WESTCARB Annual Business Meeting

Terrestrial Sequestration Pilots

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Anchorage, AK
October 1, 2008

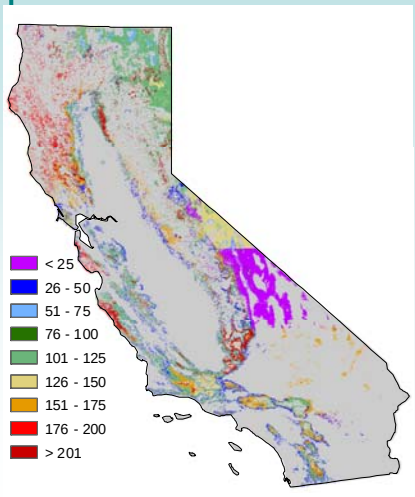
Phase II Objectives: Terrestrial Sequestration

- Validate and demonstrate the terrestrial carbon sequestration opportunities identified in Phase I, through pilot projects, methodology development, reporting, and market recognition
- Research to inform decisions by policymakers, communities, and businesses on how to invest in CCS technology development and deployment to achieve climate change mitigation objectives

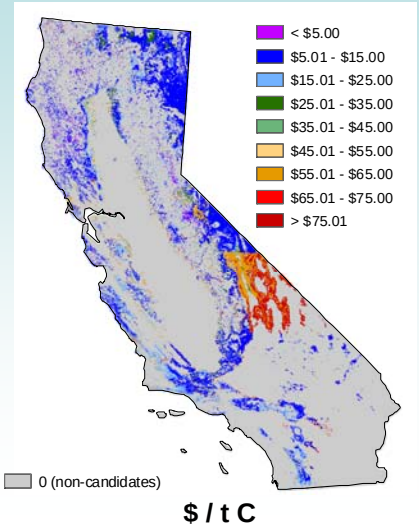
Terrestrial Sequestration Phase II Activities

1. Shasta County pilot
2. Lake County pilot
3. Develop methodology to determine carbon credits from improved fuels management
4. Ongoing regional characterization and identification of future pilot sites
5. GIS carbon reporting

Afforestation – CA statewide analysis
Potential sequestration and cost (40 Years)

