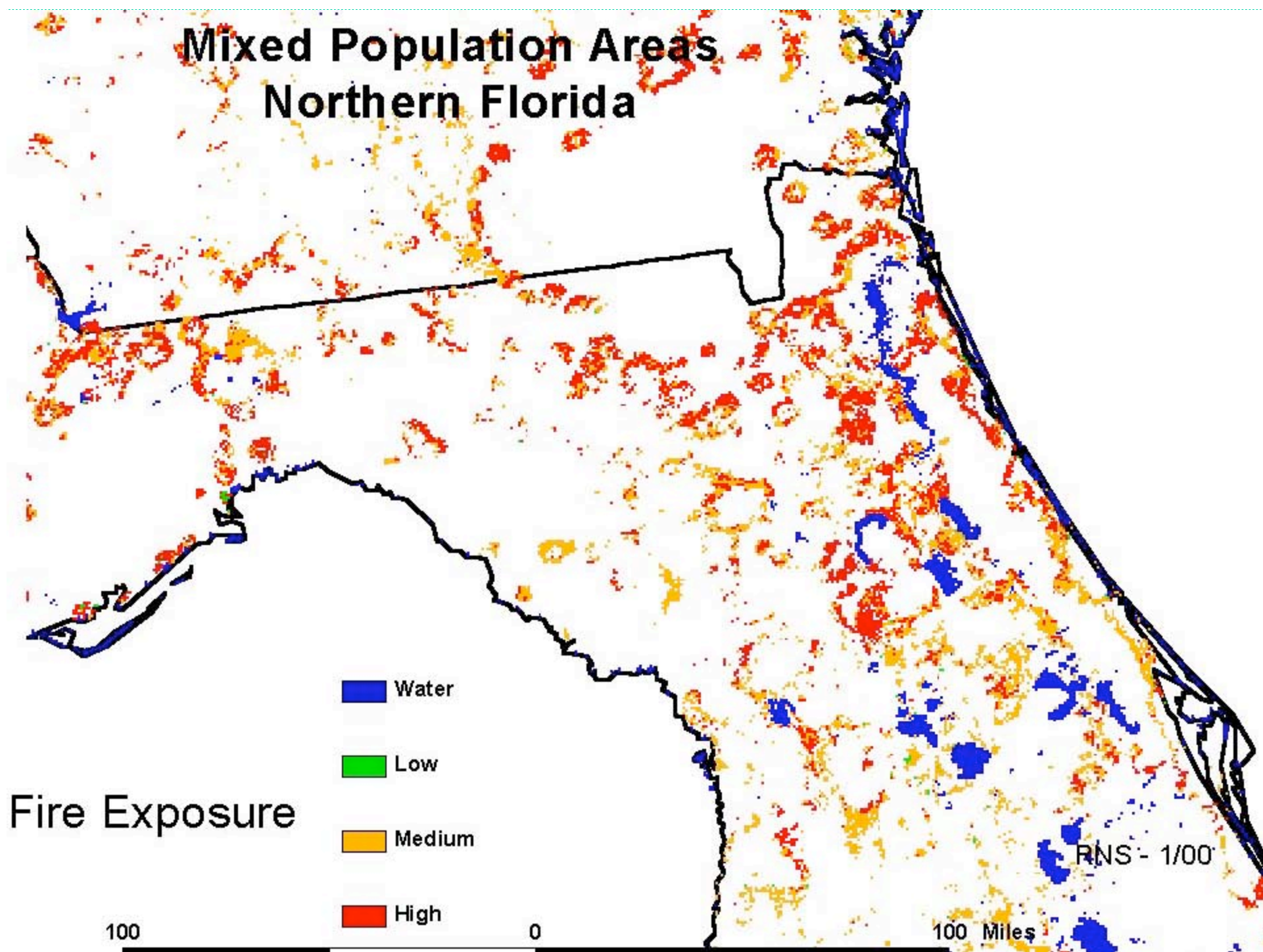


# Medium and High Fire Exposure, Wildland-Urban Interface, Northern California





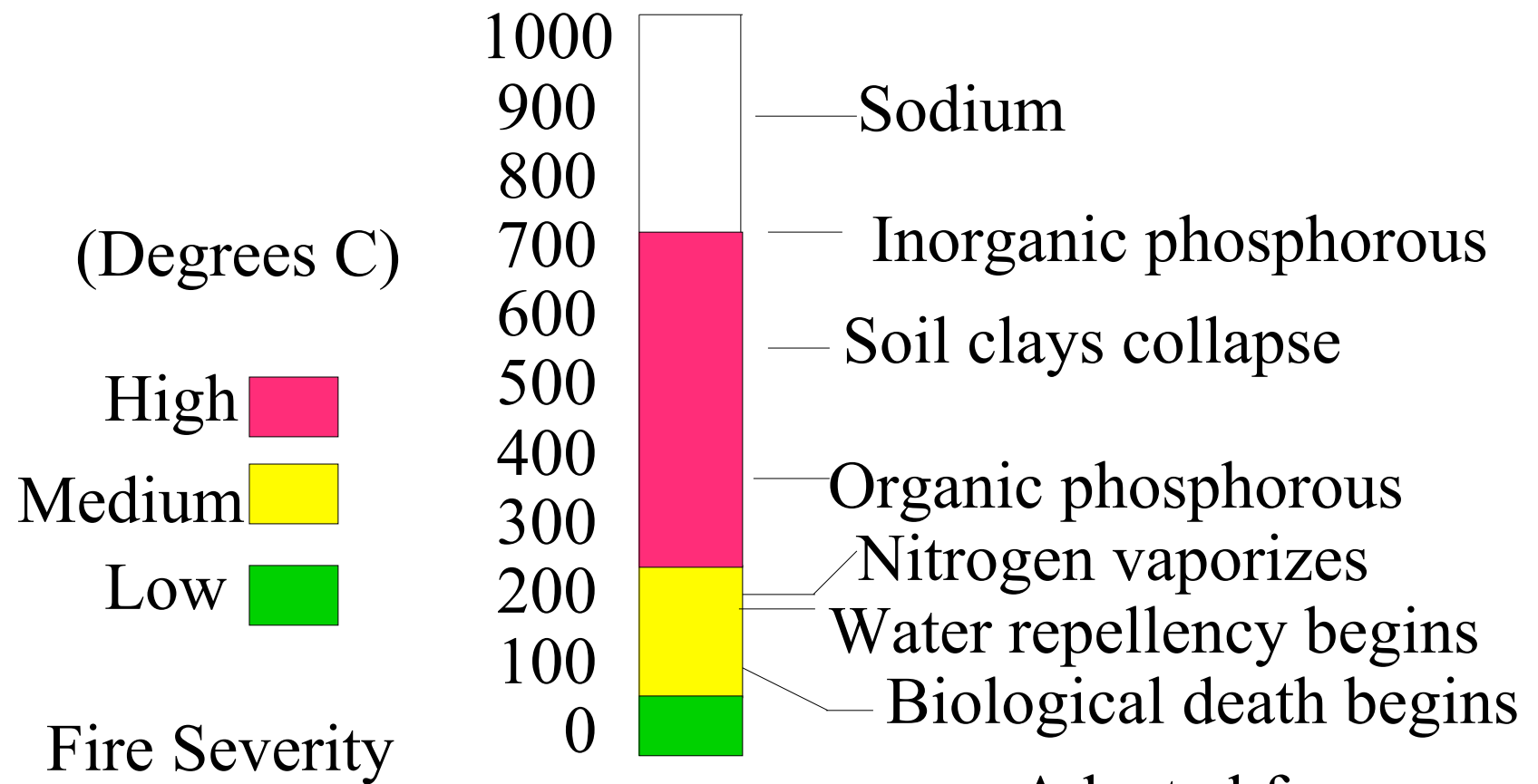
# Mixed Population Areas Northern Florida





# Will Burned Forests Recover?

- Depends on how seriously the soils have been damaged.
- Primary damage is in loss of soil carbon and nutrients.
- Severely damaged soils may have other nutrient losses, fused clays, and other structural damage.
- Erosion may be significant in post fire years.

