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West Coast Partnership: Opportunities for Reducing Emissions by Managing Forest Fuel Loads

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Sean Grimland, Tim Pearson and Nick Martin
Winrock International

West Coast Regional Carbon Sequestration Partnership

- Funded by U.S. Department of Energy – National Energy Technology Laboratory
- Lead: California Energy Commission
- 33 participating organizations representing State agencies, national labs, universities, private companies and non-profit organizations active in CO_2 capture, transportation, storage and sequestration

Region:

- California
- Oregon
- Washington
- Arizona
- Nevada
- Alaska

WCP Phase I Tasks

- Characterize the region (CO_2 sources, transportation, geologic and terrestrial sequestration opportunities
- Identify key technology deployment issues
- Plan and implement public outreach
- Develop portfolio of capture, transport and sequestration options, and identify Phase II demonstration projects

Acknowledgements

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Jim Wolf
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Jim Walls

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David (Sam) Sandberg

Summary

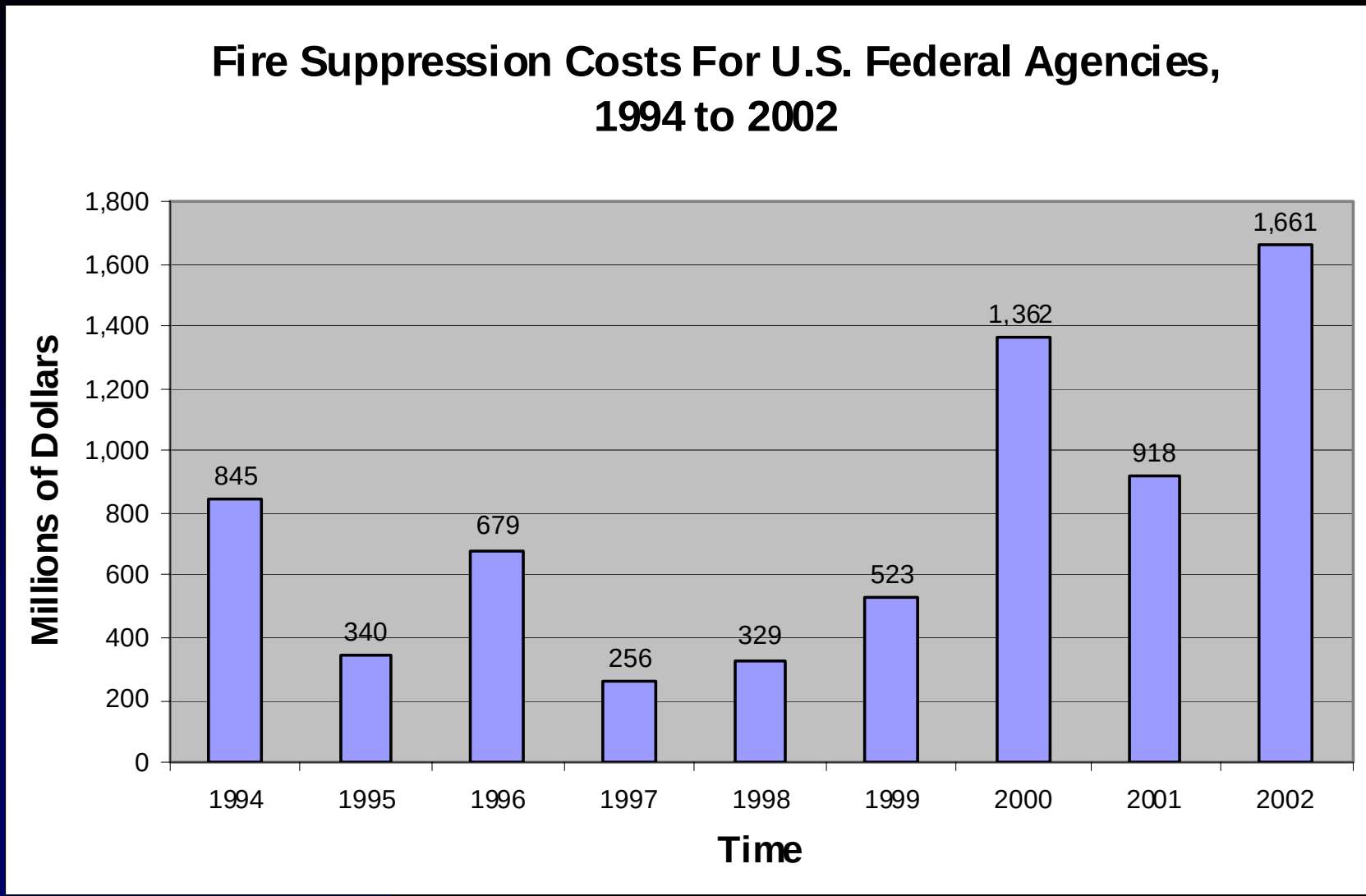
- Why fire?
  - Define potential source of carbon benefits
- Identification and classification of fire-prone lands
- California analysis
  - Progress on determining baseline and estimating magnitude of potential carbon benefits from managing forest fuel loads
  - Targeting lands for fuel reduction
- Pilot activities

Fuels and Fire Management

Not all fires are the same

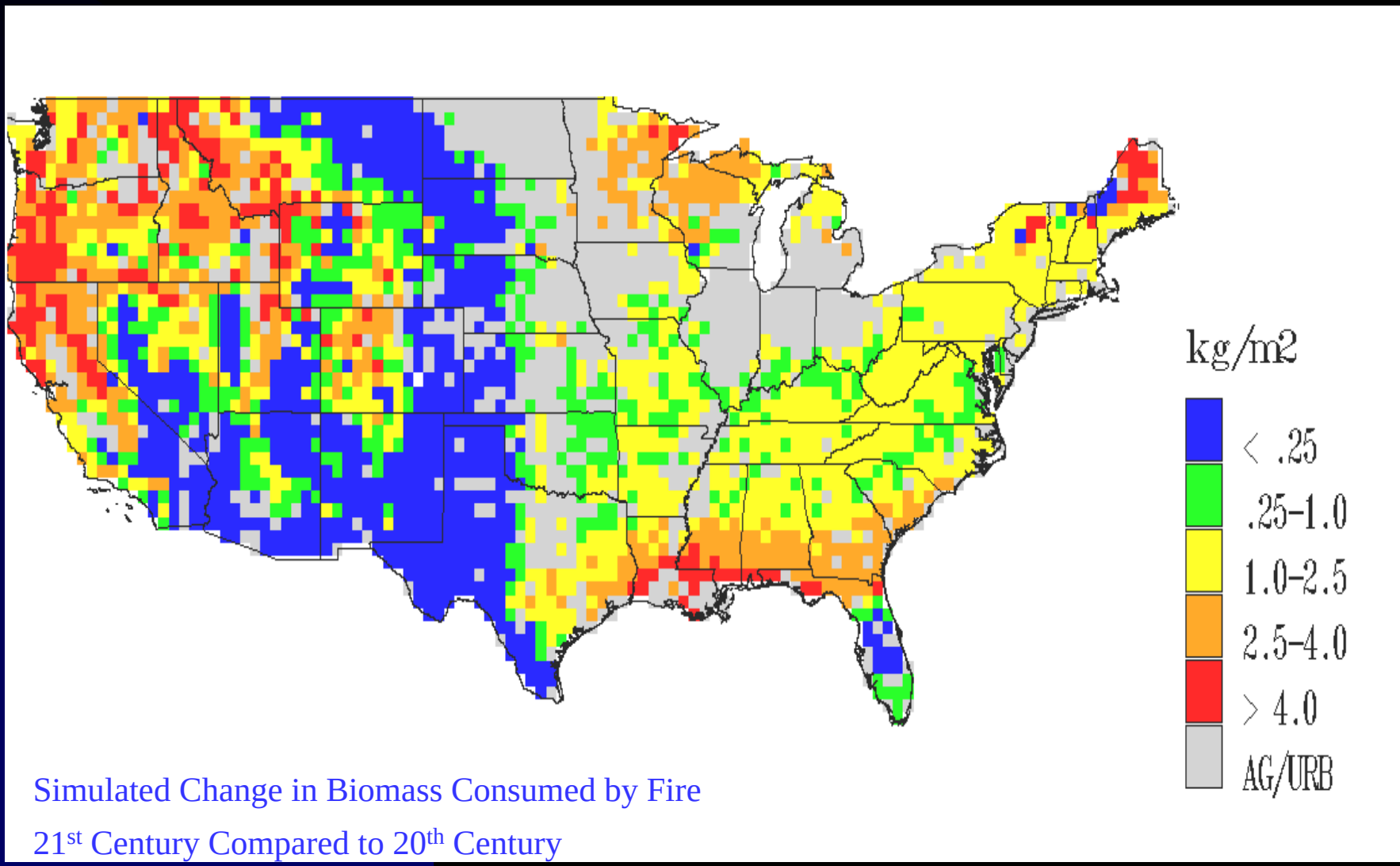
Photos: Dr. Sam Sandberg, USDA Forest Service
Pacific Wildland Fire Sciences Laboratory