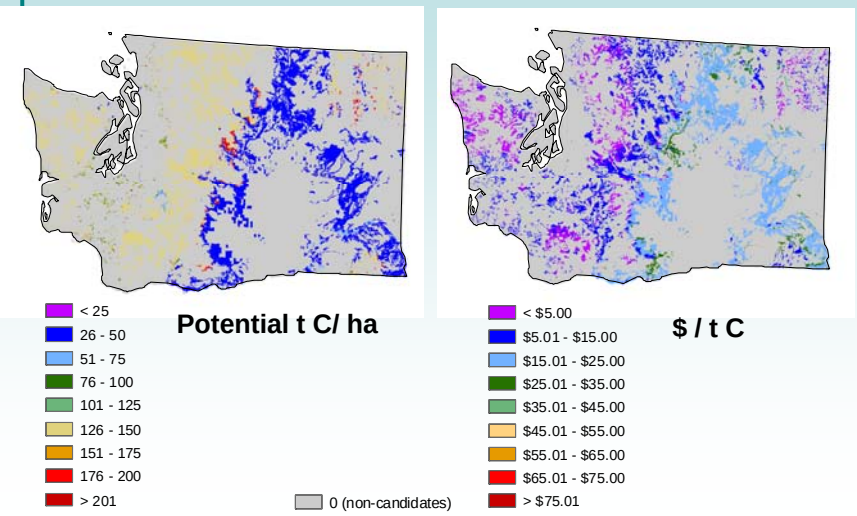


Potential t C/ ha



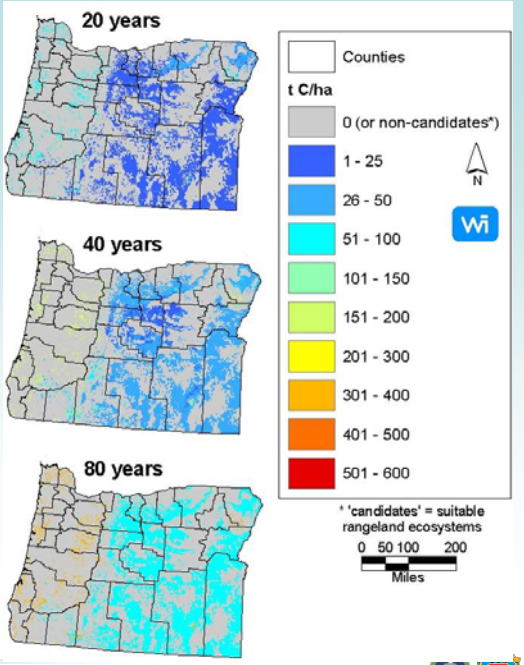
$ / t C

Afforestation – WA statewide analysis
Potential sequestration and cost (40 Years)



WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP 5

Additional carbon sequestration potential of Oregon rangelands



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1. Shasta County Pilots

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- Afforestation of marginal rangelands
- Hazardous fuel reduction
- Conservation-based forest management
- LaTour State Forest

Shasta County Partners

1

- Western Shasta RCD
- WM Beaty and Associates
- Pacific Forest Trust
- Wheelabrator Shasta
- California Climate Action Registry
- Climate Trust
- California Department of Forestry and Fire Protection
- California Energy Commission
- California Forest Products Commission
- US Forest Service
  - Pacific Southwest Research Station
  - Pacific Northwest Research Station (Pacific Wildland Fire Sciences Laboratory, FERA)
  - Shasta Trinity National Forest
- National Park Service
  - Whiskeytown National Recreation Area
  - Lassen Volcanic National Forest
- Bureau of Land Management
- Pacific Gas & Electric
- Bascom Pacific LLC

Shasta Afforestation Projects

1

Project	Acres	Description	Status
Red River Forest Partnership	98	Ponderosa pine afforestation, *brush removal for bioenergy*	Site prep done, planting done
Brooks Walker	14	Mixed conifer afforestation	Site prep done, planting done
Hendrix Phillips	20	Ponderosa pine afforestation, easement on property	Site prep done, planting done
Goose Valley	60	Mixed conifer afforestation, past fire site	Site prep done, planting done
Lammers	53	Mixed conifer afforrestation, past fire site (1992)	Site prep fall 2008, planting in 2009
Frase	43	Ponderosa pine afforestation, affected by copper smelting in 1910	Site prep done, planting in 2009
Kloeppel	51	Ponderosa pine afforestation, past fire site (1992)	Site prep done, planting in 2009
Sivadas	38	Ponderosa pine afforestation	Site prep done, planting in 2009
Eilers	8	Oak pine afforestation	Collecting acorn crop, planting in 2009
Wilson	15	Ponderosa pine afforestation	Site prep done, planting in 2009
Lakey	60	Ponderosa pine afforestation, recent fire (2007)	Site prep done, planting in 2009
BLM	10	Oak woodlands	*Agreement in process*

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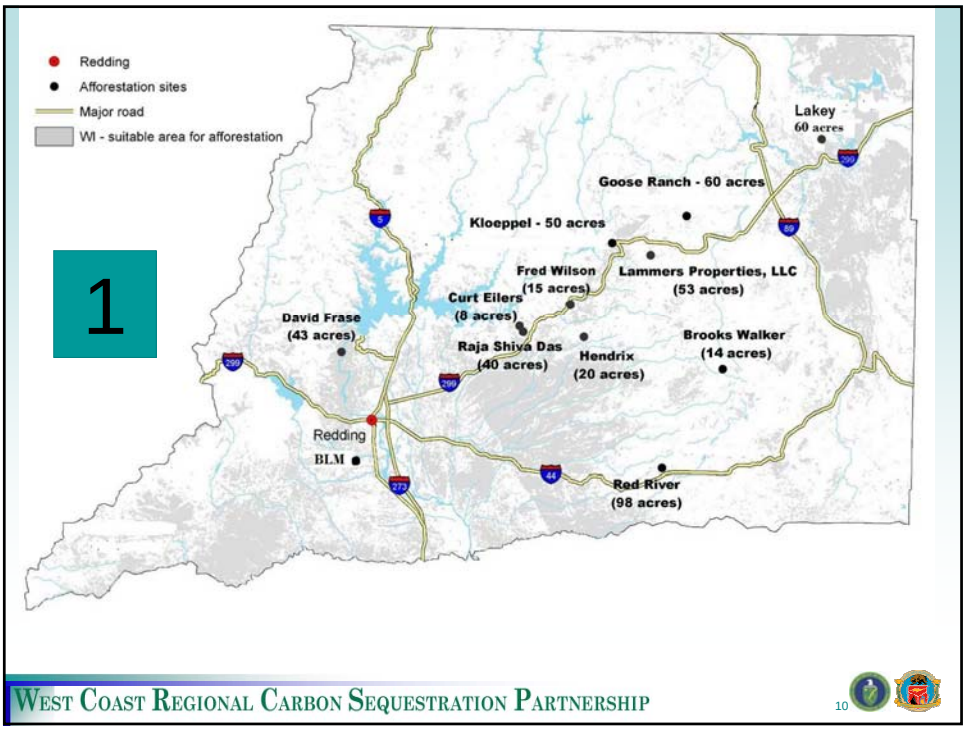

