

Quantifying Ecosystem Service Benefits of Reduced Occurrence of High-intensity Wildfires

Black Carbon GHG Offset Protocol

Placer County Air Pollution Control District

Presented at Biomass Working Group

June 17, 2015

Funding Partners

SMUD™

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
CAL FIRE
SINCE 1885

Placer County
AIR POLLUTION CONTROL DISTRICT

STATE OF CALIFORNIA
ENERGY COMMISSION

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Objectives and Outcomes

- **Carbon accounting protocol**: Establish a robust carbon accounting protocol for forest management for the California Sierra Nevada forested landscape that reduce wildfire size and severity. This will include site-specific wood products LCA for public and private land in California.
- Provide **technical support for protocol approval** in the California Air Pollution Officers Association Greenhouse Gas Exchange and/or the American Carbon Registry and/or other GHG offset credit registries that are determined to be appropriate for protocol acceptance.
- Establish robust and region-specific causal relationships and protocols that allow measurement of selected **co-benefits associated with avoided catastrophic wildfires**;
- Provide **returns on investments** in terms of carbon and ecological co-benefits for avoiding catastrophic wildfires through fuel treatments;
- Identify demand-driven market mechanisms to **co-finance avoided wildfire activities** by setting relevant and defensible economic values for ecological co-benefits and outreach to market actors.

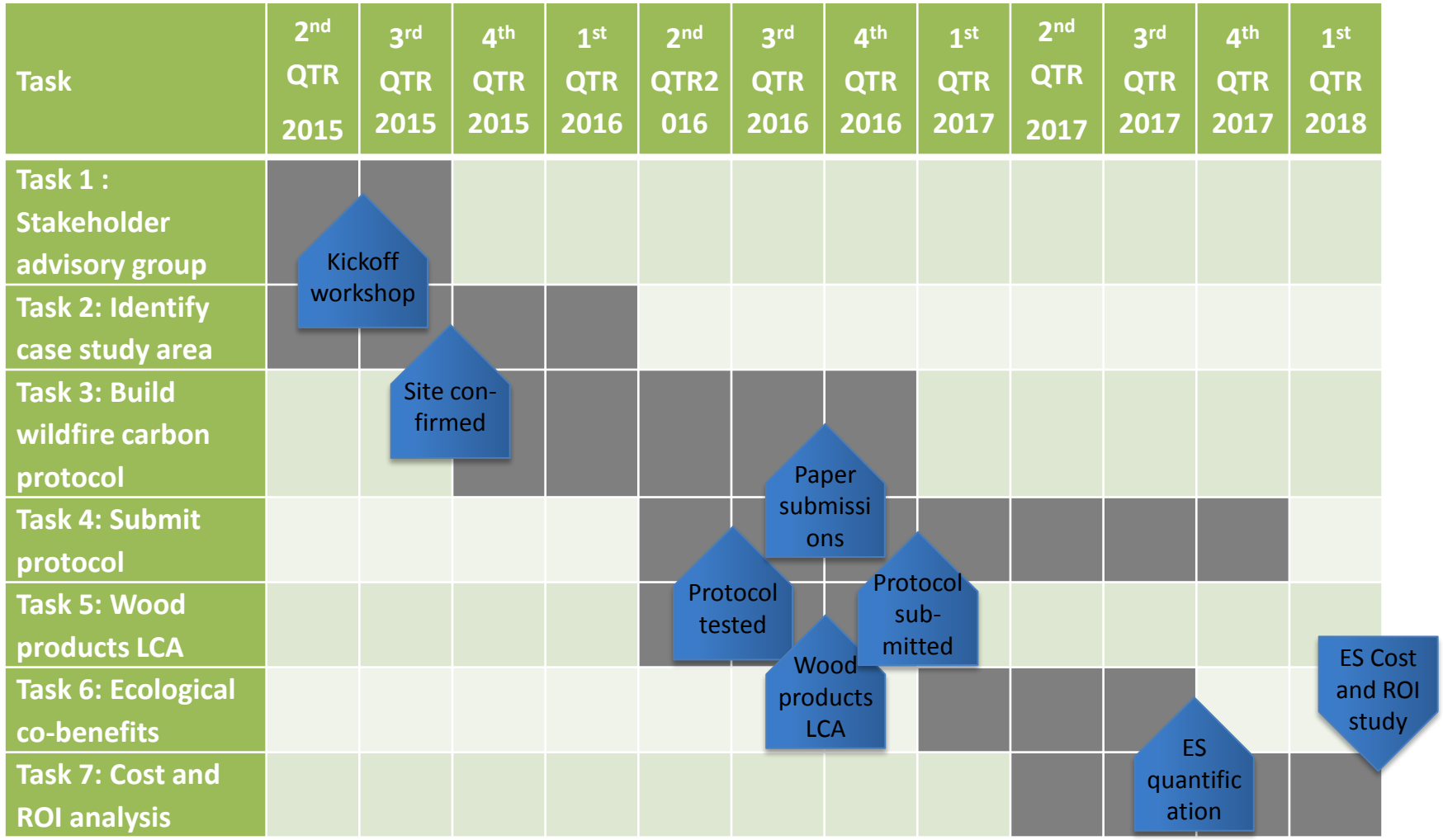
How We Got Here

Date	Project / Activity	Team
2006-2010	WESTCARB – Alder Springs, Shasta Co. CA , Lake Co. OR	Winrock, USFS, SIG, TSS, OSU, OU
2006-2010	Forest Biomass-to-Energy Assessment	USFS, SIG, TSS
2007	Forest GHG Offset Protocol, Improved Forest Management	CAR-directed
2007	AB32 early adoption of forest protocol – “fuels management protocol in development by Winrock/WESTCARB”	CARB
2008-2010	Last Chance SNAMP Case Study	SIG, TSS, USFS, PCAPCD
2015	Guidance on Methods for Evaluating GHG Emission Reductions for Programs in the CAL FIRE Greenhouse Gas Reduction Fund	CAL FIRE

Tasks

- Task 1. Form stakeholder advisory group
- Task 2. Identify case study area
- Task 3. Ensure versatility and robustness in the carbon accounting framework
- Task 4. Protocol submittal, review, and approval process support
- Task 5. Add wood products life cycle analysis (LCA) to carbon accounting framework
- Task 6. Avoided wildfires effects analysis: accounting for ecological co-benefits
- Task 7. Avoided cost and return-on-investment analysis and market outreach

Timeline


Task
2nd QTR 2015
3rd QTR 2015
4th QTR 2015
1st QTR 2016
2nd QTR2 016
3rd QTR 2016
4th QTR 2016
1st QTR 2017
2nd QTR 2017
3rd QTR 2017
4th QTR 2017
1st QTR 2018
Task 1 : Stakeholder advisory group
Task 2: Identify case study area
Task 3: Build wildfire carbon protocol
Task 4: Submit protocol
Task 5: Wood products LCA
Task 6: Ecological co-benefits
Task 7: Cost and ROI analysis
Kickoff workshop
Site con-firmed
Paper submissi ons
Protocol tested
Protocol sub-mitted
Wood products LCA
ES quantific ation
ES Cost and ROI study

Milestones

	Task 1. Science Advisory Committee selection
	Task 2. Case study location selection
June 1, 2015	Kickoff meeting
	Task 3. Carbon accounting framework report
	Review meeting
	Task 4. CAPCOA and ACR GHG Registry submittal
	Task 5, 6, 7. Final project results report
	Final meeting