Federal Cost of Fighting Fire



National Interagency Fire Statistics

Predicted Increase in Fire



Simulated Change in Biomass Consumed by Fire

21st Century Compared to 20th Century

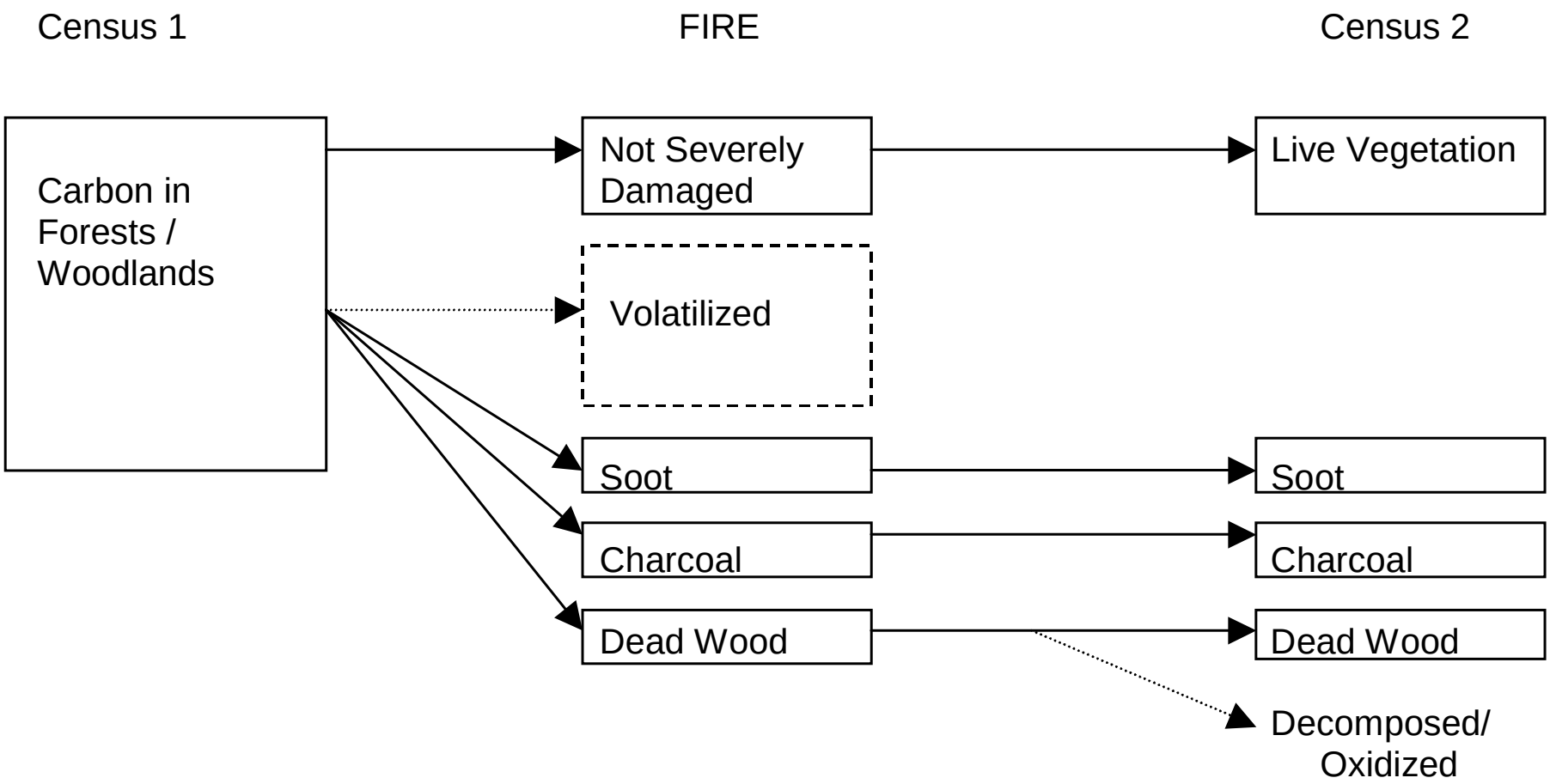
Source: Ron Nielson, MAPSS Team, USDA Forest Service Research

Potential Sequestration Benefits from Improved Fire Management

Source: Dr. Sam Sandberg, USDA Forest Service

- Change GHG emissions from combustion
- Reduce loss of carbon stocks from large trees
- Reduce loss of carbon stocks from duff
- Maintain or enhance carbon accumulation rates during recovery
- Avoid ecosystem-changing fires
- Potentially offset fossil-fuel emissions

What Happens to Carbon Stocks?



Assumptions

	Fire Intensity		
	H	M	L
Volatized	60%	40%	20%
Not Volatized	25	15	8
Charcoal	*5.5*	*3.3*	*1.8*
Soot	*11*	*6.6*	*3.5*
Dead Wood	*8*	*4.8*	*2.6*
Surviving Vegetation	15	45	72

- Fate of carbon in fire-induced changes in canopy cover vary by severity of fire

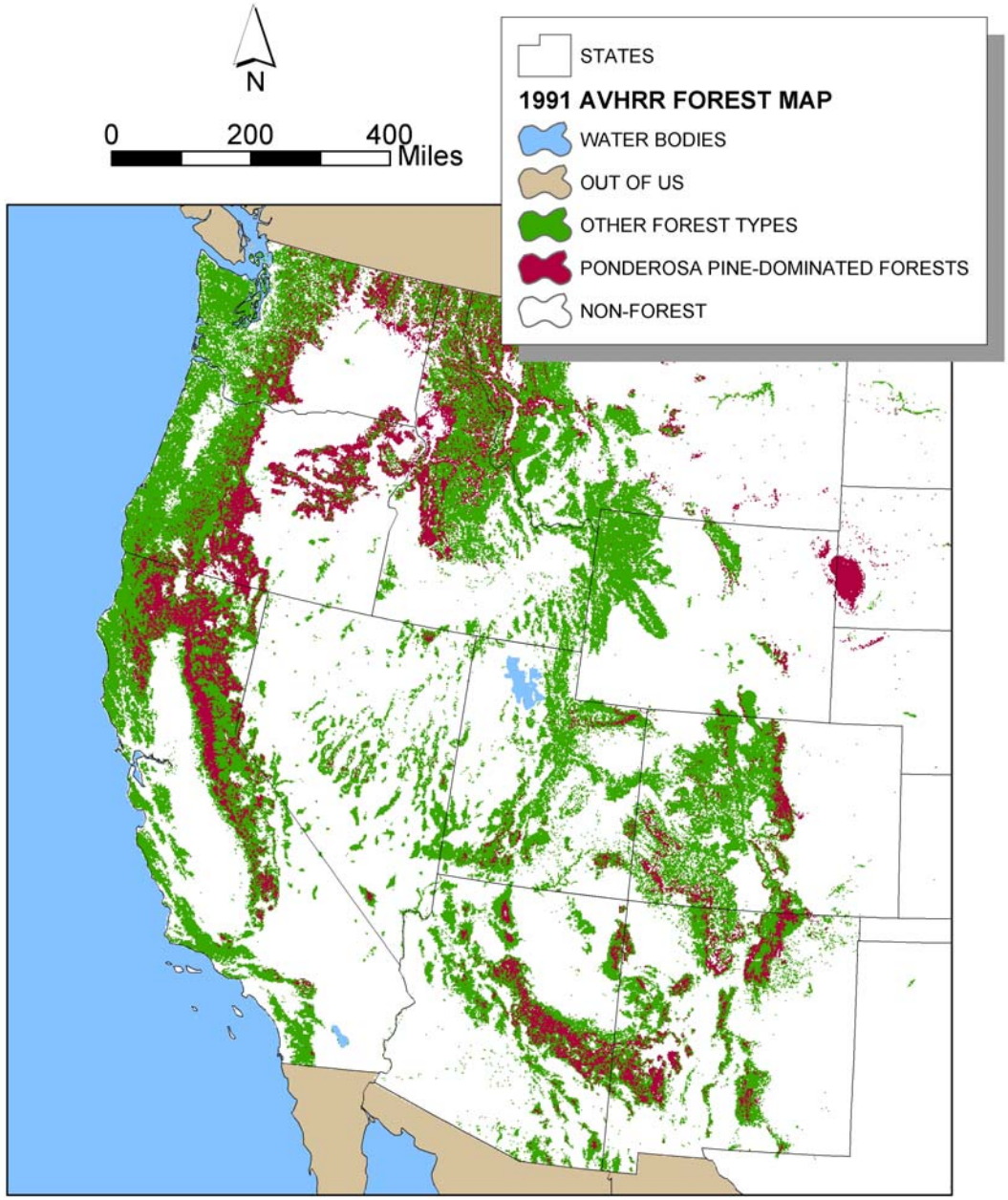
What changes can be made in fuels and fire management to reduce net GHG emissions?

- Continuous fuel management to keep fuel loads below prescribed levels
- Substitution of low severity prescribed fire for high severity wildland fire
- Substitution of low severity wildland fire for high severity wildland fire

Source: Dr. Sam Sandberg, USDA Forest Service – Pacific Wildland Fire Sciences Laboratory

Remote sensing-derived datasets can identify vegetation-types with fire regimes where low-intensity wildfires are common.

Ponderosa pine forests have been identified as such (Schoennagel et al 2004)