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Shasta afforestation preliminary results

1

Project	Baseline C prior to site prep		
	Mean (t C/ac)	95% CI (t C/ac)	# plots taken
Red River Forests Partnership	3.1	1.4	8
Brooks Walker	3.6	1.9	5
Hendrix-Philipps	11.3	4.3	10
Goose Valley Ranch	22.9	10.0	10

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Shasta Hazardous Fuel Treatments

1

On all treatments, trees were extracted intact, commercial timber was taken to a mill and tops and branches of commercial trees were chipped and hauled to a biomass energy plant.

Example:

PG&E: 11 pre- and post-treatment plots; 71 t C/ac; 26% of tree biomass removed during fuel treatments

Preliminary results from PG&E plots

Field measurements revealed the following aboveground biomass components before treatment:

1

Pre-treatment:	
Trees	50.0 t C/ac
Litter	8.9 t C/ac
Understory/shrubs	0.2 t C/ac
10/100 hour fuels	1.8 t C/ac
1000 hour fuels	10.1 t C/ac

Post-treatment measurements revealed that during treatment:
9 t C/ac were extracted for commercial timber
13.7 t C/ac were extracted for biomass energy
0.23 t C/ac were left as additional dead wood stocks on the forest floor

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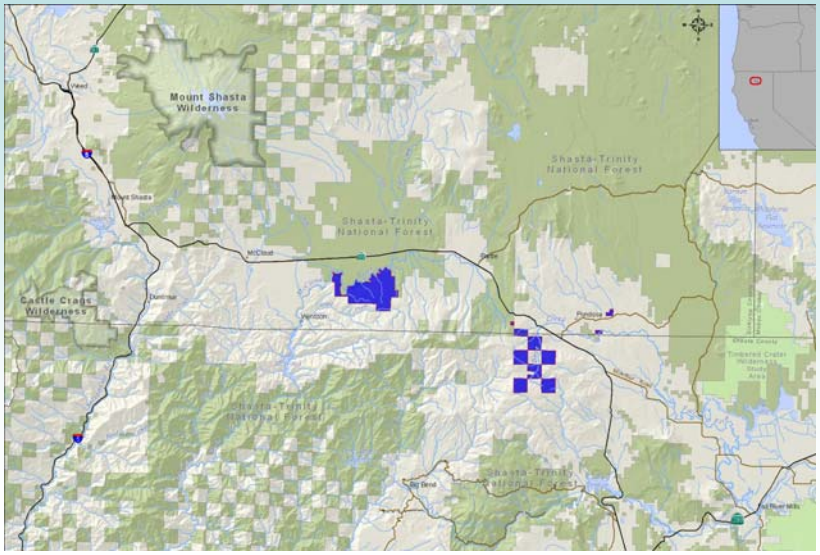
Forest management: Bascom Pacific Forest