Stakeholder Advisory Group

Science Advisory Committee

Name	Organization
Matt Hurteau	Univ of New Mexico
Bruce Hartsough	UCD
Rob York	Berkeley
Jessica Orego	ACR
John Nickerson	CAR
Blane Heumann	TNC
Steve Hallmark	SMUD
Ed Murphy	SPI
Chris Keithley	CAL FIRE
David Sapsis	CAL FIRE
Bill Kinney	CEC
Rizaldo Aldas	CEC
Malcolm North	USFS
Bruce Springsteen	PCAPCD
Peter Stine	USFS
Brandon Collins	USFS
Hugh Safford	USFS

Research Team

Name	Organization
David Saah	USF/SIG
Thomas Buchholz	SIG
Tadashi Moody	SIG
Jason Moghaddas	SIG
Travis Freed	SIG
Shane Romsos	SIG
Charles Kerchner	SIG
William vanDoren	SIG
David Schmidt	SIG
Austin Troy	SIG
Max Moritz	SIG
John Gunn	SIGNAL
Steve Eubanks	Independent
Tad Mason	TSS
John Lendvay	USF

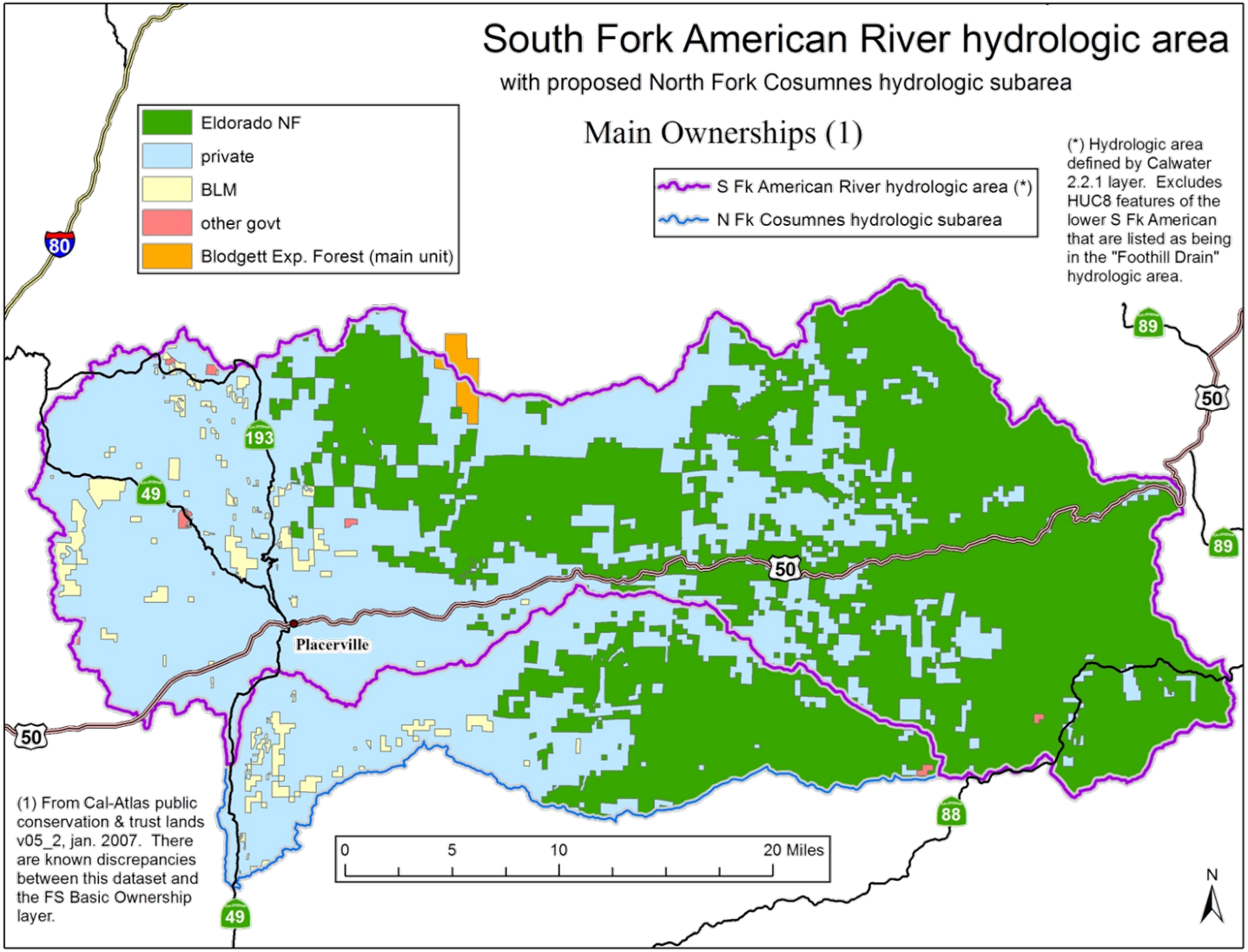
Senior Science Reviewers

Name	Organization
John Battles	USB
Scott Stephens	UCB

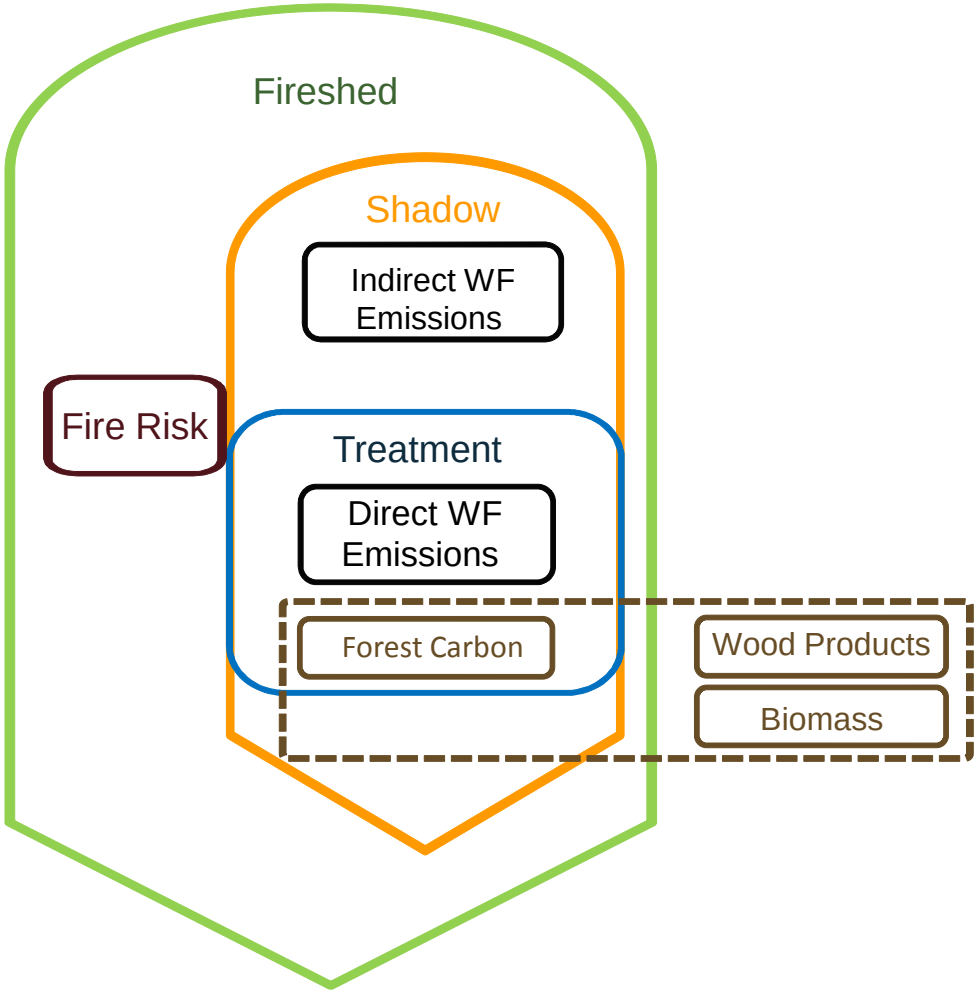
Steering Committee

Name	Organization
Tom Christofk	PCAPCD
Bruce Springsteen	PCAPCD
Mark Pawlicki	SPI
Val Tiangco	SMUD
Duane Shintaku	CAL FIRE
Ken Pimlott	CAL FIRE
Jerry Bird	USFS
Liz Berger	USFS
Russ Henly	Resources Agency
Ashley Conrad Seydah	Cal EPA
Steve Brink	CFA