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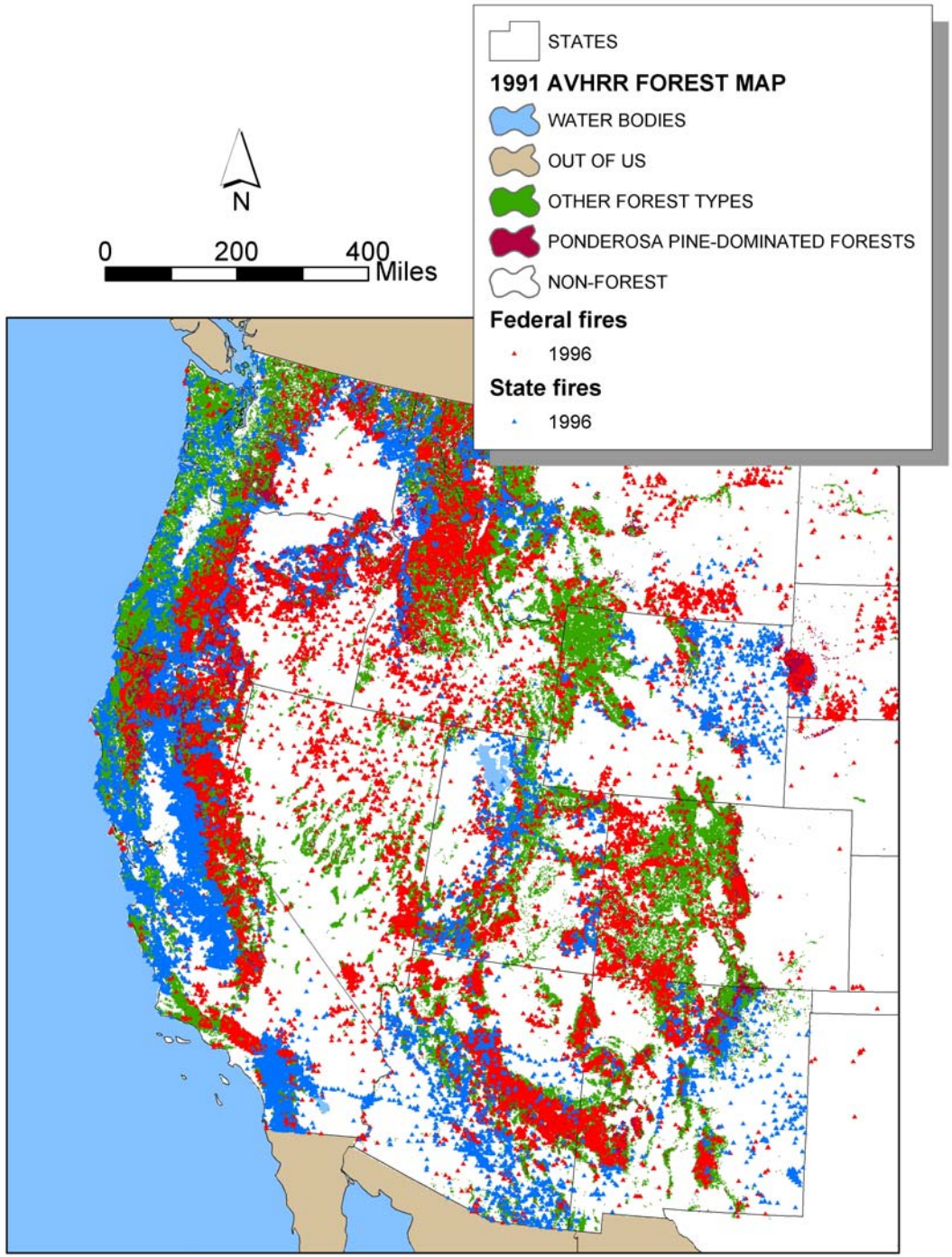
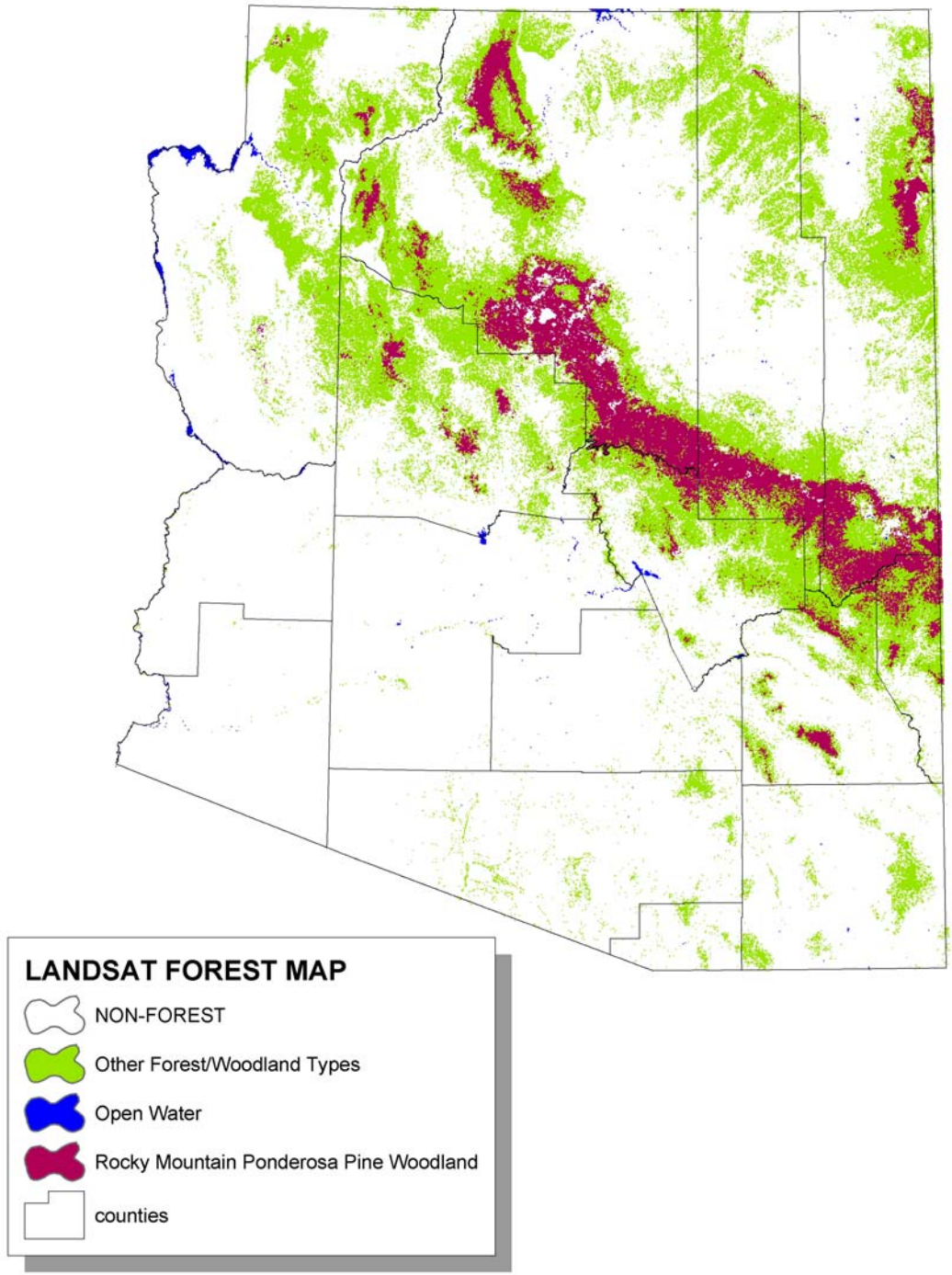
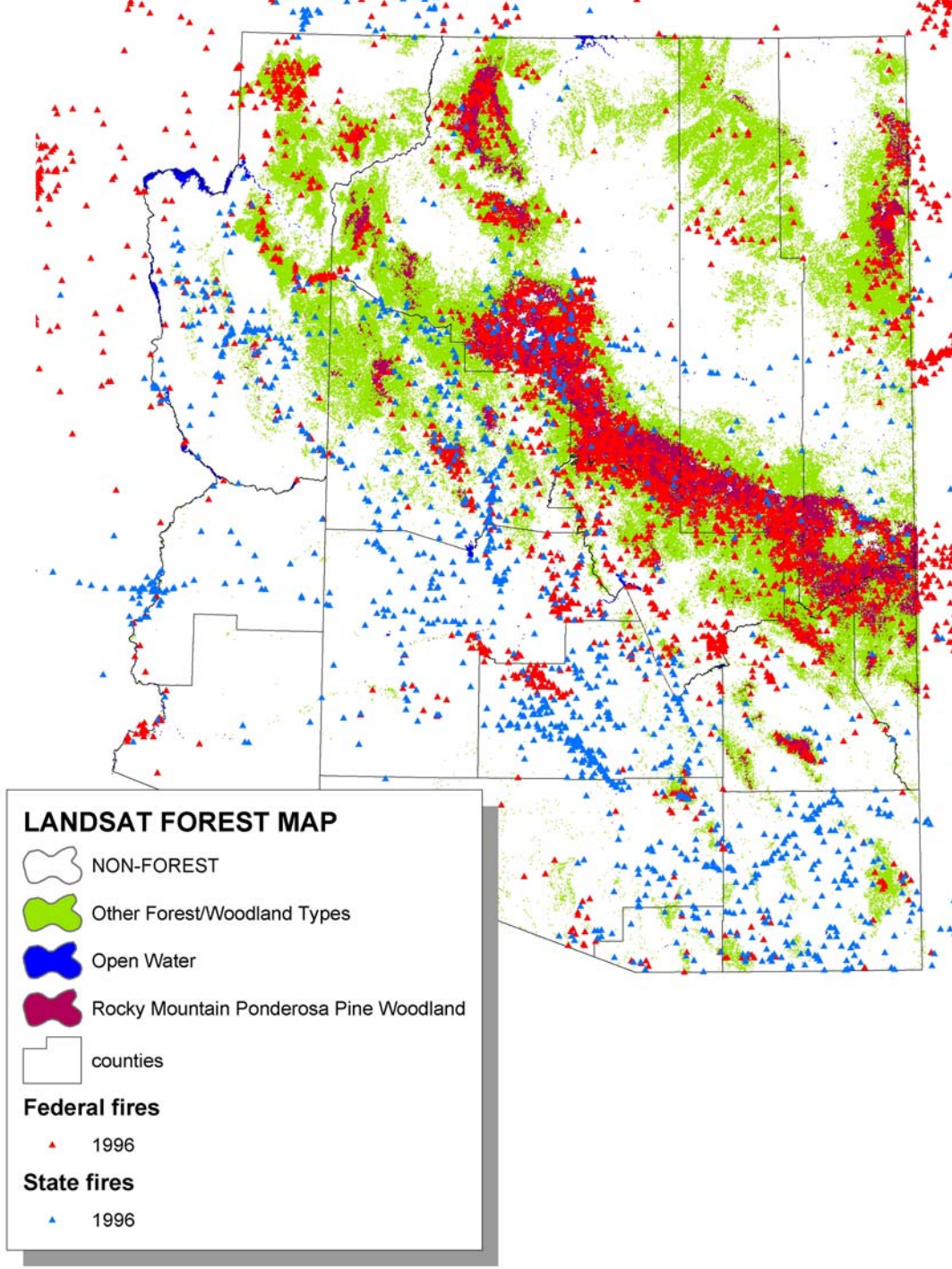
Point locations of fires



