



Forest Resource Sustainability: Improving Air Quality and Reducing Greenhouse Gases

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Forest Resource Sustainability Objectives

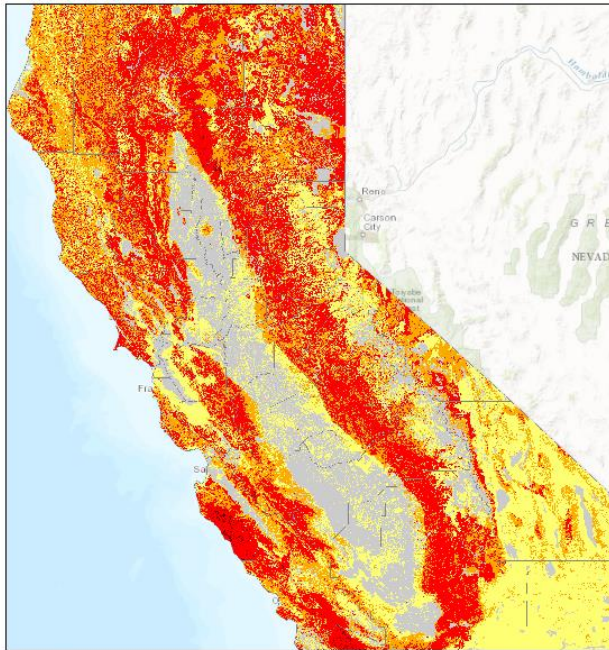
- Improve air quality
 - Wildfire mitigation
 - Reduced prescribed and open pile burning
- Initiatives
 - Fuels reduction
 - Renewable energy and biochar from forest wastes
 - Greenhouse gas emission reduction opportunities
- Increased sustainability
 - Economic, environment, social





Wildfire Threat is Increasing

Fire Threat

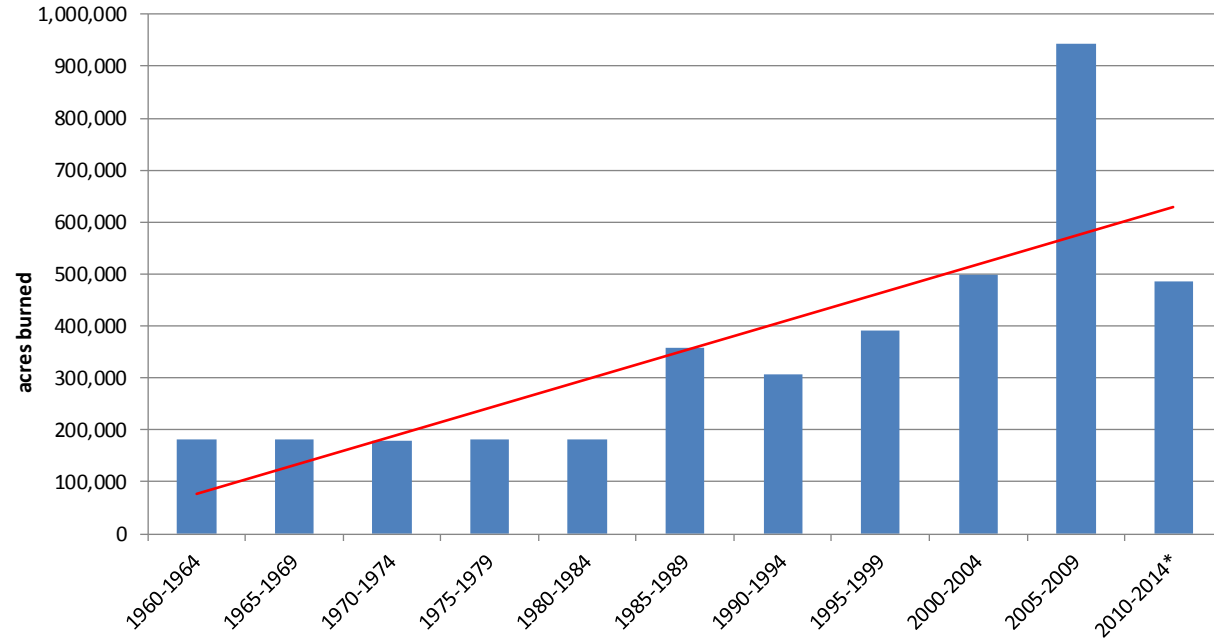


- July 29, 2016
- 1:4,622,324
- 0 37.5 75 150 mi
0 62.5 125 250 km
- County Boundaries
 - Extreme
 - Non-fuel
 - Moderate
 - High
 - Very High