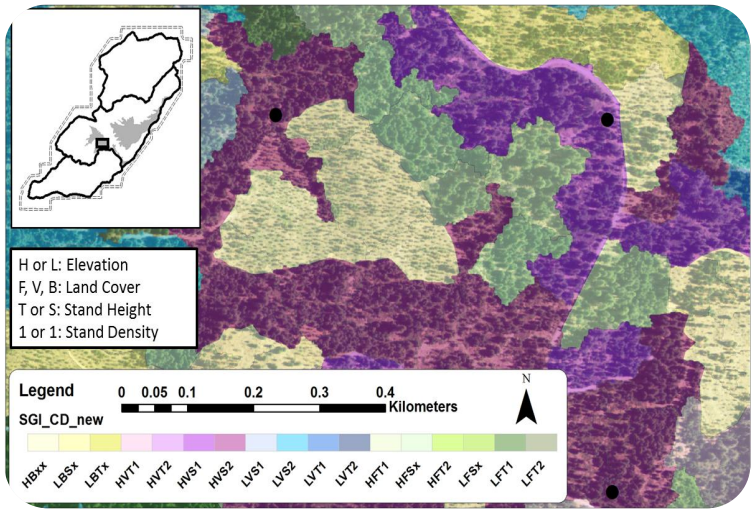
Case Study Area

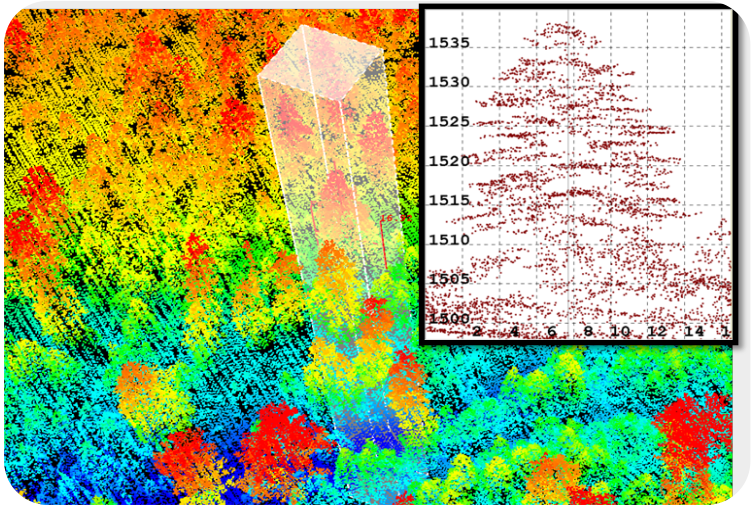


Accounting Framework



Fireshed





Fire Basin Development
- Watersheds
- Ecoregions

Fire Behavior Triangle
- Fuels
- Weather
- Topography

Barriers
- Water
- Roads
- Urbanized Areas

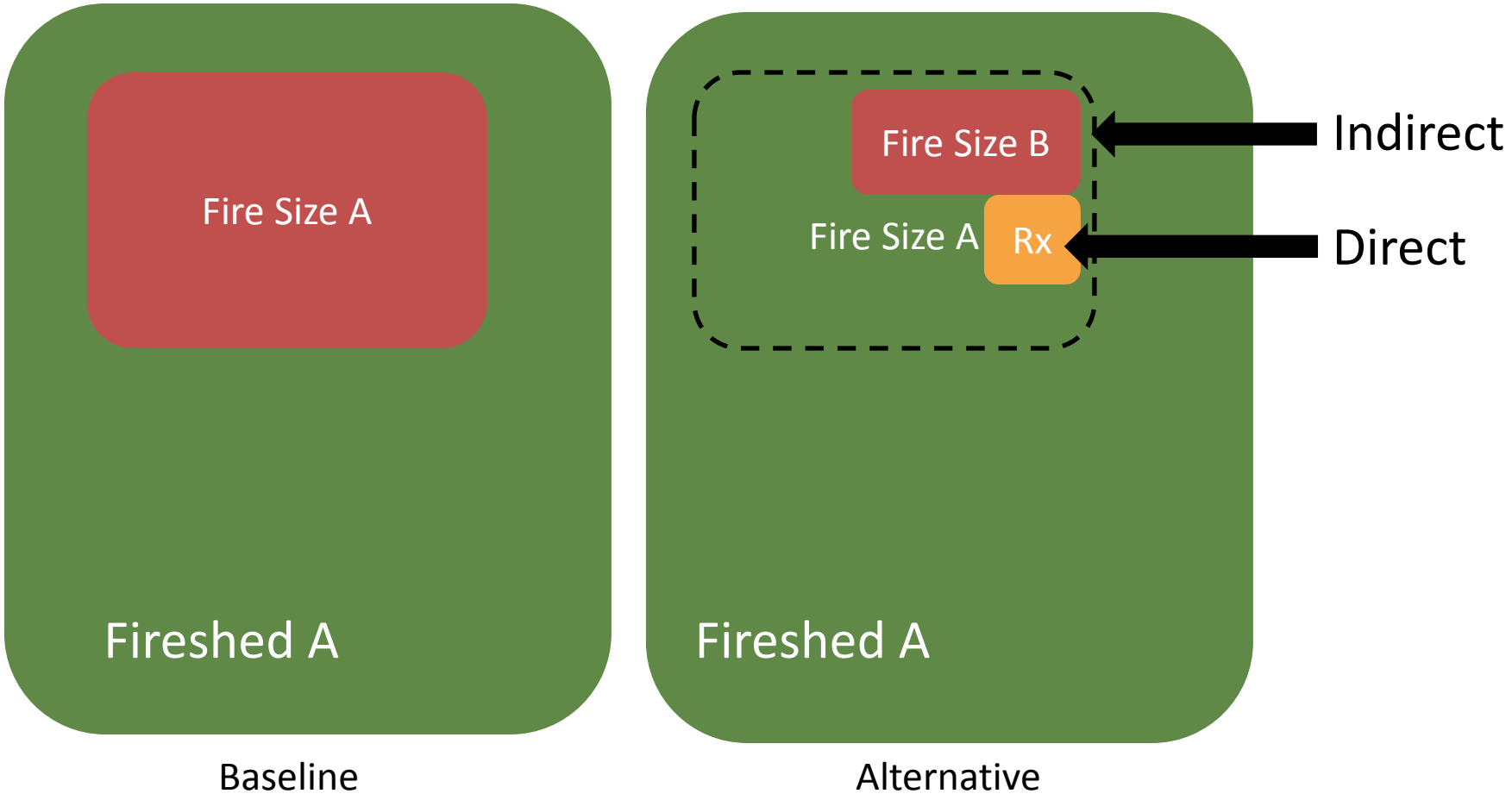
Fire Behavior Paths
- Flammap

Network Analysis
- Locations
- Destinations
- Barriers

Historical Analysis
- Fire Size
- Fire Intensity

Fireshed Development
- Watersheds
- Ecoregions

Wildfire -- Direct and Indirect Emissions



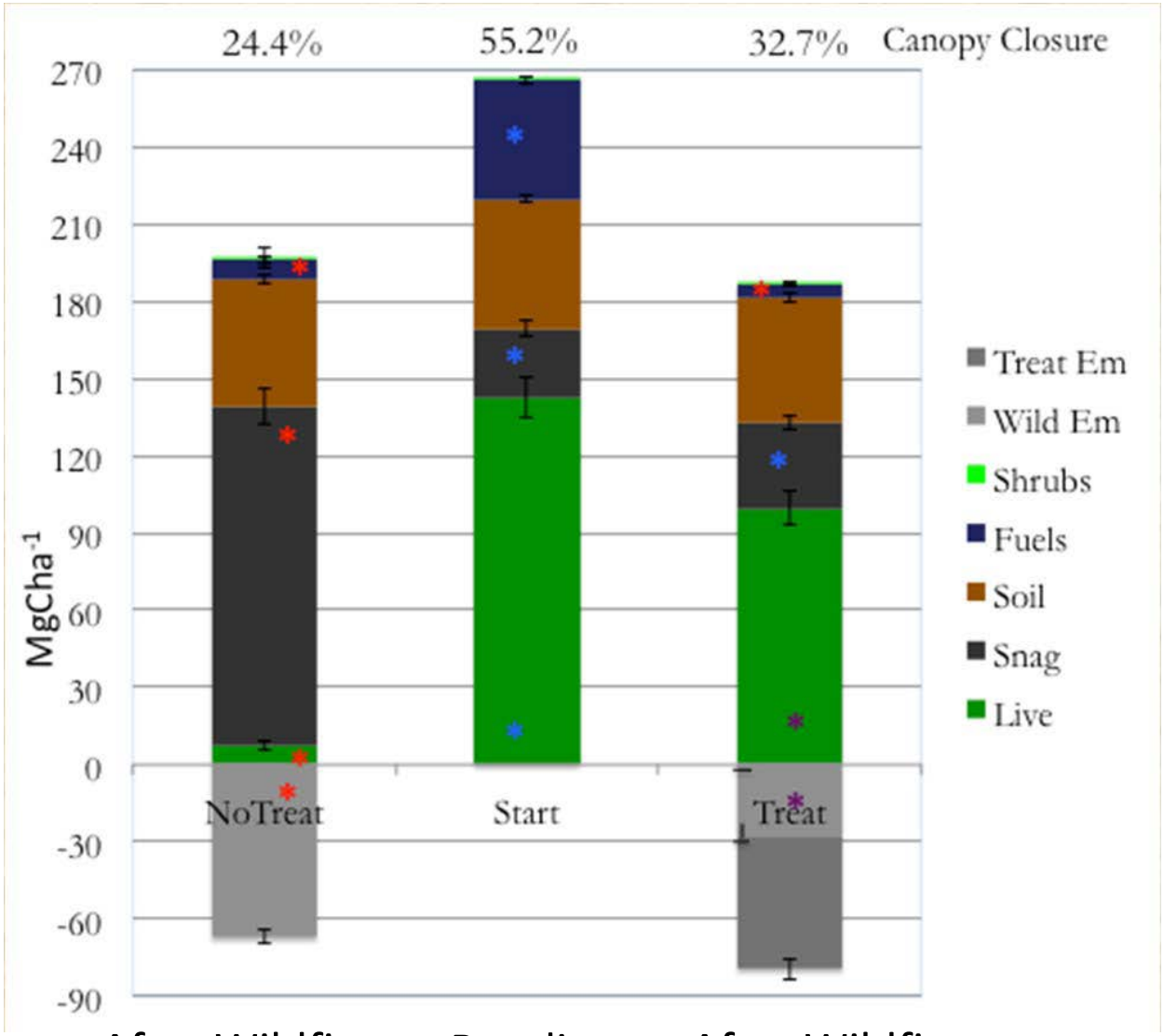
Other Ecological Co-benefits

- Identification of relevant ecological co-benefits – focus on water quantity and quality
- Develop a protocol to scientifically link ecological co-benefits to avoided wildfire measures:
  - Scoping effort of available models (e.g. occupancy models, hydrology models)
  - Identification and implementation of applicable models for the case study area.
- Previous projects:
  - Mokelumne Avoided Cost Analysis (Buckley et al. 2014)
  - USDA Forest Service's Forests to Faucets project (USDA Forest Service 2014)
  - Tahoe Regional Planning Agency's efforts to measure ecosystem services in the Tahoe Region (in progress).