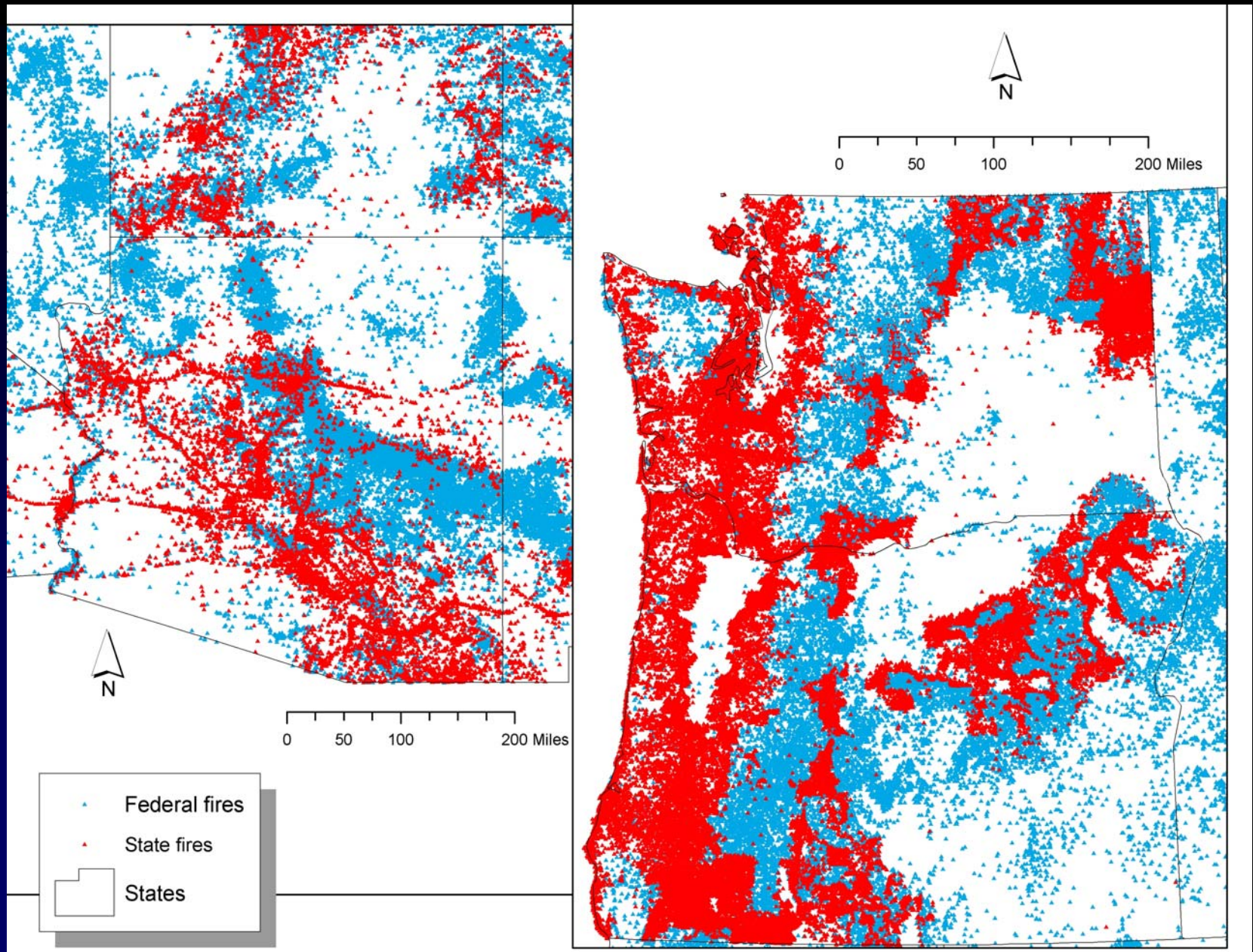
Finer-resolution land cover datasets are also available

(AZ GAP 2005) ⟶

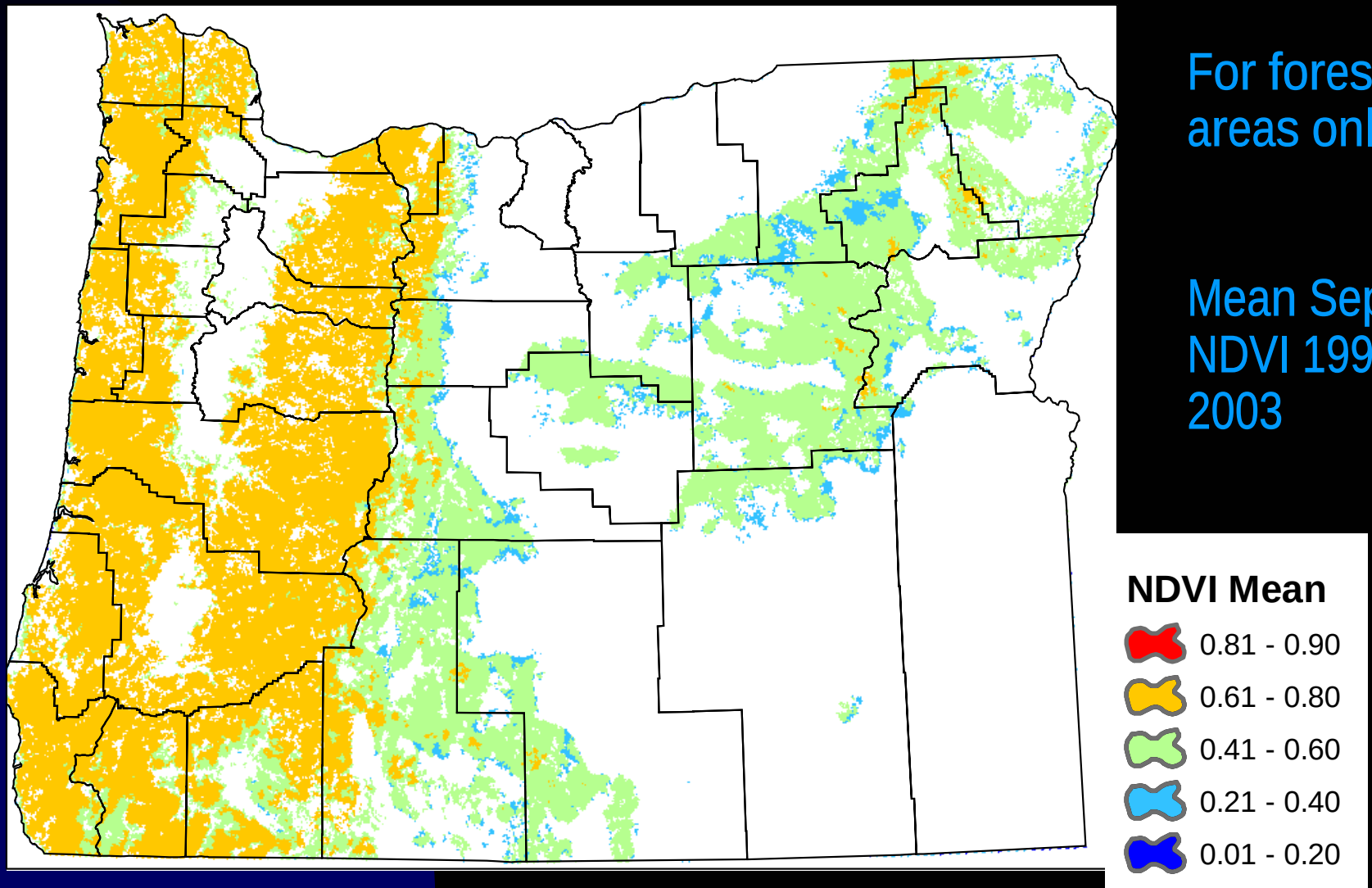



LANDSAT FOREST MAP
NON-FOREST
Other Forest/Woodland Types
Open Water
Rocky Mountain Ponderosa Pine Woodland
counties
Federal fires
1996
State fires
1996

Some states only map *point locations* of wildfires on lands under their jurisdiction –federal fires are plotted by other agencies

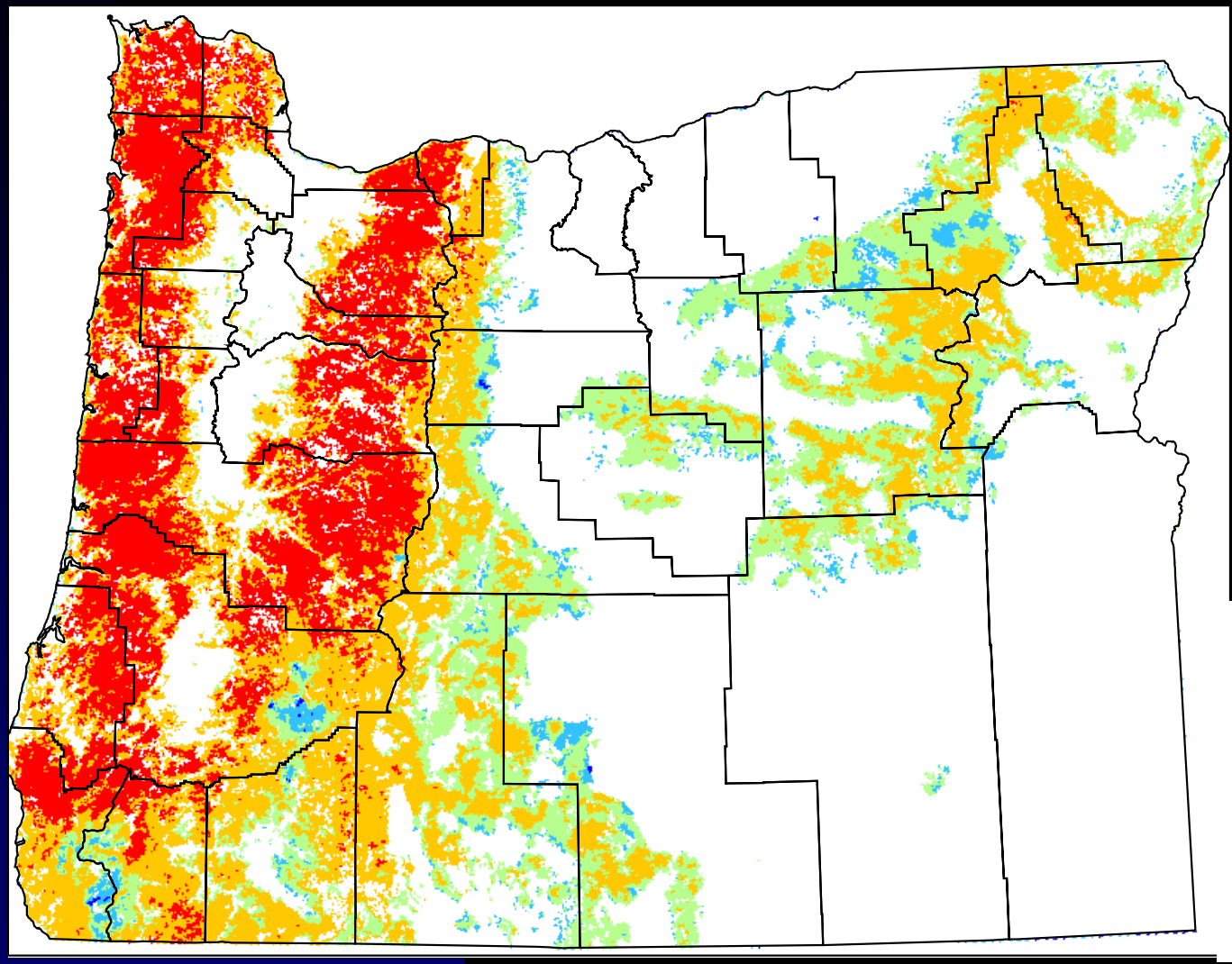


Pilot methods to measure relative fire intensity, area and vegetation type burned.