Source: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, IGN, Swire, NGA, IGN, GEBCO, IGN, Esri, Swire, Esri Japan, METI, Esri China (Hong Kong), Swire, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Exported from the Tree Mortality Viewer (<http://angle.fire.ca.gov/TreeMortalityViewer/>)

5-year average of acres burned by wildfires in California



* 2014 data is preliminary

Source: Cal Fire Historical Wildfire Activity Statistics (Redbooks) http://www.fire.ca.gov/fire_protection/fire_protection_fire_info_redbooks.php

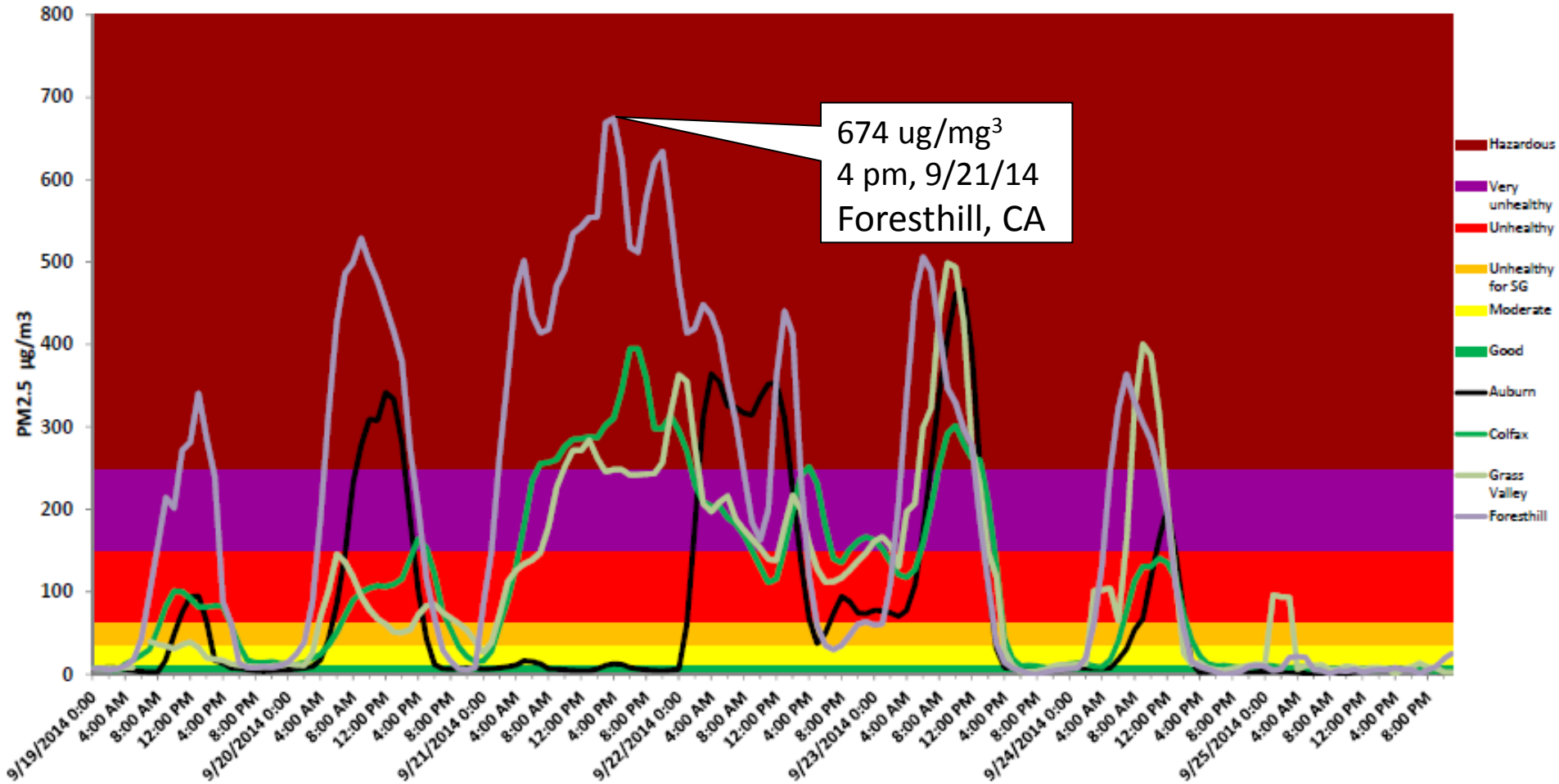
Wildfire Trend



Significant AQ Wildfire Impacts

King Fire (97,717 acres)

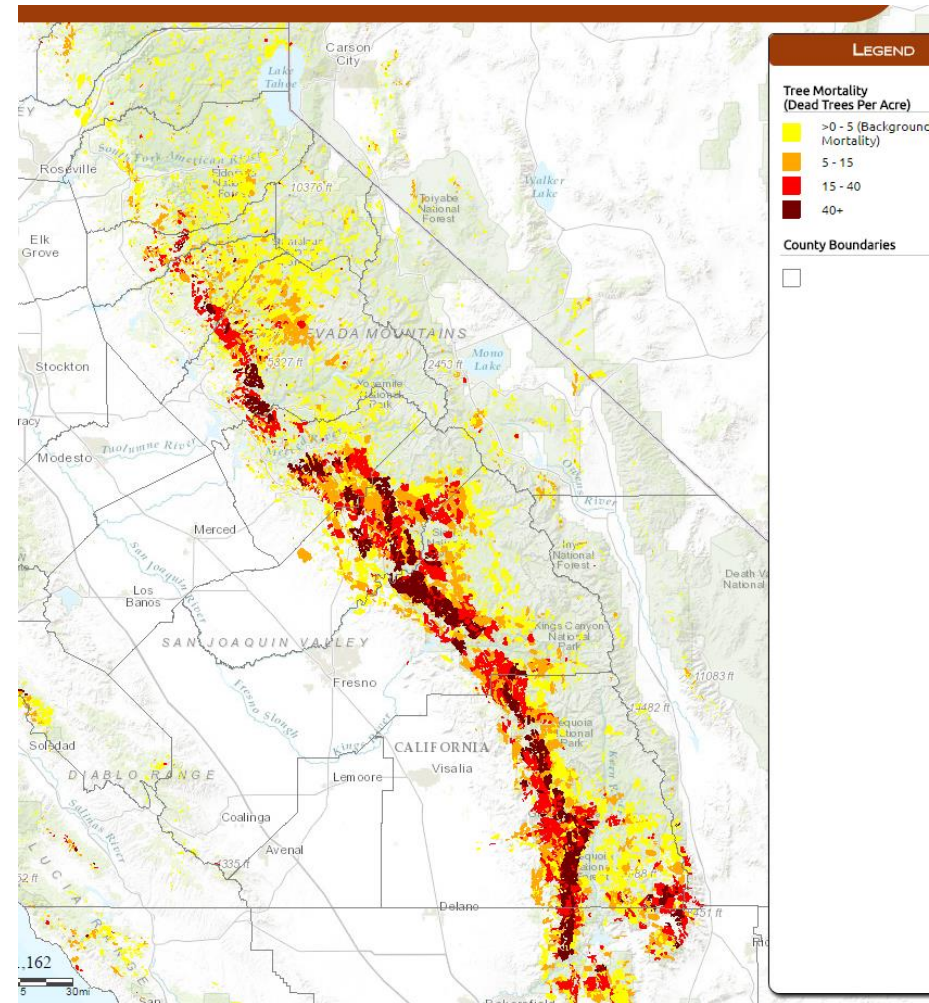
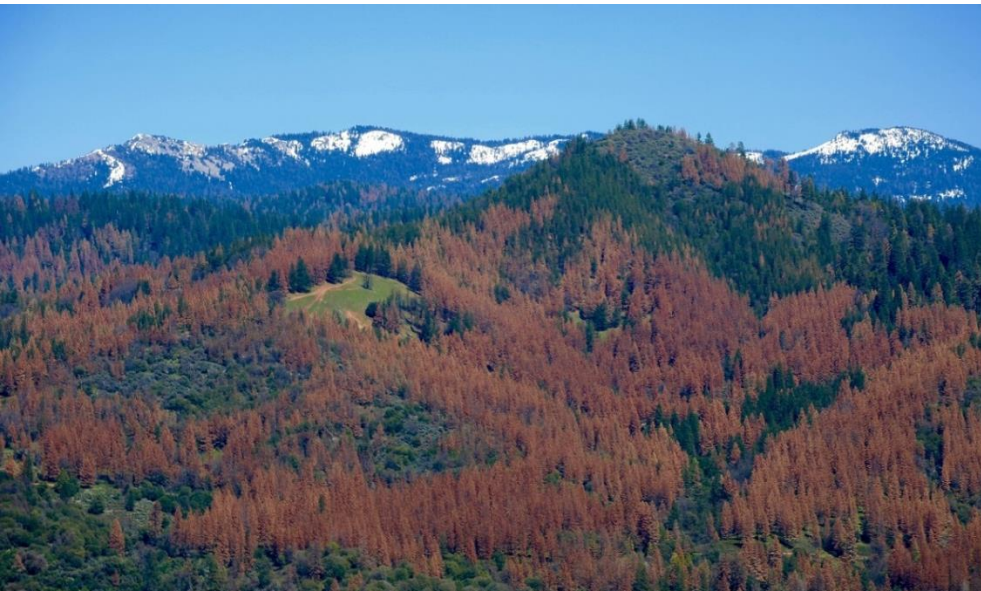
Foothill Area