Fuel Treatment Impacts on Forest Carbon After Wildfire

Distribution of carbon in typical Sierra Nevada mixed conifer forest

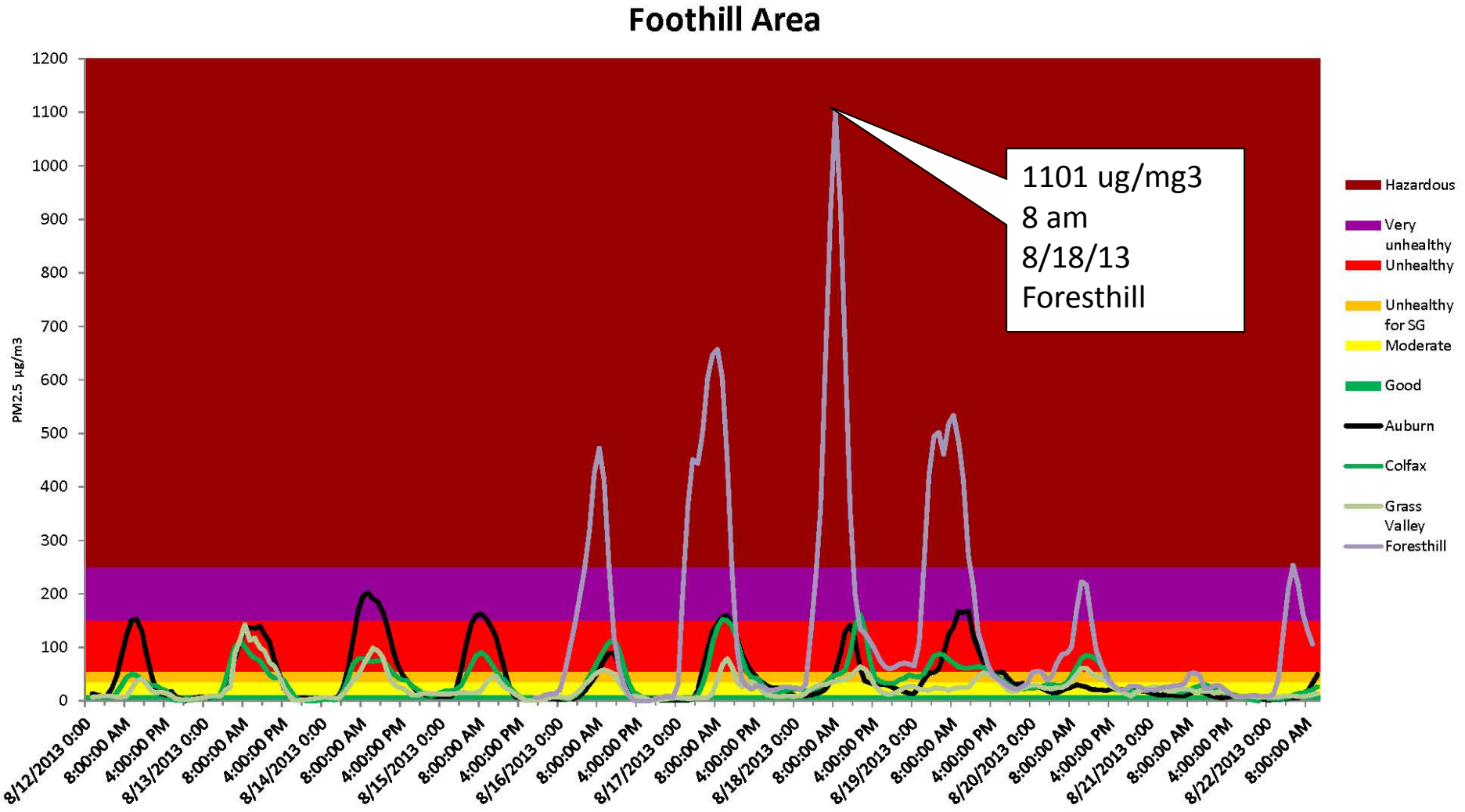
- **Trees: 55%**
- **Dead wood: 5%**
- **Surface fuels: 10%**
- **Soil: 18%**
- **Roots: 13%**



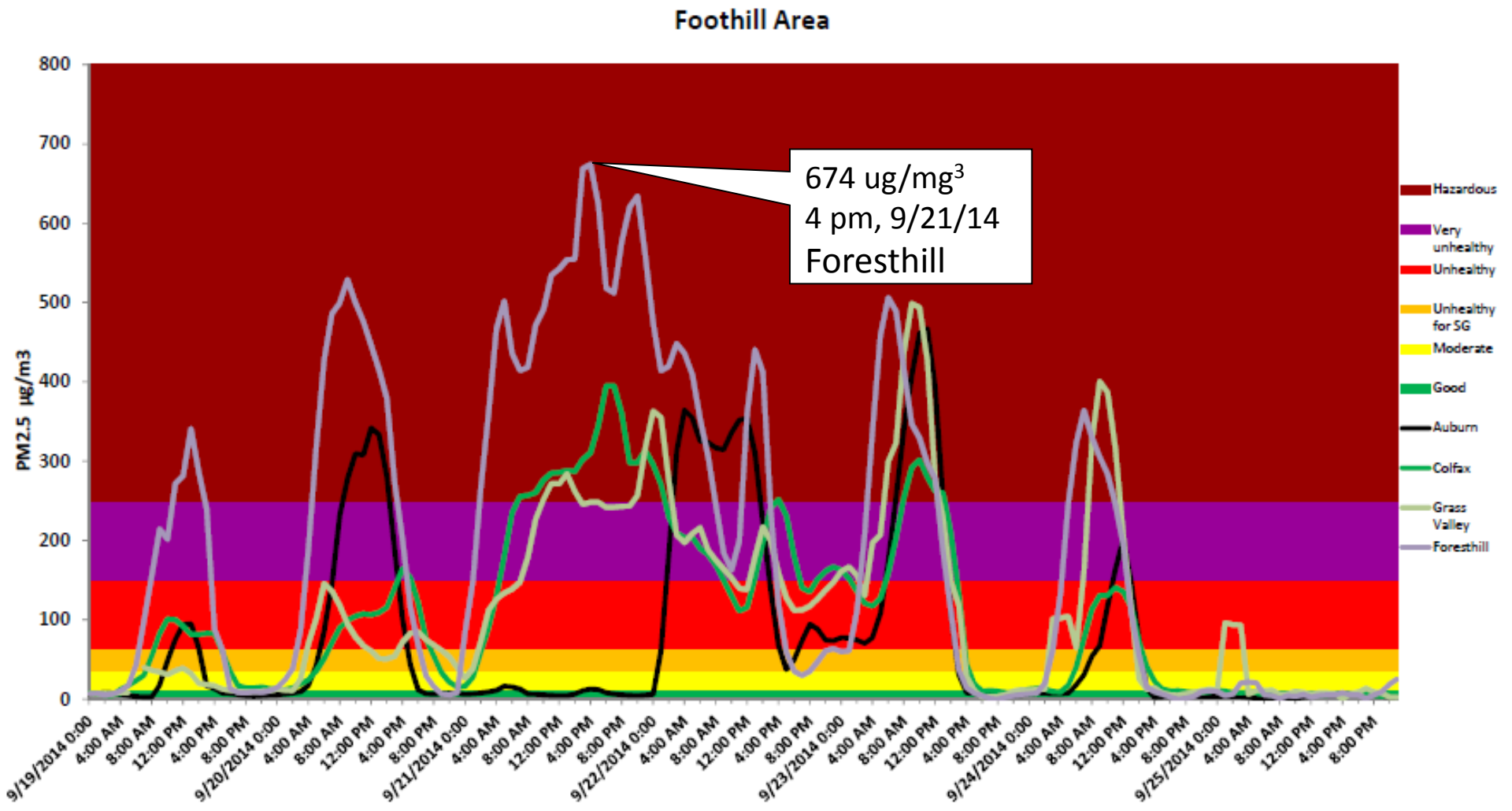
After Wildfire No Treatment | Baseline | After Wildfire, Treated