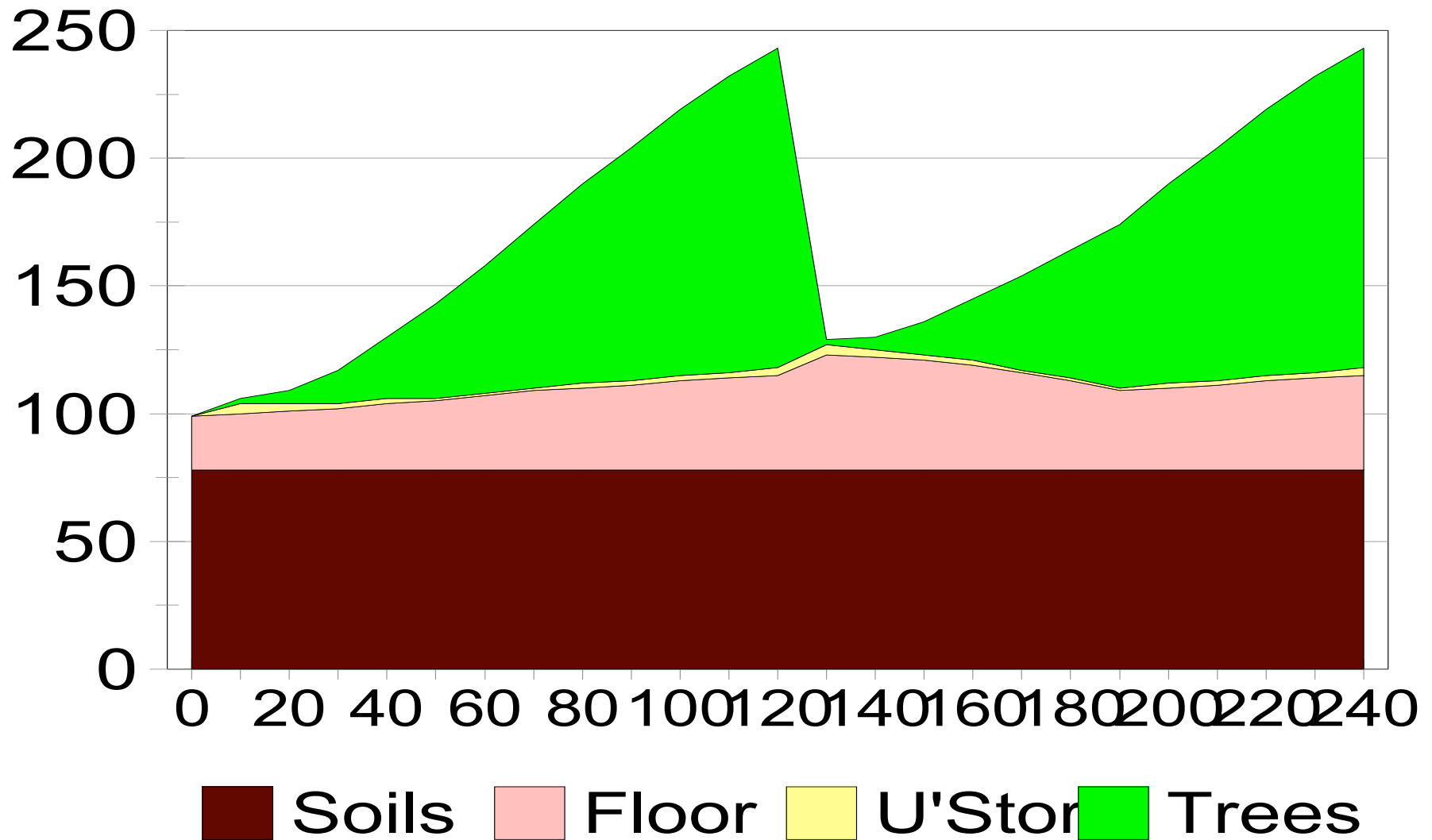


Adapted from  
Agee, 1993

## Soil Impacts from Heat

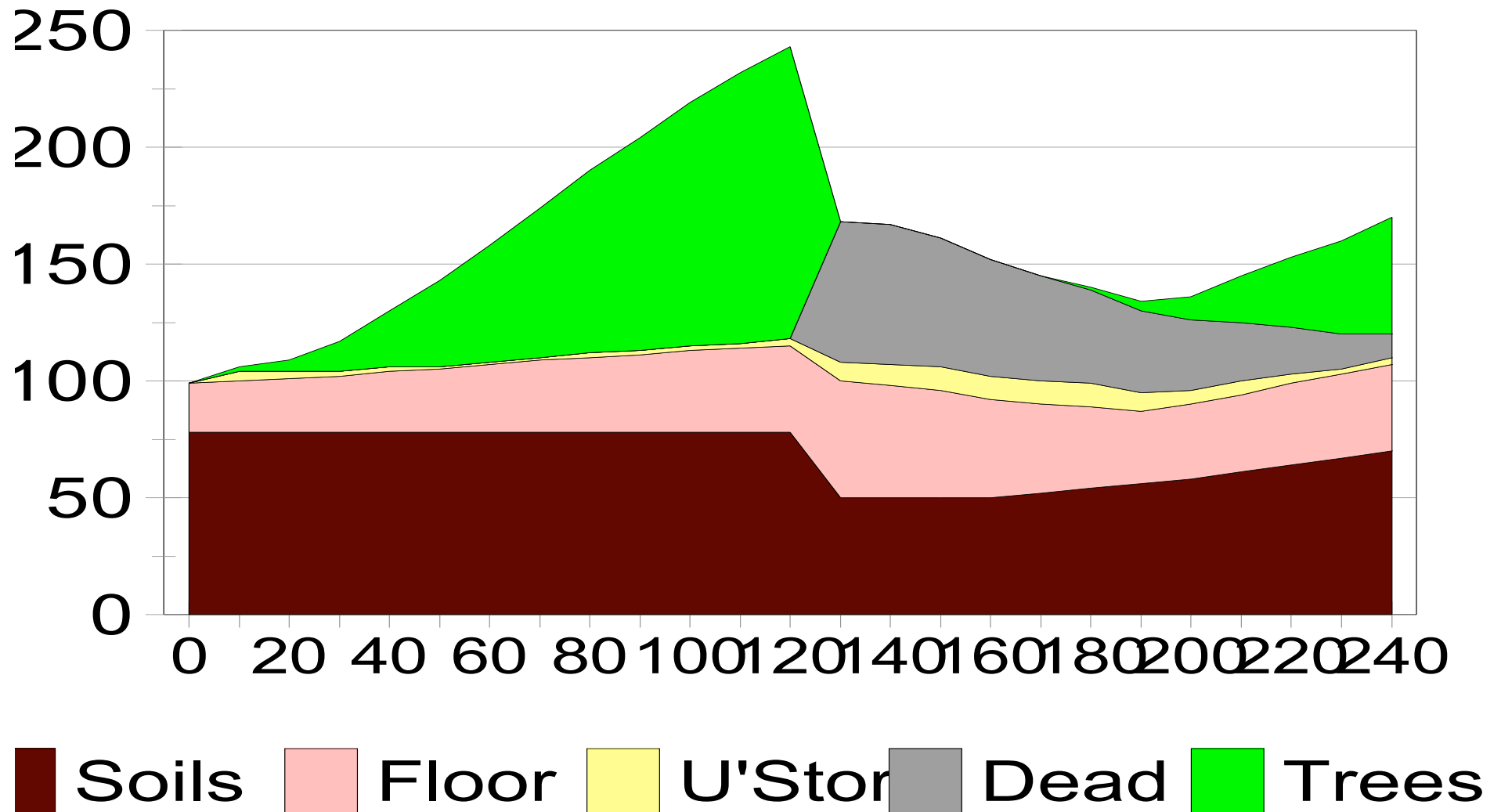
# Ponderosa pine

## Managed Forest



# Ponderosa pine

## Severely Burned Forest







# The Challenge...

- As the U.S. seeks to use its forests to sequester atmospheric Carbon Dioxide, 100 years of fire suppression is catching up with us, and we need a strategy to deal with it.