Tree Mortality Crisis Increasing Fire Risk

- Governor's tree mortality and drought emergency declaration
 - 66 million dead trees
- Crisis in southern Sierra, quickly moving north





Co-benefit of Forest Sustainability: Protecting Upland Watersheds

- Sierra Nevada forests are the most significant source of water for California farmers and cities
- Forest condition is critical to water supply quality and quantity, especially important during on-going drought
 - High-intensity wildfire impacts quality and timing
 - Erosion
 - Rapid run-off
 - High-density forest reduces water quantity



Challenges Facing Forest Management

- Fuel treatments
 - Plans to increase treatment from 100,000 acres/yr to >500,000 acres/yr
 - Upside-down economics – revenue (wood products) < treatment cost
 - Slope, access, environmental restrictions
 - Dwindling forest management contractor industry expertise
 - Limited markets for excess biomass
 - Conservation group legal challenges
 - Unable to monetize all “avoided” benefits – reduced air pollution, fire fighting, watershed and ecosystem damage
- Biomass energy
 - Not cost competitive with natural gas, other renewables
 - Fuel costs high due to processing and transport
 - Contraction of existing industry



Open-Pile Burning





Challenges to California Forest Biomass Energy Industry

- California electricity market
 - Flat or reducing demand due to energy efficiency and economy slowdown
 - Utilities are “long” on total supply and renewables
 - Large supply and low cost of natural gas
 - Subsidies for solar and wind
- Contracting due to reduced demand from utilities
 - Currently 400 MW, 600+ MW at peak
- Location
 - Valley for agricultural and urban wood
 - Very few in mountains and heavy forests
- High fuel cost for forest waste materials
 - Long distance from source to energy plant
 - Expensive to grind and transport





Forest Resource Sustainability Initiatives

Market-based solutions to reduce the costs of fuel hazard reduction

- Bioenergy conversion
- GHG offset protocols
- Small-scale distributed generation bio-energy facility assessment
- State agency engagement
- Regional biomass collection