Courtesy of work by Dr. Malcolm North, USFS and UC Davis

2013 Wildfire Impact
American Fire (27,440 acres)



2014 Wildfire Impact
King Fire (97,717 acres)

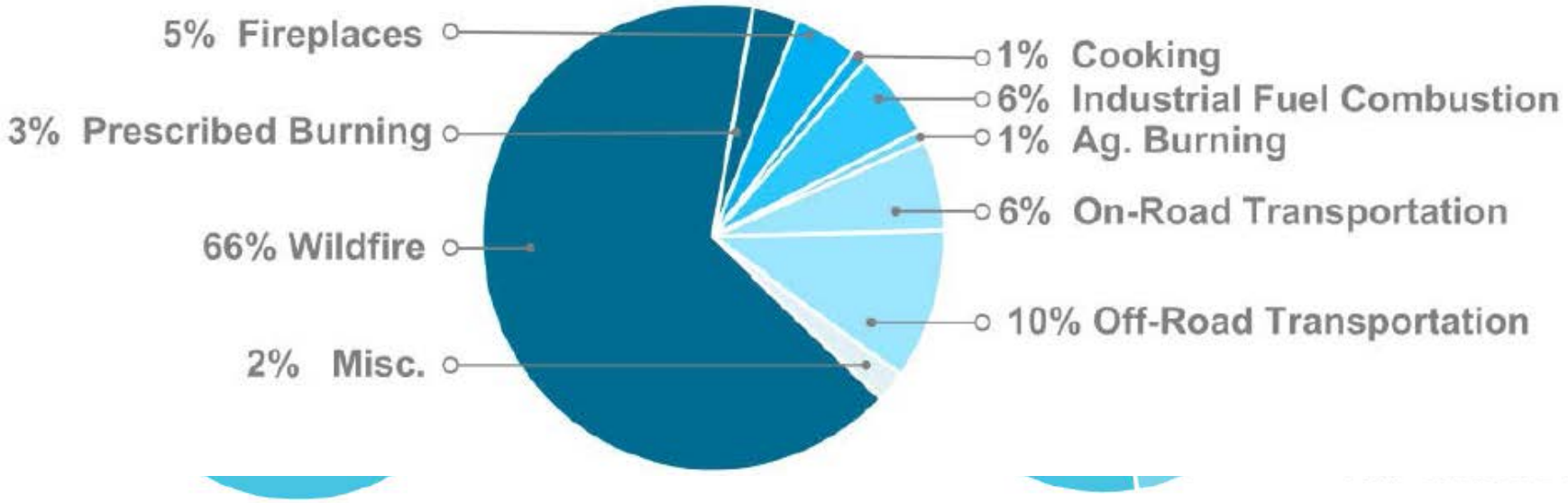


Black Carbon GHG Protocol

- Product of incomplete combustion
  - Soot
- Small particles
  - Travel long distance through air
- "Short-lived climate pollutant"
  - 900 times by weight more potent than CO_2