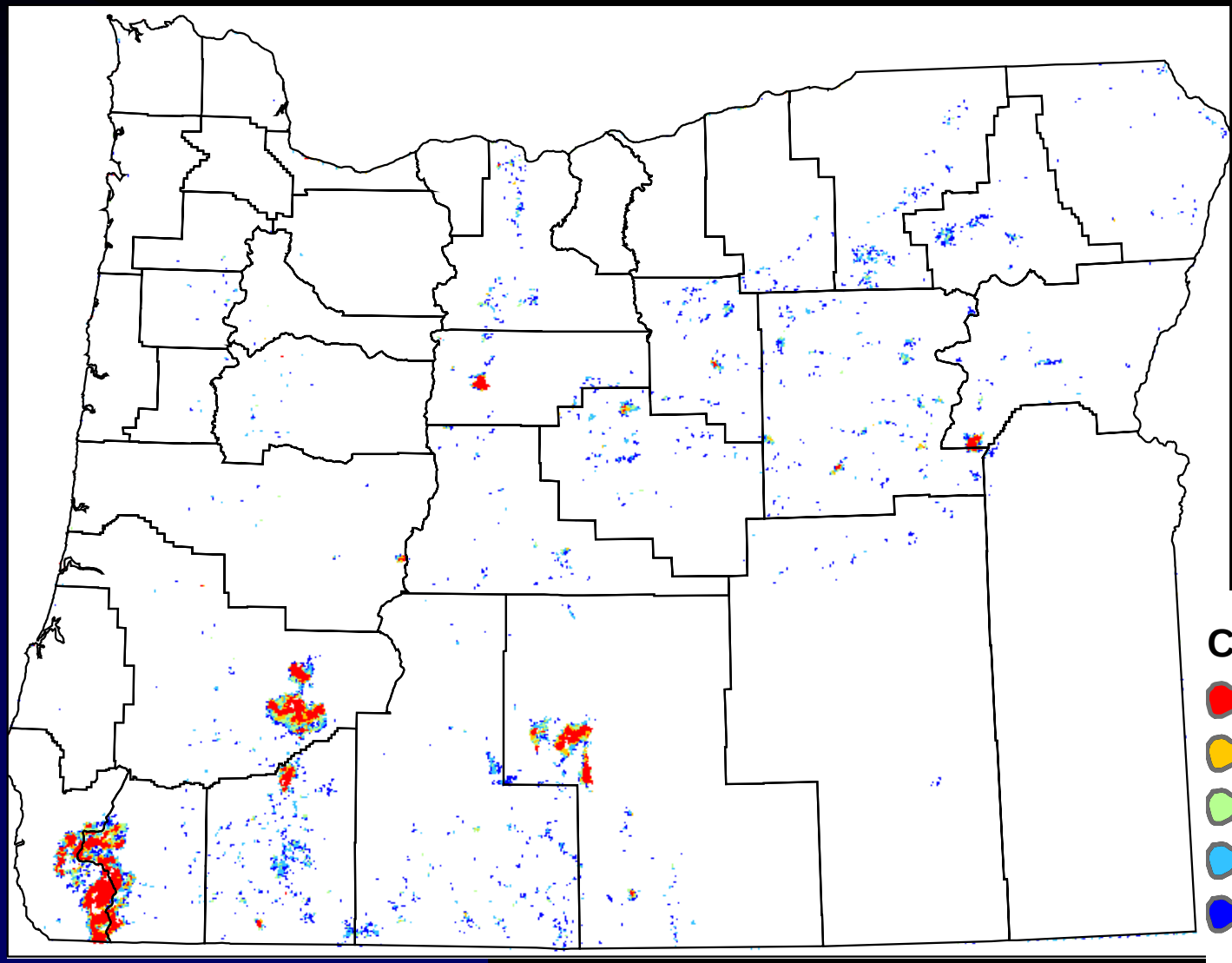
For forest areas only

Mean Sept. NDVI 1990 – 2003



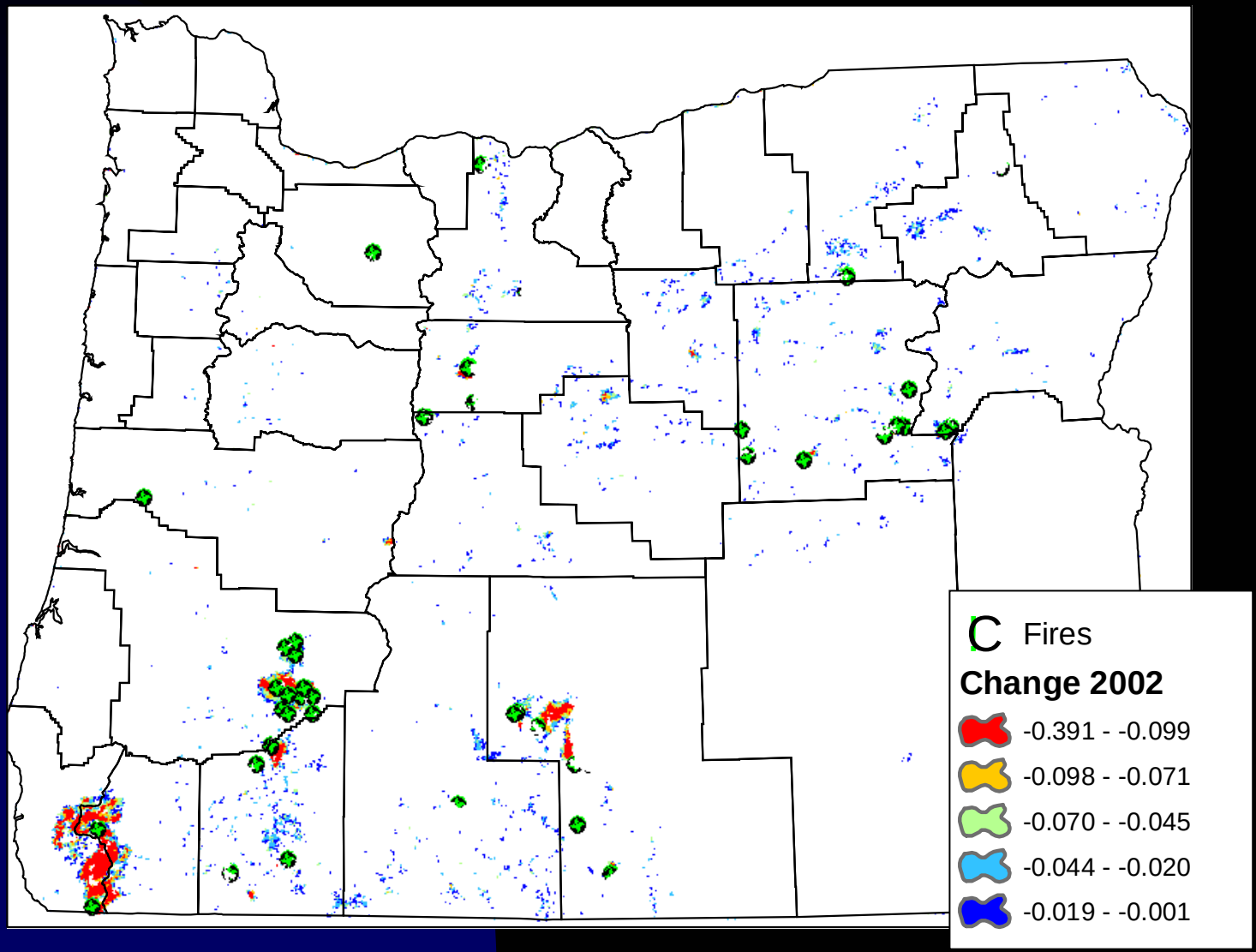
Forest Areas

NDVI Sept.2002 from max. values



Negative Change in Forest Areas between Mean & 2002 NDVIs

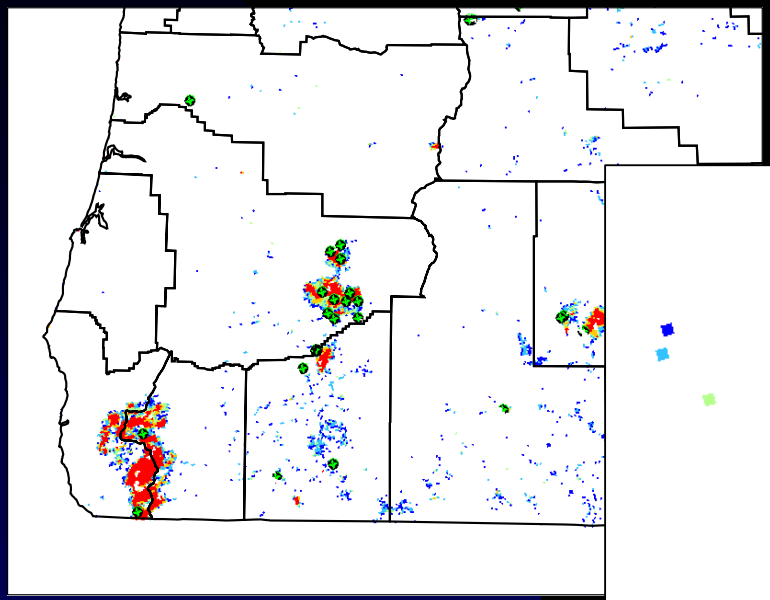
With AVHRR satellite imagery, fire polygons and relative intensity are mapped