Forest Management Greenhouse Gas Offset Protocols

Biomass waste for energy

- Reduce open-pile burn
- Avoided fossil fuel for equivalent electricity
- Reduce black carbon

Biochar

- Sequester carbon in stable structure

Forest fuel treatment impact on wildfires and emissions

- Reduce wildfire severity and size
- Reduce tree mortality
- Stimulate forest growth
- Wood products, biomass energy

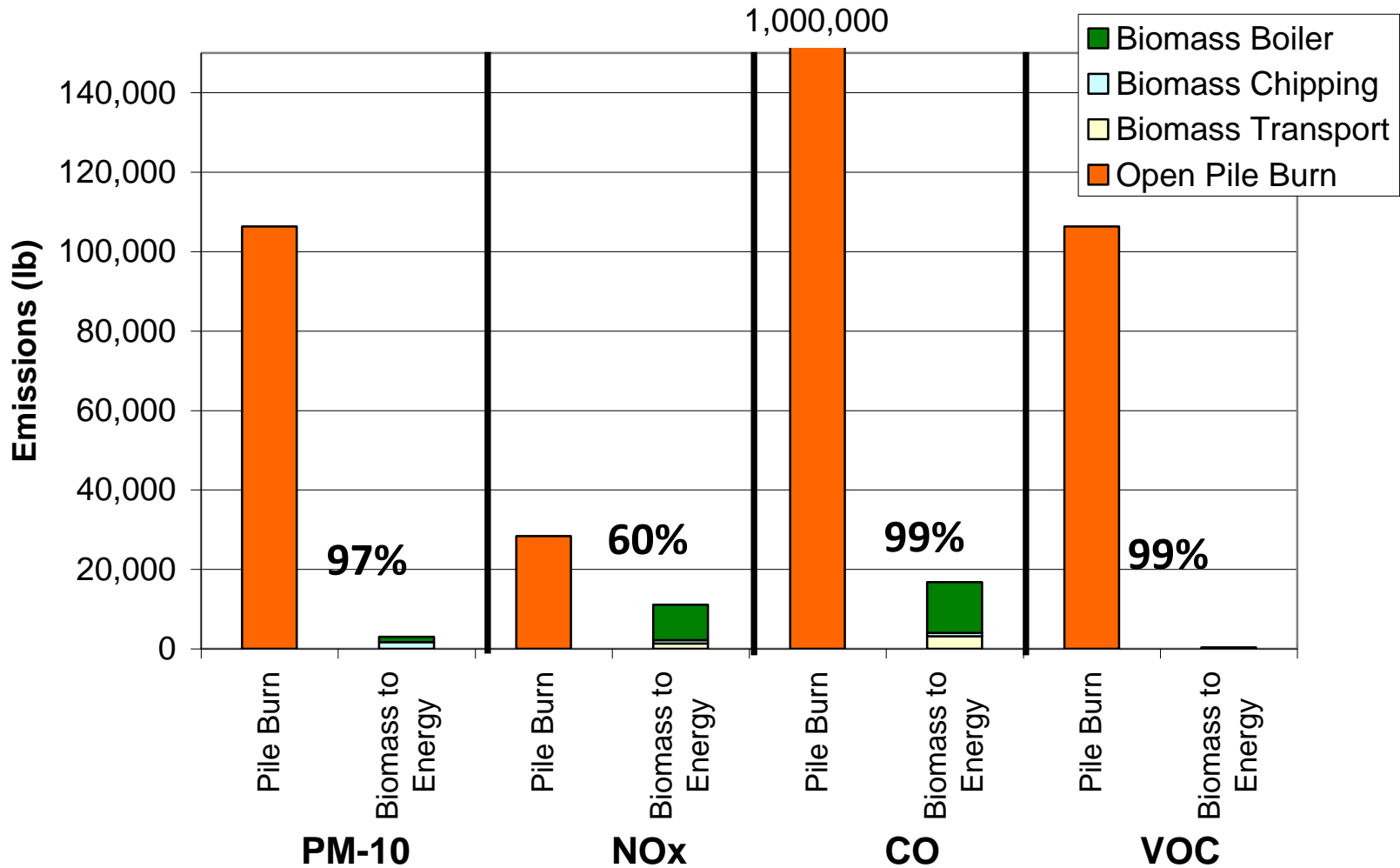
Carbon Registries





Benefits: Biomass to Electricity