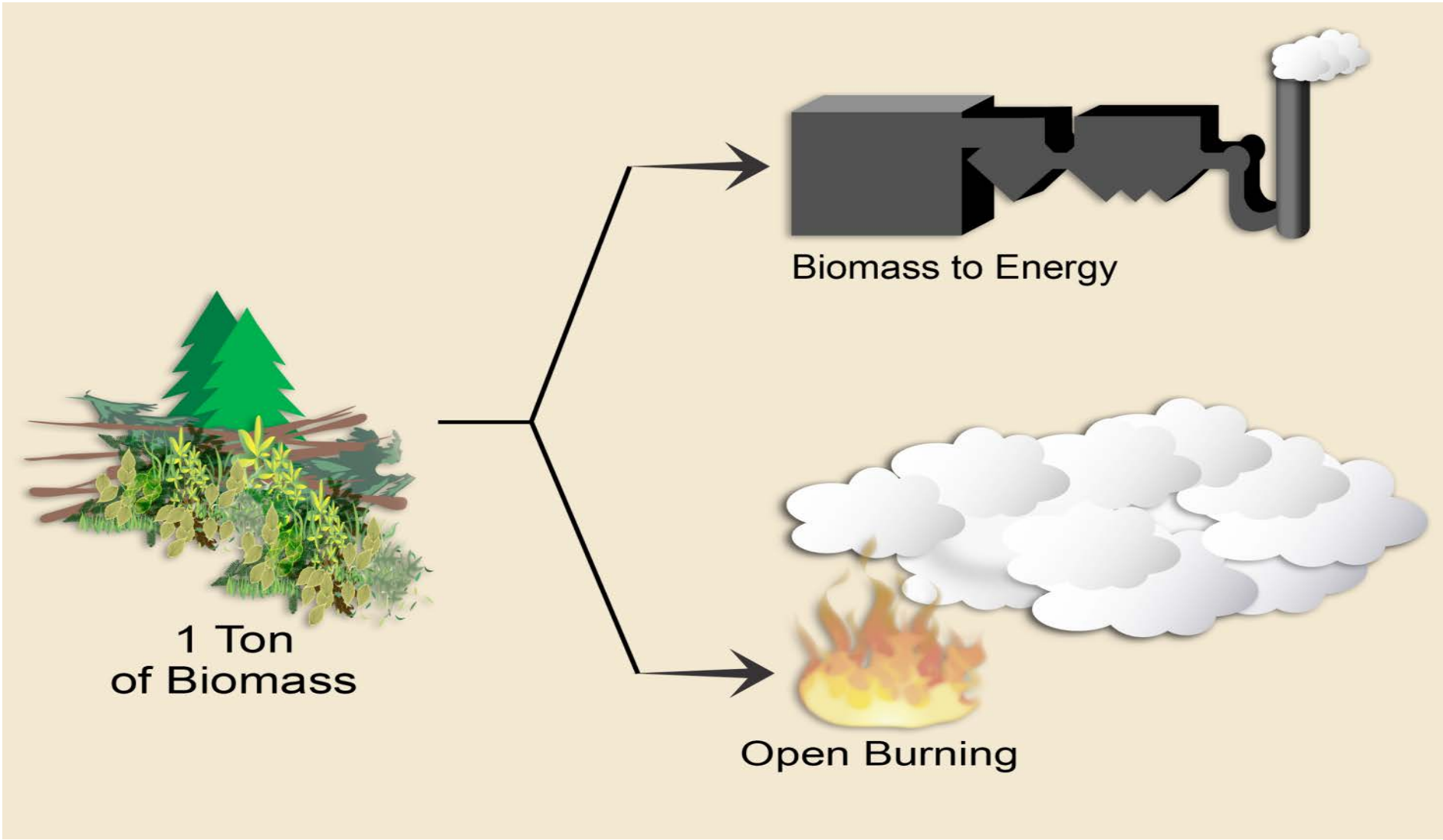
Short-Lived Climate Pollutants

Figure 3: California 2013 Black Carbon Emission Sources

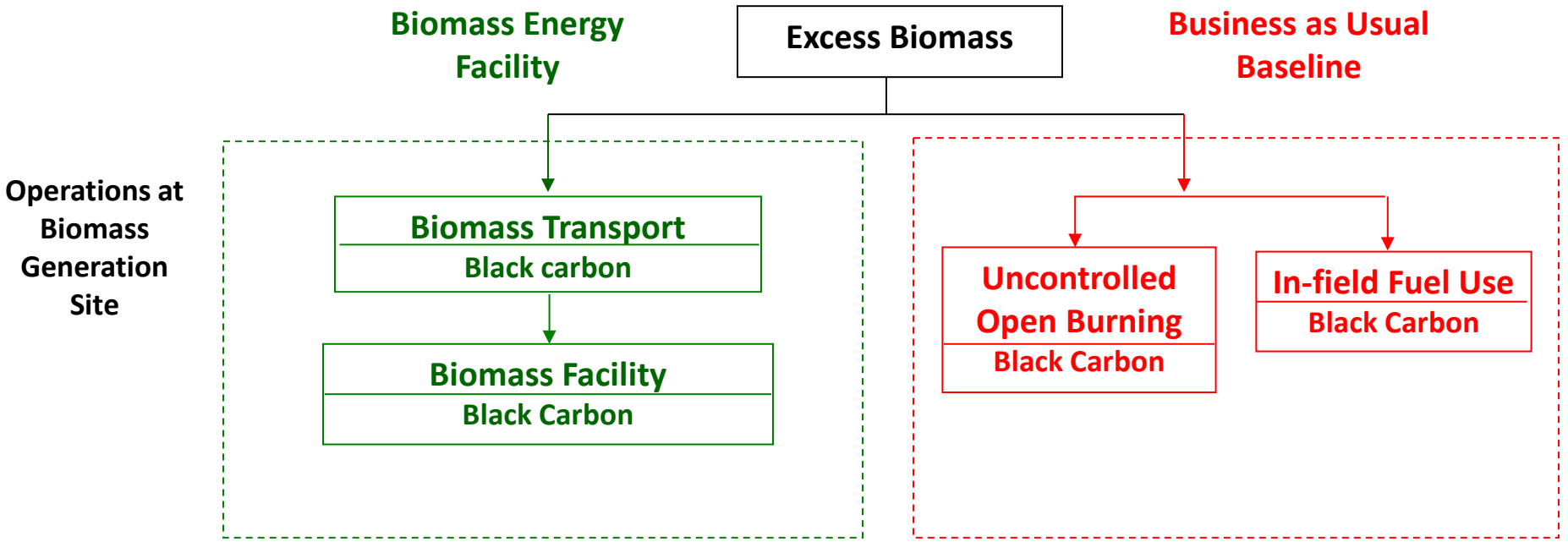


California Air Resources Board Concept Paper for Short-Lived Climate Pollutant Reduction Strategy, May 7, 2015 http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf

Black Carbon Protocol Concept

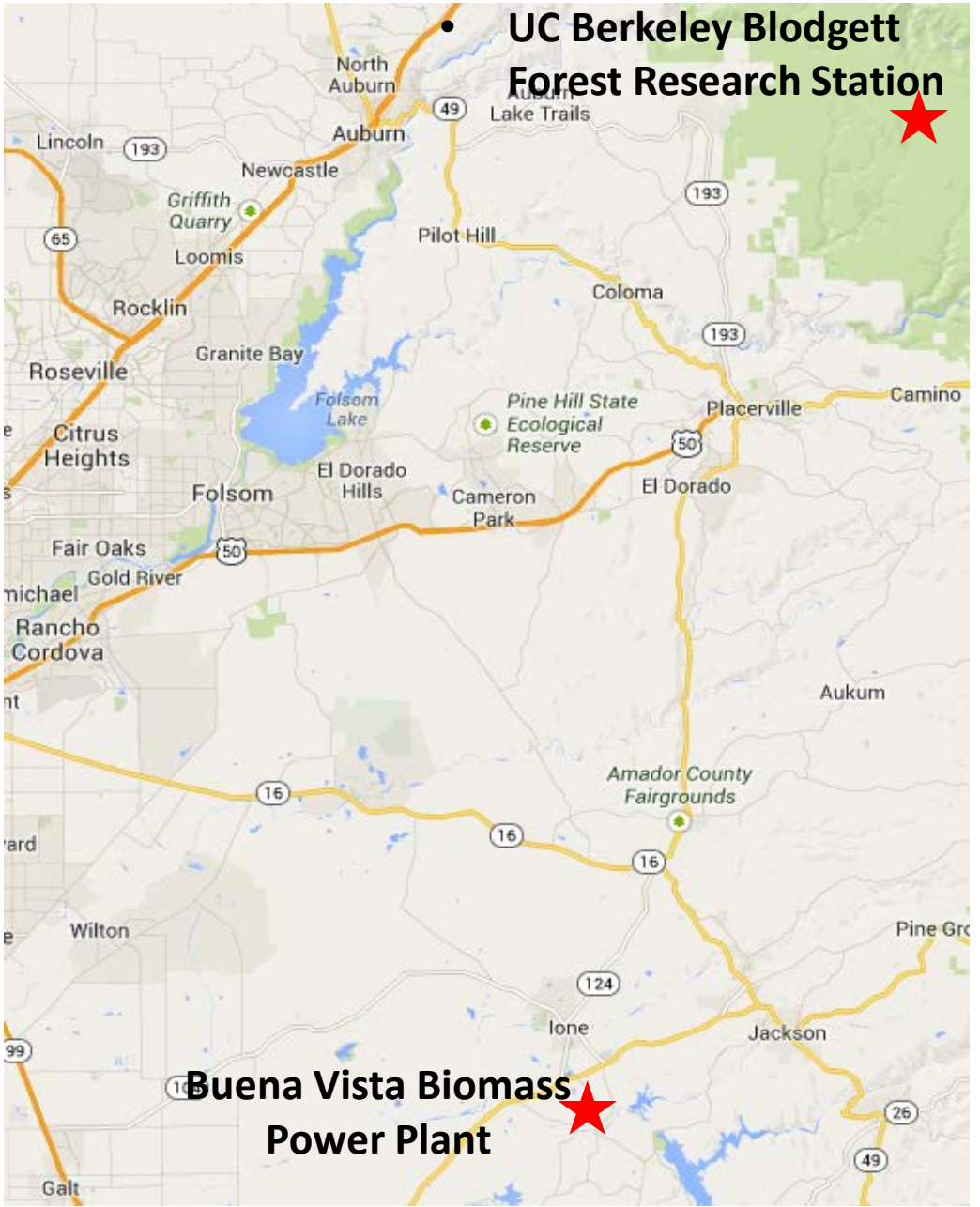


Black Carbon Protocol Concept



$$BC_{Reduction} = BC_{Open\ Burn} + BC_{In\text{-}Field\ Fuel\ Use} - BC_{Biomass\ Facility} - BC_{Biomass\ Transport}$$