Bascom Pacific Forest: Objectives

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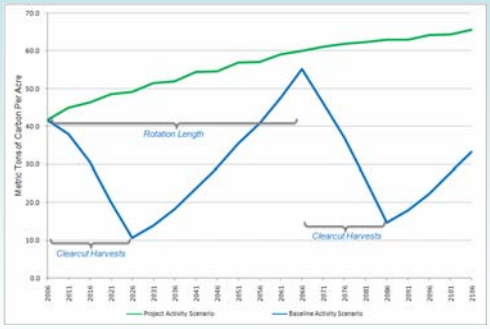
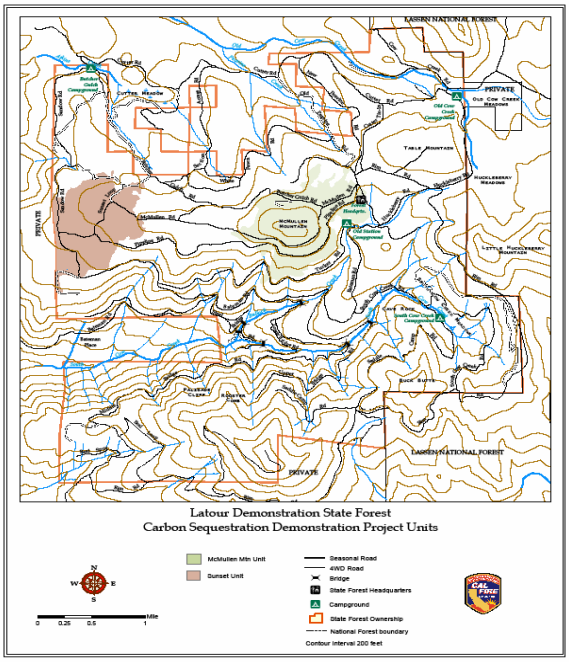


Compare average carbon stocks that would be achieved under the CA Forest Practice Rules in a commercial timberland setting with the project conservation management plan

LaTour Demonstration State Forest

- Two Project Areas
  - McMullen Mtn
  - Sunset
- Evaluated
  - Private Land
  - Public Land
  - Reforestation
  - Forest Mgmt
- Costs
- Revenues
  - Timber & Carbon
- Rate of Return



2. Lake County Pilots

2

- Hazardous fuels reduction linked with long-term commitments to supply fuel for biomass energy plant
- Afforestation using fast-growing species, hybrid poplar

Lake County Partners

- Lake County Resources Initiative
- Oregon Department of Forestry
- Oregon State University
- Greenwood Resources
- California Climate Action Registry
- Climate Trust
- Oregon Forest Resources Institute
- Collins Company
- Jeld-Wen Timber and Ranch
- US Forest Service, Fremont National Forest
- Bureau of Land Management

2

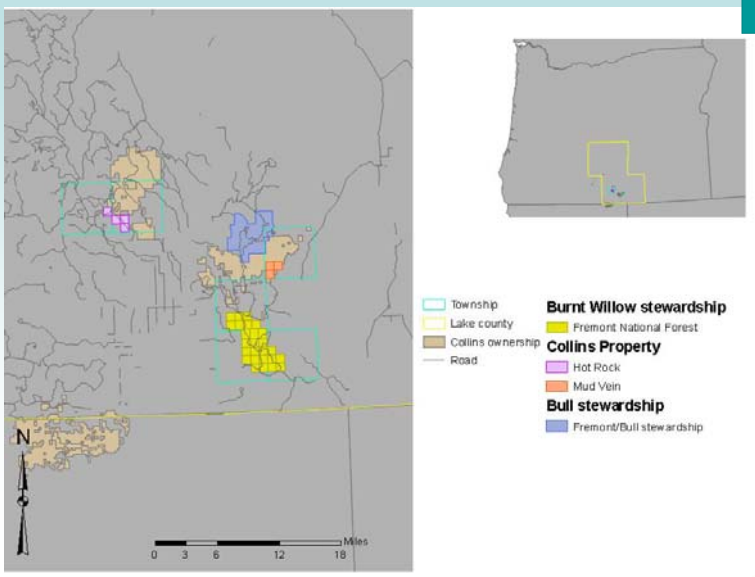
Lake County Hazardous Fuel Treatments

- Lake County Resources Initiative is collecting pre- and post-treatment data on three sites
- Biomass Implementation Team objectives
  - Develop 20-year Supply MOU – The Collins Companies, Marubeni Sustainable Energy, LCRI, Town of Lakeview, City of Paisley, BLM, Forest Service
  - Initiate (3) 10-year Stewardship Contracts

2

WESTCARB fuel reduction treatments

2



Pre- and post-treatment measurements

2

- Random measurement plots within fuel treatment units
- All carbon pools potentially affected by treatment or fire
  - Trees, tree heights, canopy density, height to live crown
  - Standing and lying dead wood
  - Understory vegetation, litter/duff
- Fire model inputs