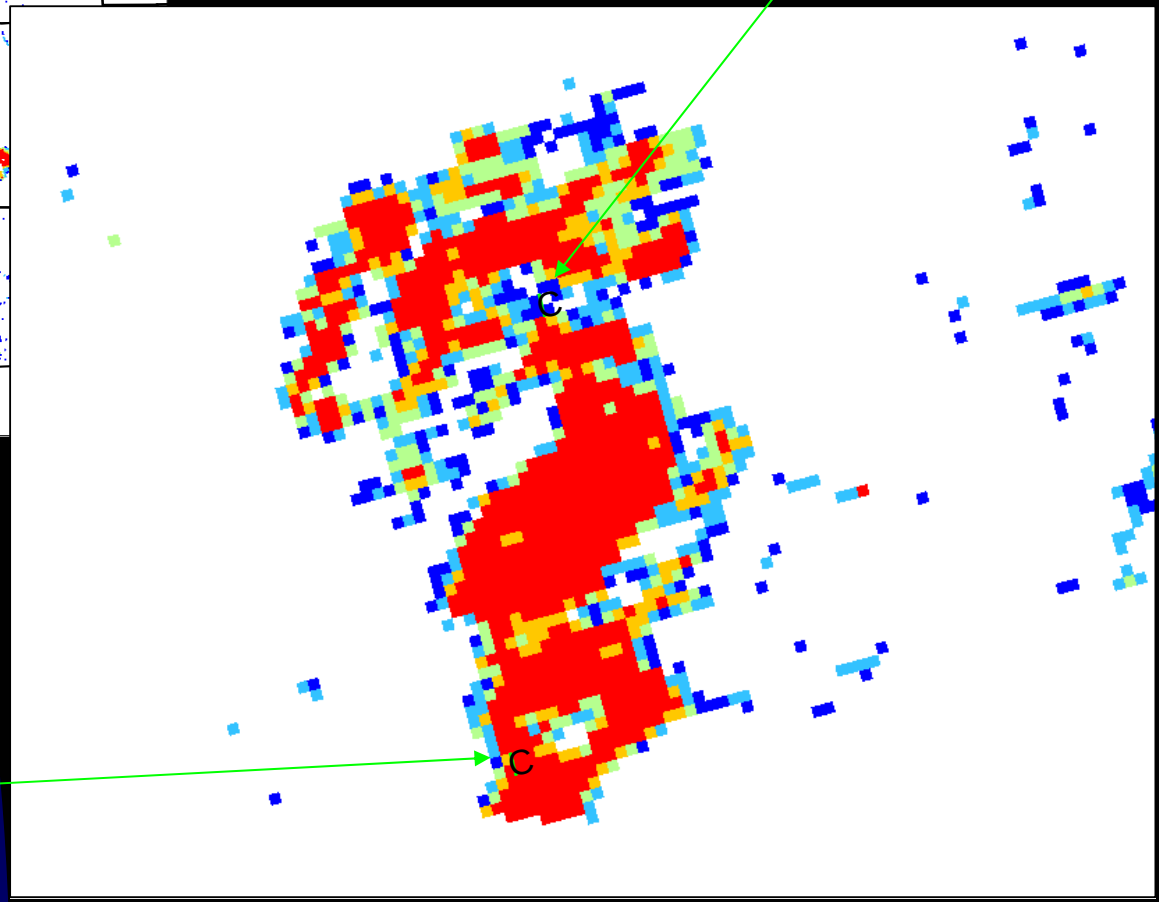


Negative Change in Forest Areas between Mean & 2002 NDVIs

Fire records come from ODF and USFS. There are a few overlapping points such as the Biscuit fire.

ODF and USFS list the ‘Biscuit fire’ damage total acres as 499,945. We measured ~369,352 acres of change.





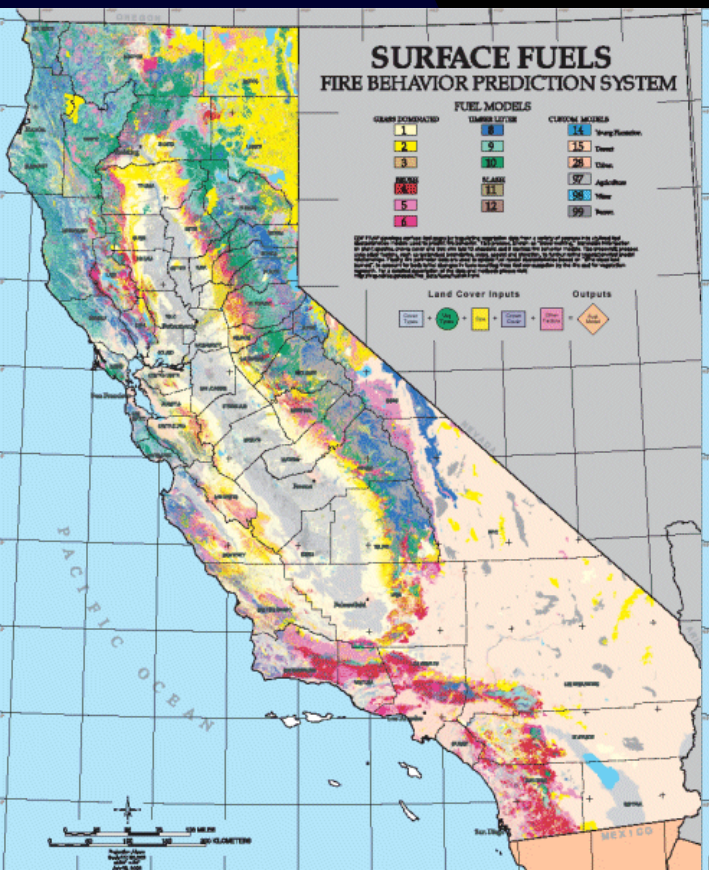
Agencies measure the perimeter –not area actually burned

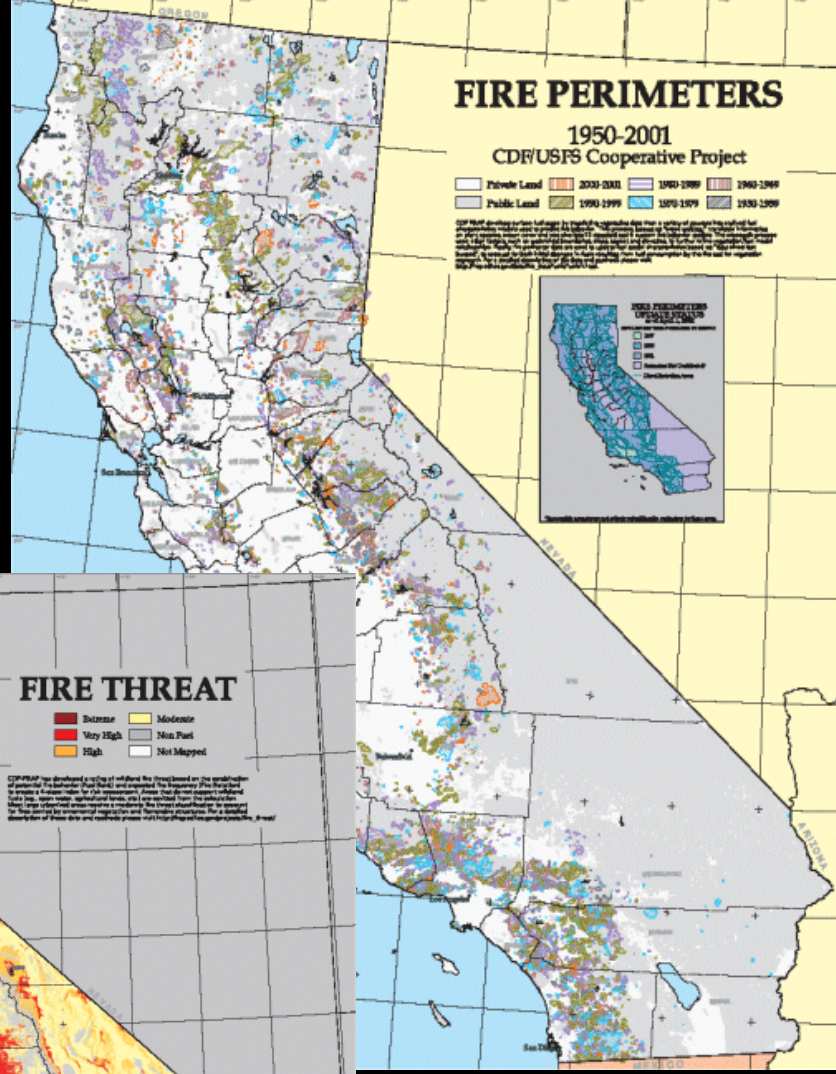
California Baseline: Annual Emissions and Removals by Cause of Change for 1994-2000

$MMTCO_2/yr$	Forests	Rangelands
Fire	-1.55	-0.14
Harvest	-1.40	-0.03
Development	-0.01	-0.004
Other/Unverified	-0.79	-0.10
Regrowth	+10.96	+0.46

Some states have more detailed datasets than others

(CDF-FRAP 2005)

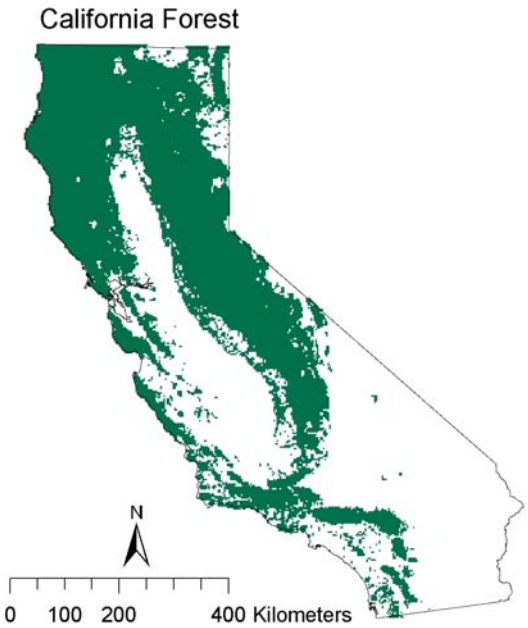


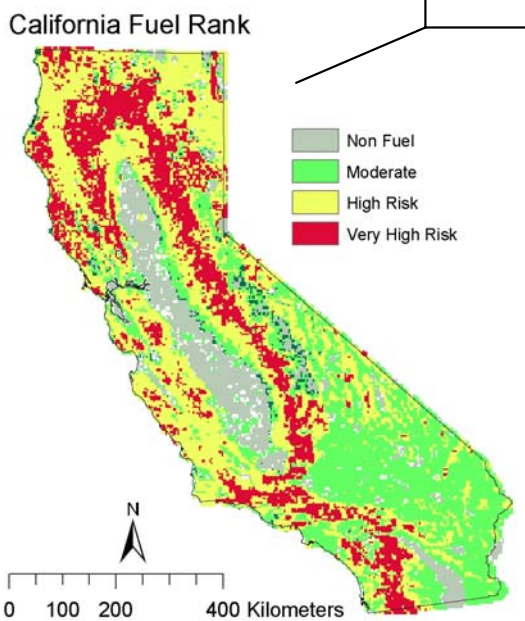


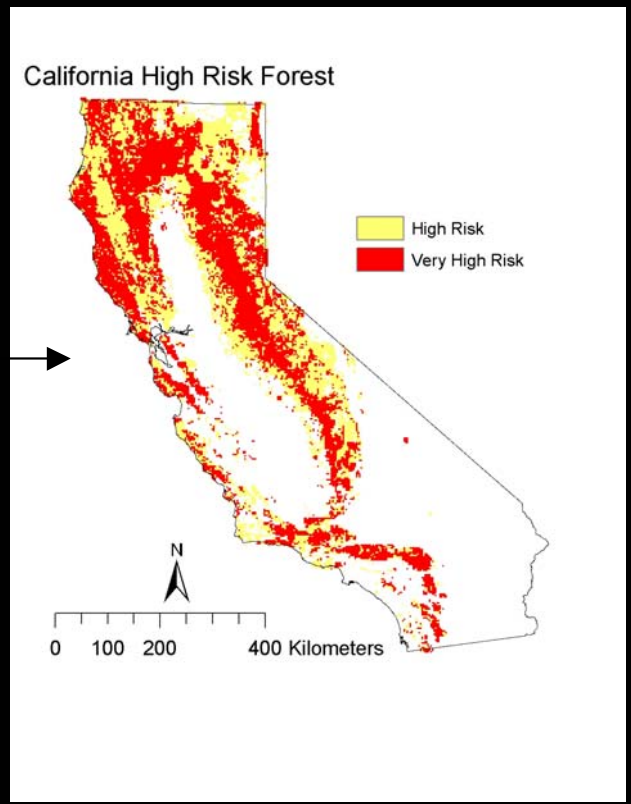
Potential for Carbon Benefits from Forest Fuel Reduction