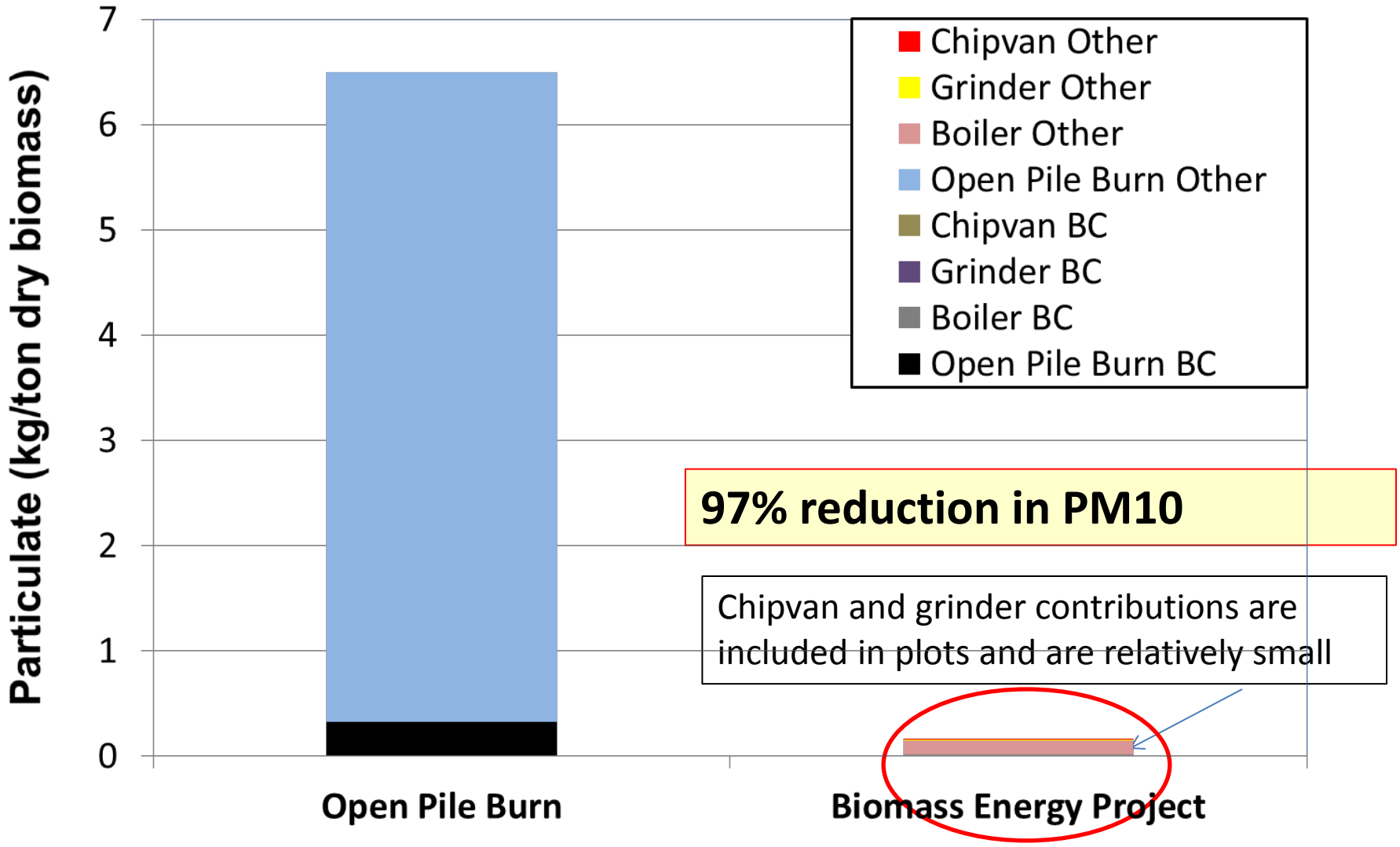
Blodgett Bioenergy Project Summer 2013



Blodgett Bioenergy Project

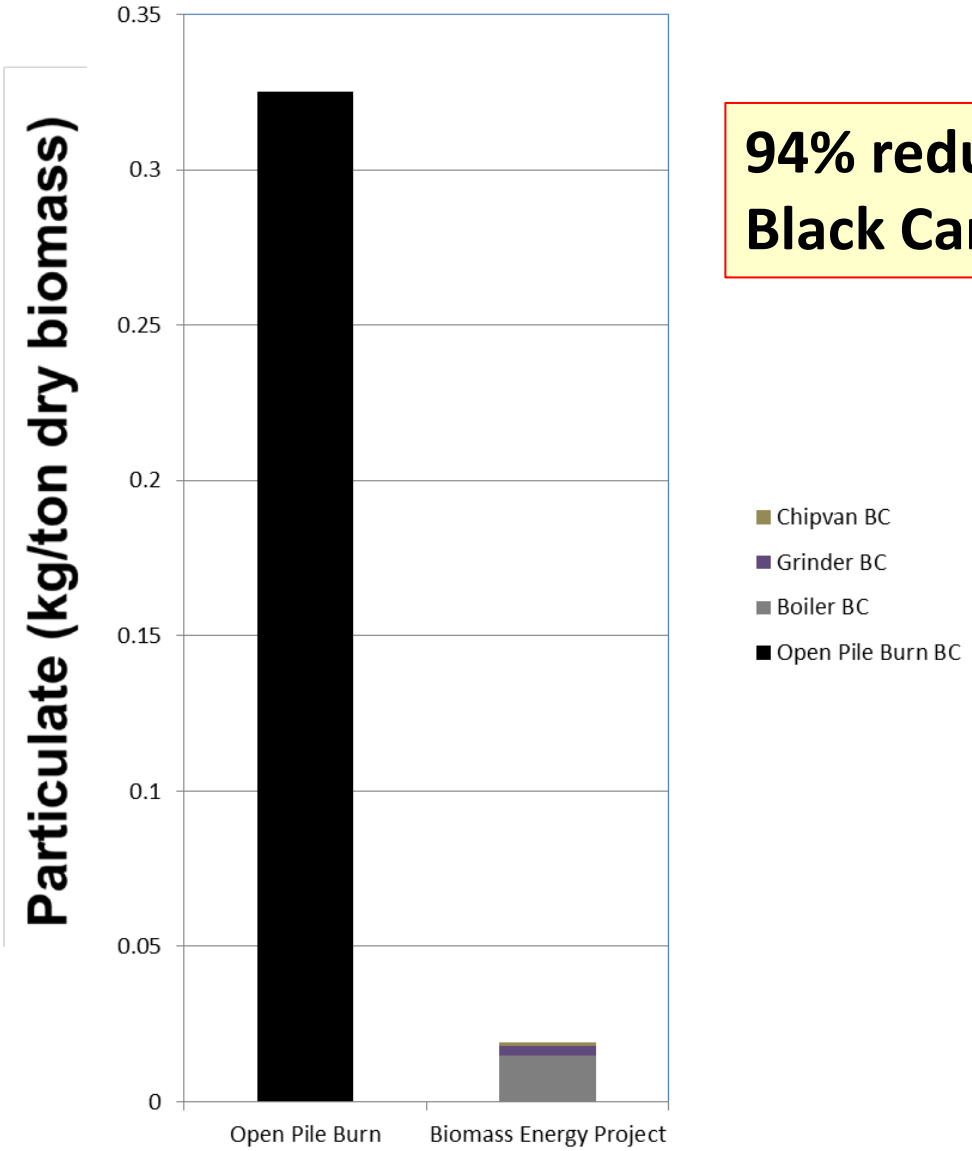
- Collaboration between UC Berkeley College of Natural Resources, PCAPCD, UC Davis, and USFS Rocky Mountain Research Station
- 600 BDT of slash from timber operations used to produce 600 MWh electricity (powers 100 homes for one year)
- Air pollution measurements taken from open pile burn
- Significant reduction in greenhouse gases and criteria air pollutants

Results from Blodgett Project (PM10)



PRELIMINARY ESTIMATES

Results from Blodgett Project (Black Carbon)



94% reduction in Black Carbon

Open Pile Burn Field Study

- Quantify BC emissions from open pile burns
- Study related parameters
  - Woody biomass type
    - ✓ Mixed conifer
    - ✓ Brush
    - ✓ Ag fruit and nut wood
  - Moisture / seasoning
  - Pile stacking
    - ✓ Hand
    - ✓ Machine
  - Combustion efficiency
  - Carbon content
- Create a user-friendly matrix for project operator to quantify avoided BC emissions from open pile burn

Open Pile Burn Field Study

- Literature Review for open pile burning emission factors
  - Matrix of factors identified by research for emission estimations
  - Reference for field studies
- Forming a field study research team to characterize BC emissions from open pile burning
  - Field studies (partnering with USFS Rocky Mountain Science Station Missoula Fire Sciences Laboratory)
  - Three separate trips to Sierra Nevada and Sacramento Valley for measuring BC emissions from biomass open pile burning and Ag burning
  - Data analysis and integration with literature review
- Funding contribution to date: PCAPCD ($25k), SMAQMD ($10k), expect additional from SCAQMD, BAAQMD, and SLOAPCD
- Concurrent effort to evaluate black carbon reductions from wood stove upgrades and replacements