Carbon stocks before treatment

2

	Number of plots	Total C above	Trees	Down dead	Litter/ duff
Bull Stewardship	46	89 tC/acre	74%	17%	9%
Collins Lands	34	47 tC/acre	87%	9%	4%

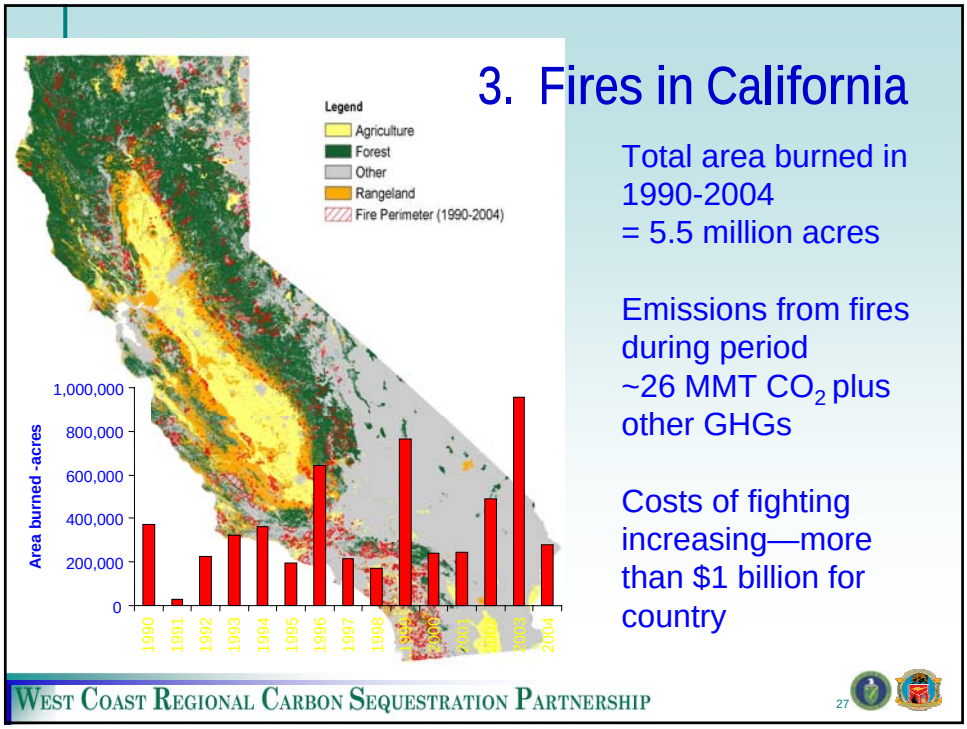
Post-treatment measurements pending.