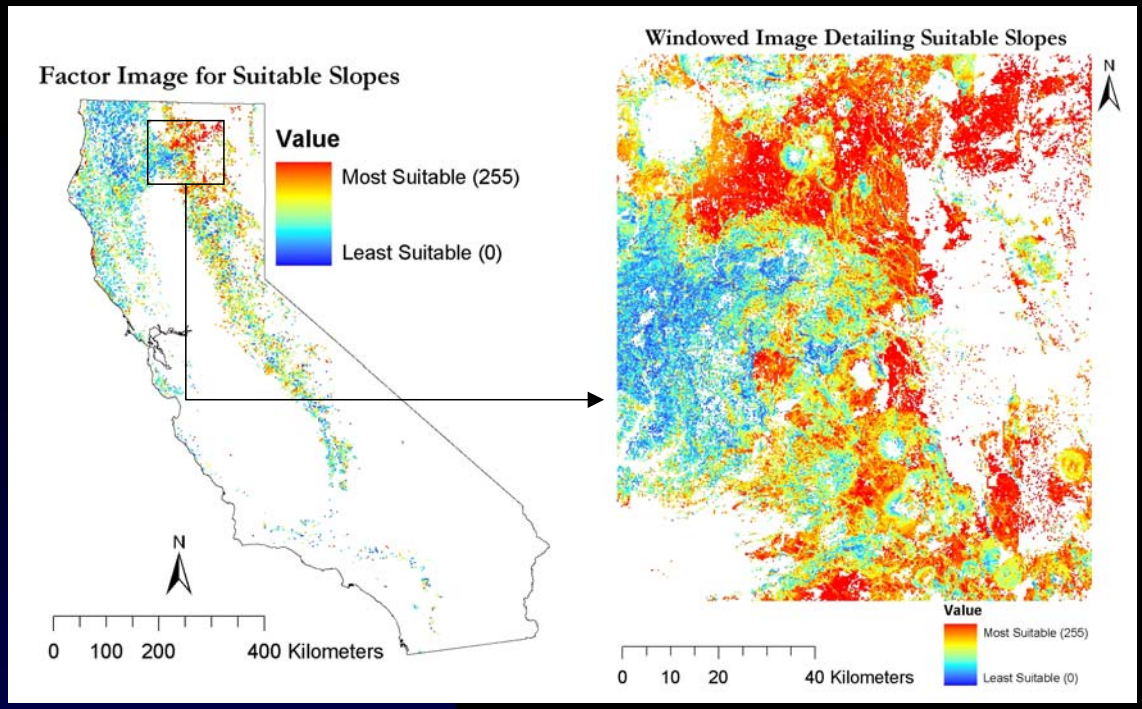
- Estimate the areas and carbon stocks of forests suitable for fuel reduction to reduce their fire risk and their location relative to existing power plants
- Develop a “Suitability for Potential Fuel Reduction (SPFR)” score for high fire risk forests based on slope, distance to biomass plants, and distance from roads
- SPFR scores rank areas feasible for transporting the removed fuels to biomass power generating plants

Distribution of California's forests at high and very high risk for catastrophic fire

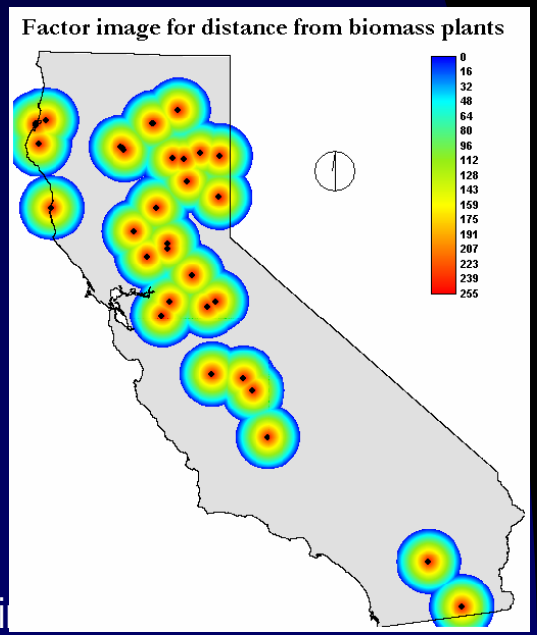


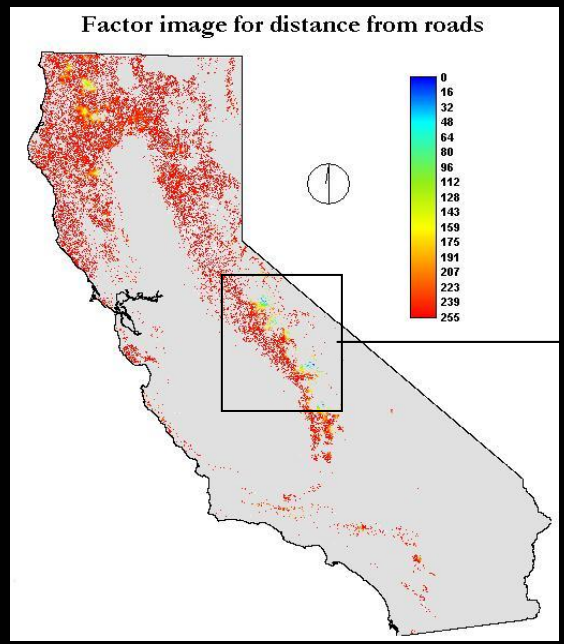


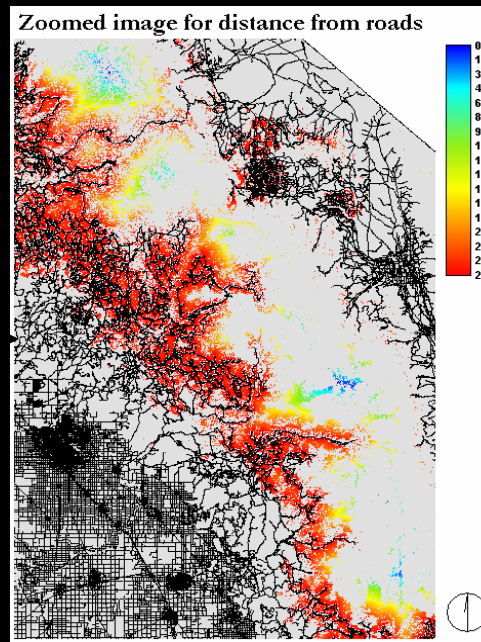




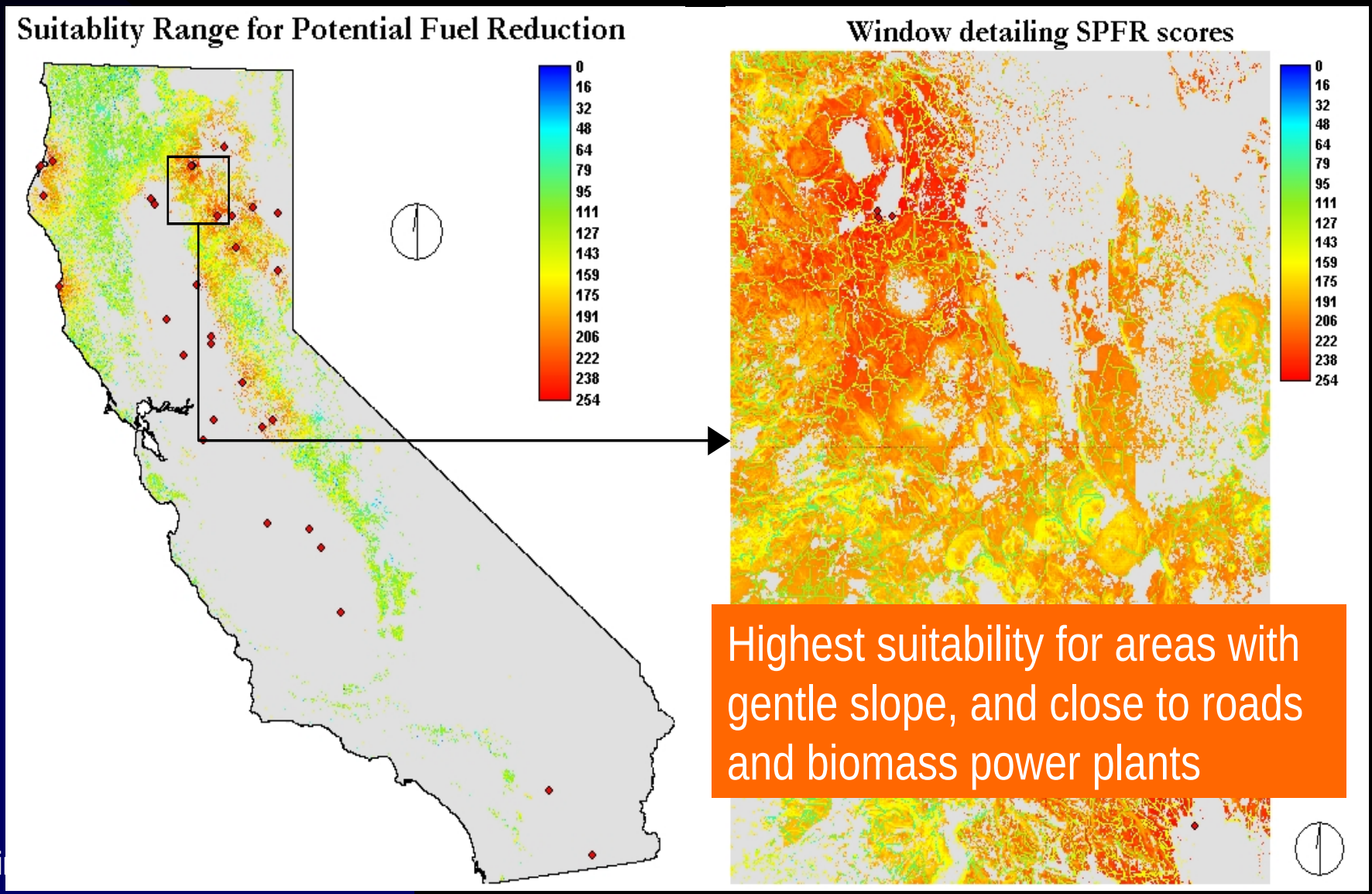
Factors used to develop index of suitability for fuel reduction