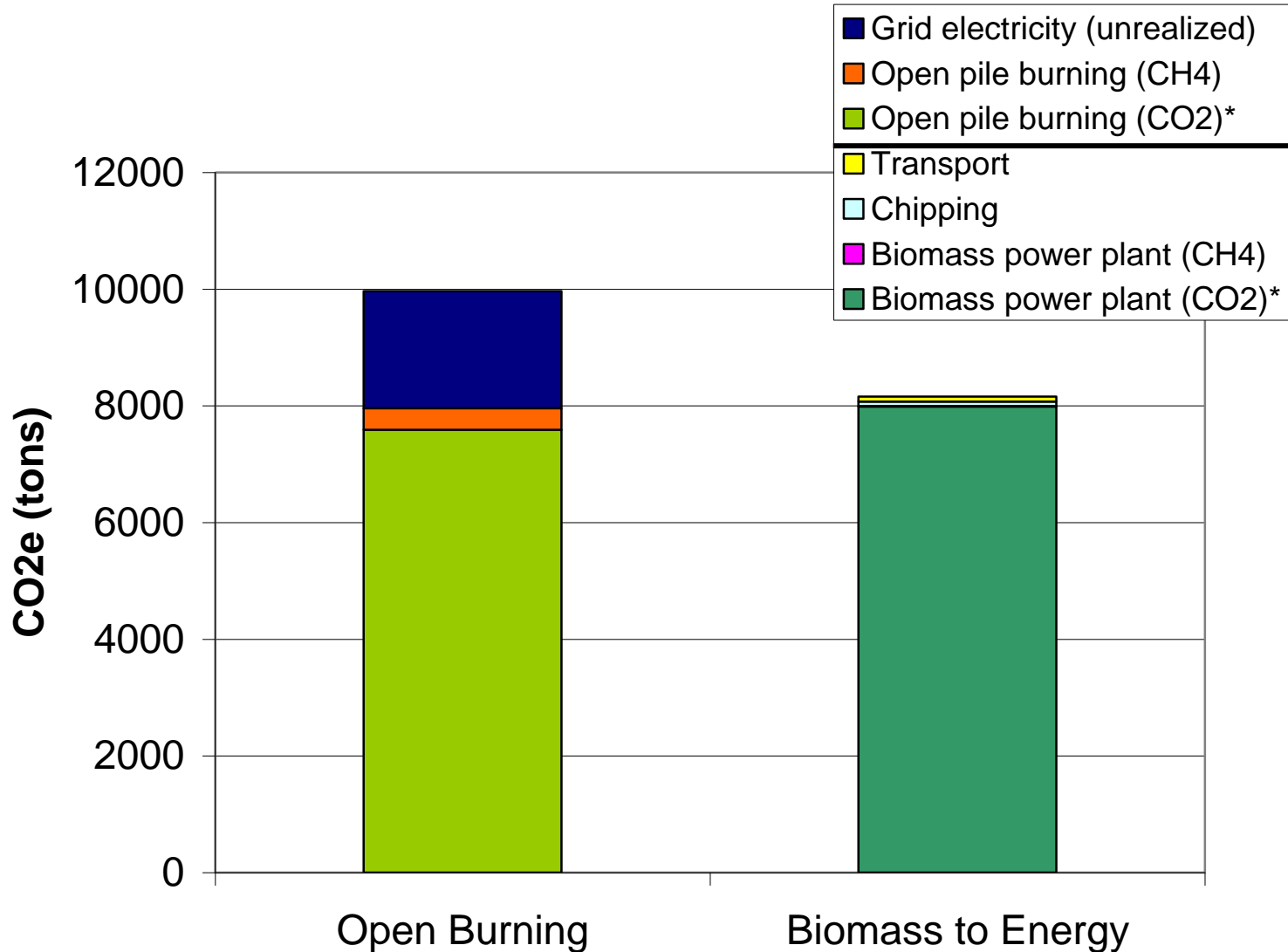
Criteria Air Pollutants





Benefits: Biomass to Electricity

Greenhouse Gases





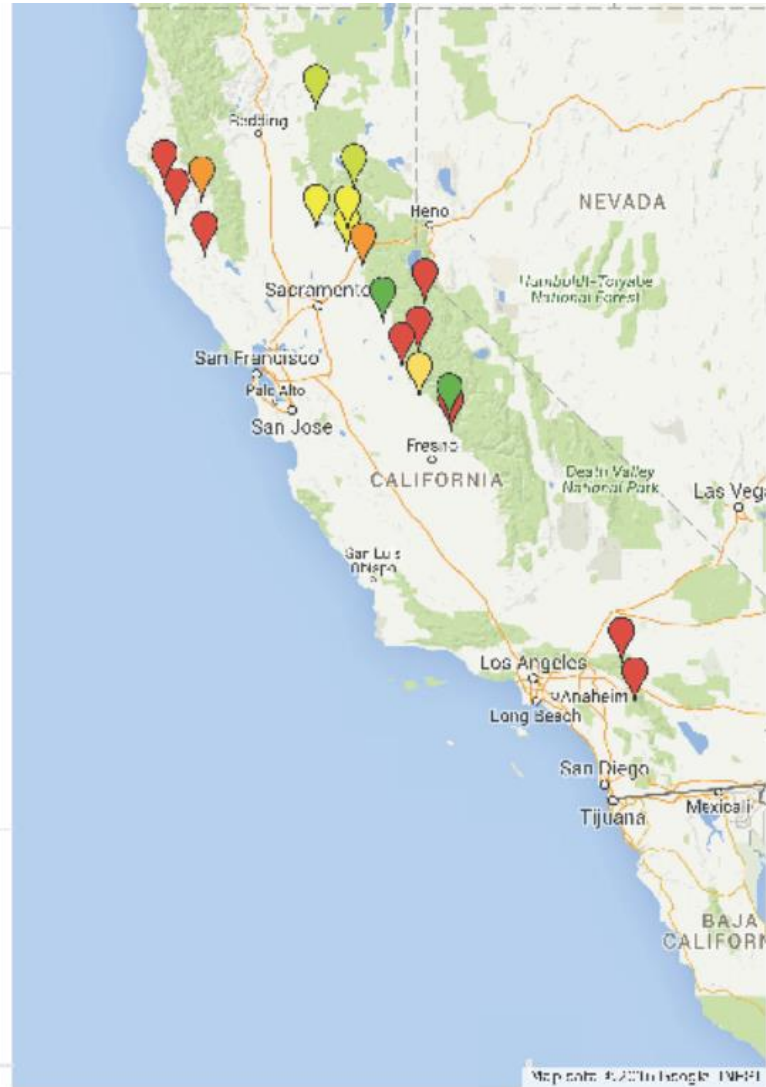
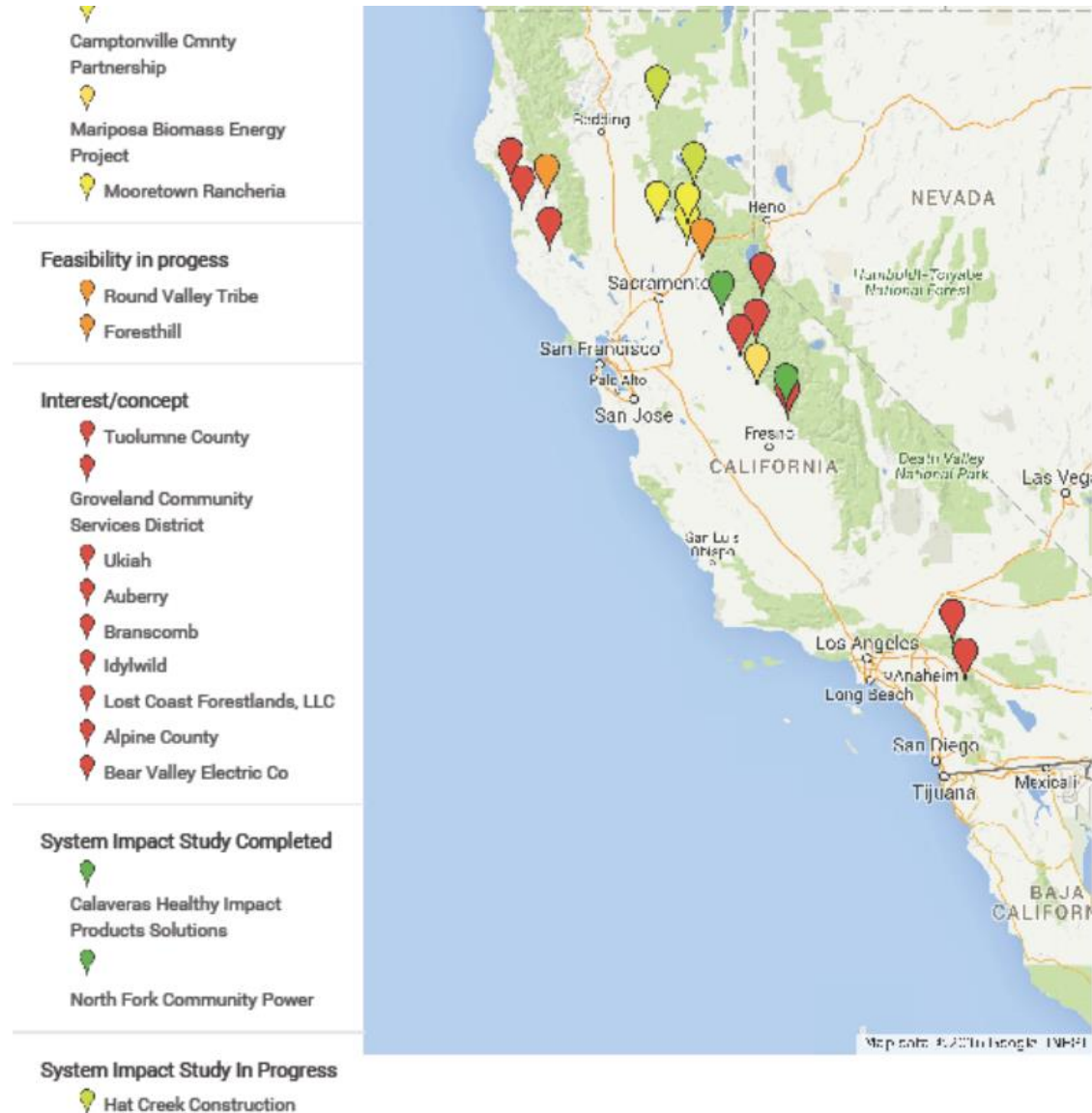
Biochar for Sequestration

- Biochar — porous, carbon-rich, charcoal-like solid
- Formed from the thermal pyrolysis / gasification of biomass
- Use as soil amendment:
 - Sequesters carbon — highly stable and resistant to decomposition
 - Enhances soil fertility — increases water and nutrient holding capacity
 - Reduces soil emissions, enhances biomass growth
 - Displaces fertilizer manufacturing
- Protocol approved in the CAPCOA GHG Rx in October 2015





New California Distributed Bioenergy Projects





A Future Vision: Support of Forest Health and Alternative Biomass Uses

- Continued technology research and development
 - Distributed electricity and heat
 - Biochar
- Legislative needs for 2017
 - Imminent BioMat Program launch
 - Recognition of biomass baseload capability and parity with other renewables
- Regulatory changes and streamlining
- Educational outreach for policymakers and private sector leadership
- Develop multiple markets for forest greenhouse gas offset projects and protocols
 - Black carbon, biochar and avoided wildfire protocol enhancements and opportunities to engage with CARB on protocols
- Support statewide forest health initiatives
 - Statewide tree mortality task force engagement, policy development and advocacy
 - USFS and CAL FIRE partnerships
 - Biomass and forest resiliency investments