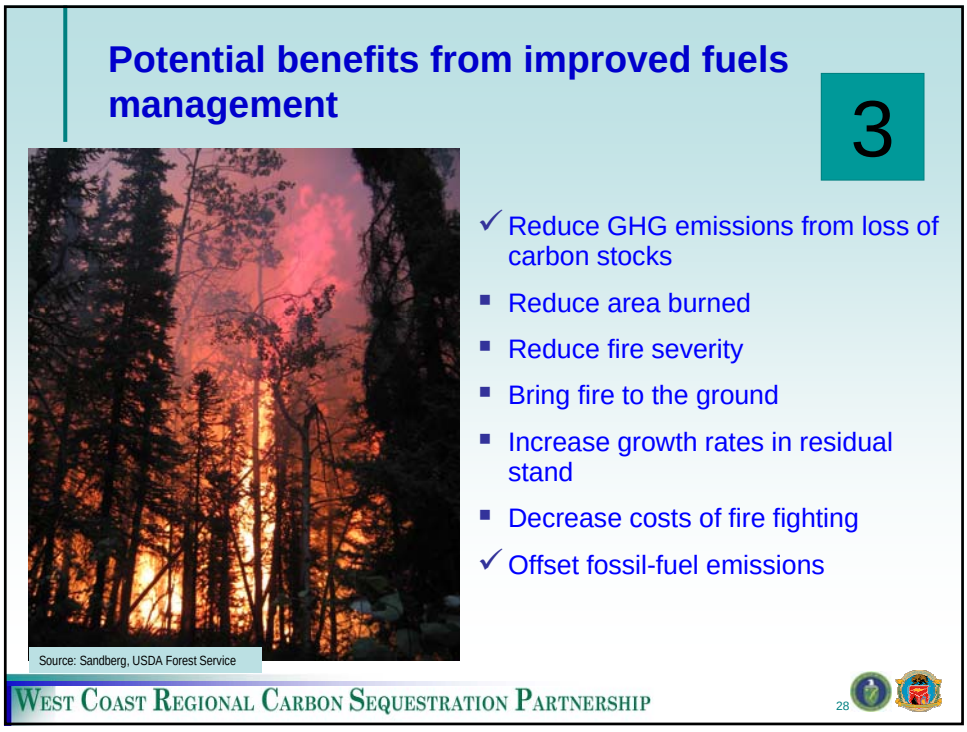
Comparison of Hybrid Poplar Management

2

	Fuel Supply	Multiple Markets	Marginal Site
Density (trees/acre)	**1,450**	**440**	**680**
Regeneration	**Coppice**	**Replanting**	**Replanting**
Rotation	**6**	**20**	**20**
MAI (green tons/acre/year)	**8**	**9**	**4**
Harvesting	**Whole tree chipping**	**Logs**	**Logs**
Stand improvement	**None needed**	**Pruning**	**Not justified**

All categories use the same plant material and integrated pest management.


3. Fires in California
Legend
Agriculture
Forest
Other
Rangeland
Fire Perimeter (1990-2004)
Area burned -acres
1,000,000
800,000
600,000
400,000
200,000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
2003
2004
Total area burned in 1990-2004 = 5.5 million acres
Emissions from fires during period ~26 MMT CO_2 plus other GHGs
Costs of fighting increasing—more than $1 billion for country
West Coast Regional Carbon Sequestration Partnership
27


Potential benefits from improved fuels management
3
✓ Reduce GHG emissions from loss of carbon stocks
▪ Reduce area burned
▪ Reduce fire severity
▪ Bring fire to the ground
▪ Increase growth rates in residual stand
▪ Decrease costs of fire fighting
✓ Offset fossil-fuel emissions
Source: Sandberg, USDA Forest Service
West Coast Regional Carbon Sequestration Partnership
28

Overall goal of WESTCARB fire task

3

- Develop a methodology, at the project scale, for determining the net GHG benefits associated with improved management of hazardous fuels in forests susceptible to wildfires
  - The methodology must be cost-effective, practical, and transparent
  - The methodology would be able to qualify fuels management projects for the carbon offset market

Additional Fire Partners

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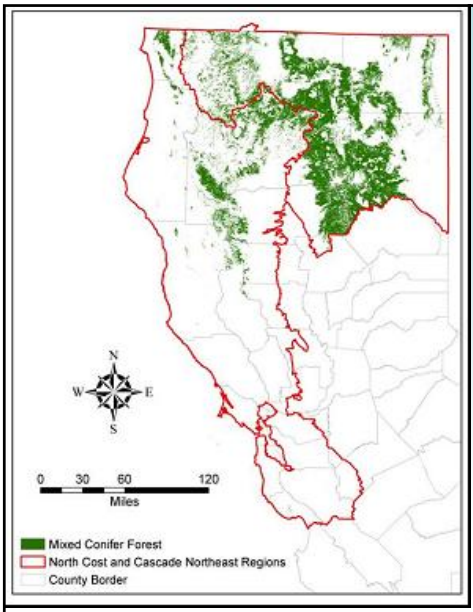
- Sam Sandberg
- Spatial Informatics Group, LLC
- University of California at Berkeley
- Mark Nechodom, USDA Forest Service



Initial focus: Mixed conifer forests at low to mid elevations

Forest class had historically low to mixed severity fires and are good candidates for fuel treatments to restore their historical stand structure and fire regimes (Schoennagel et al. 2004)