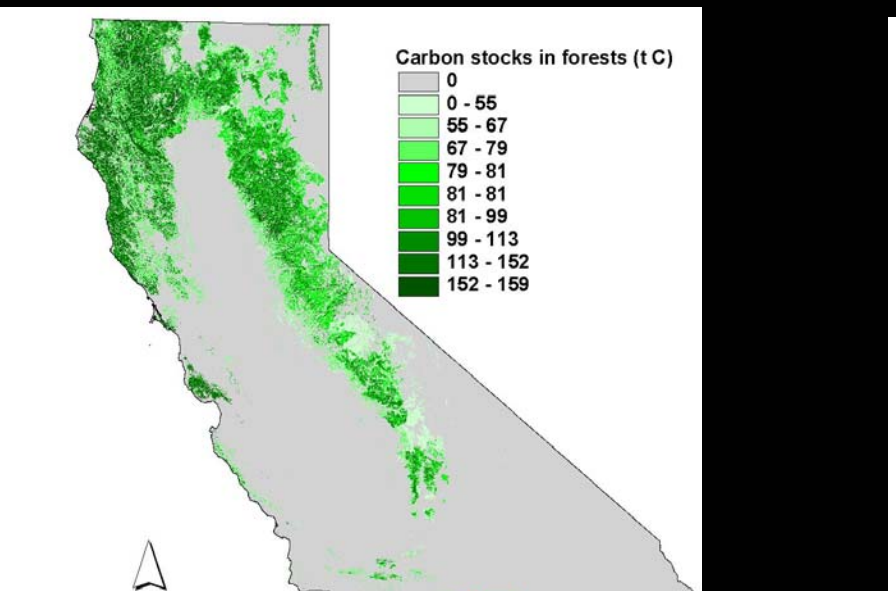


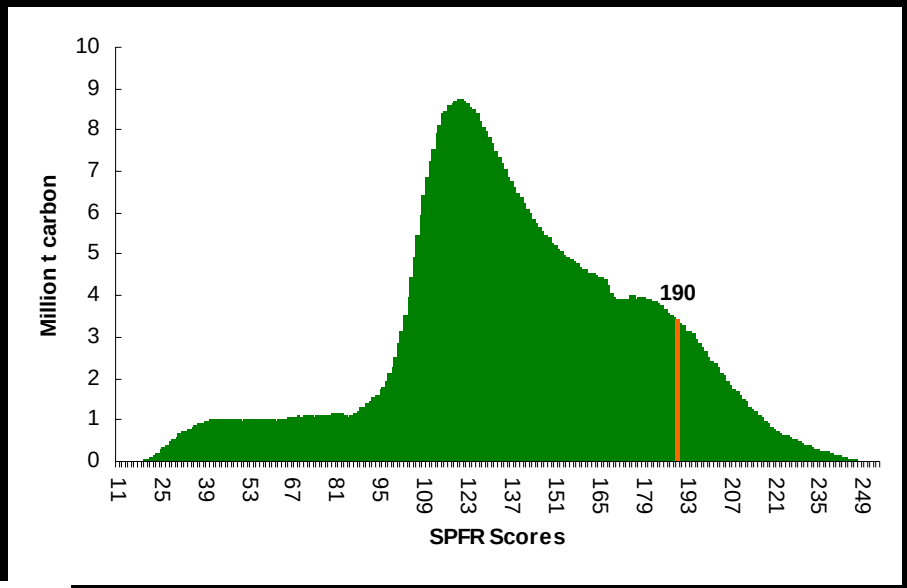


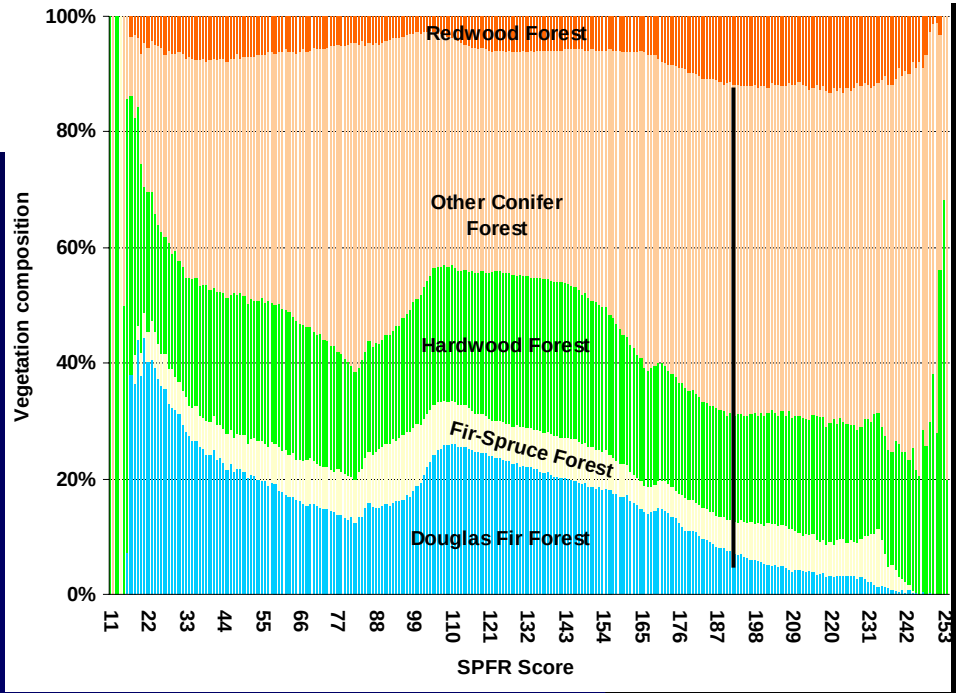
Map of suitability scores for potential fuel reduction for California forests



Carbon stocks in forests exposed to fire







Carbon stocks by SPFR classes for forests at high and very high risk for fire

Forest composition of the SPFR classes for areas at high and very high risk for fire.

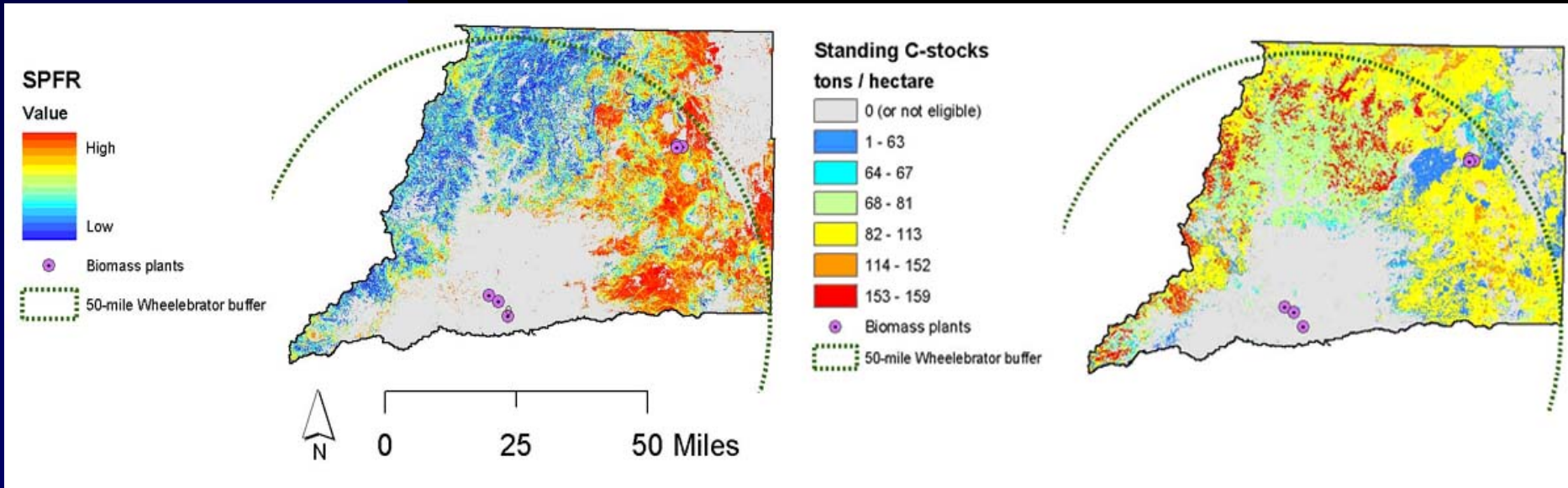
Potential Carbon Emissions from Fire

- Cumulative carbon stocks in forests at high and very high risk for fire with SPFR classes higher than the top 25% (score of 190) = 74.2 million t C covering an area of approximately 775,000 hectares
- The estimated net emissions from these forests if they burned could be as much as 22 million t C (range for different forest classes =25-51 t C/ha)

Terrestrial sequestration pilot project opportunities

Shasta County, CA and Lake County, OR:

- Validation of forest growth potential of rangelands
- Fire management
- Forest conservation management



Project Example: Fire Management

- Remove fuel load from forests to reduce carbon emissions from fire
- Transport fuel to power plant
  - Account for emissions from transport
- Power plant fuel requirements
  - 30 MW plant with 80% reliability would require about 250,000 BDT/ year
- Area required
  - 5,000 --10,000 hectares per year
  - 0.2-0.4% of area within 50-mile radius of a power plant

Fire management pilot activities

- Treatment options to optimize carbon sequestration while reducing fire risk
- Validate fire models and impacts
- Predict emissions from wildfire (changes in forest carbon stocks)
- Economics of forest fuel reduction
- Peer-reviewed, consensus-based process for baseline and MMV methods for this project type
- Develop protocols to make emissions reductions marketable (CCAR, CCX, Climate Trust)

Summary

- Changing fire management practices can reduce annual GHG emissions leading to increased average carbon stocks in fire prone areas
- Achievable benefits in California appear to be 25–51 MT per hectare
- Many questions remain to be answered
  - Baseline and MMV protocols
  - Economics
  - Renewable Portfolio Standards, RECs and other incentives

More detailed information on the data and analysis for California covered in this presentation can be found in:

- **"Carbon Supply Curves for Forest, Range, and Agricultural Lands of California: Final Report," March 2004**
- **"Baseline Report for Forest, Range, and Agricultural Lands in California,"March 2004**

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