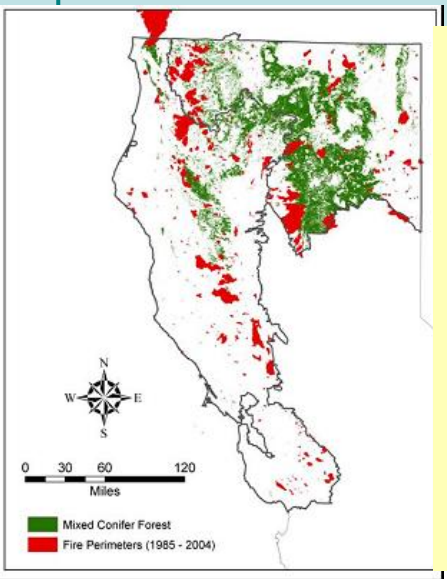
3

Methodology challenges for fuels treatment projects

3

- Permanence – need for retreatment
- Baseline
  - Forward projection based on past trends or probabilities?
    - How far back and over how many years
    - Not readily modeled or estimated or able to predict well
  - Impact of fire on C stocks—related to intensity of fire, fuel loads, and forest recovery after fire
    - Many aspects can be measured, and emissions can be estimated well with robust models

Fire perimeters for North Coast and Cascades Northeast during 20-year period



Year	Area (ac) Public	Area (ac) Private	Percent Public	Percent Private
1985	1,863	367	0.070	0.019
1986	129	393	0.005	0.021
1987	83,344	4,272	3.116	0.224
1988	1,976	4,881	0.074	0.256
1989	400	379	0.015	0.020
1990	4,505	15,175	0.168	0.795
1991	314	818	0.012	0.043
1992	5,132	41,741	0.192	2.188
1993	81	1,013	0.003	0.053
1994	5,241	1,001	0.196	0.052
1995	103	0	0.004	0.000
1996	7,342	392	0.275	0.021
1997	79	39	0.003	0.002
1998	3,836	1,020	0.143	0.053
1999	13,670	5,547	0.511	0.291
2000	20,959	4,757	0.784	0.249
2001	16,906	4,345	0.632	0.228
2002	19,895	2,272	0.744	0.119
2003	1,988	3,016	0.074	0.158
2004	2,809	1,799	0.105	0.094
Total 20 years	190,573	93,228		

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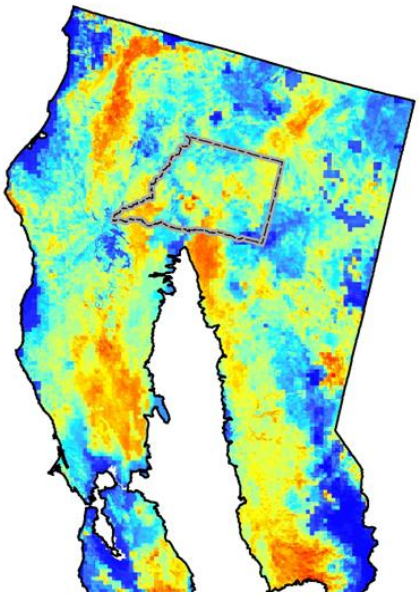

Estimated annual potential burn probability

Draft from Max Moritz (work ongoing)

3

Center for Fire Research and Outreach
College of Natural Resources • University of California, Berkeley

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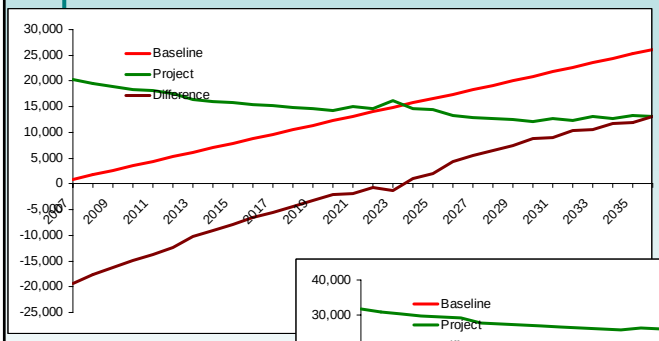
Project GHG Benefits—loss or gain of C stocks

3

- + Gain from decreased intensity or spread of fire due to fuel treatment
- + Gain from growth differences between with and without project and with and without fire
- + Loss from removal of fuel to biomass energy plant
- + Gain from displaced fossil fuel
- + Loss from removals of fuel to wood products
- + Gain from sequestration in long-lived wood products
- + Loss from decomposition of additional dead wood stocks created through fuels treatment
- + Loss from fires occurring in with-project case

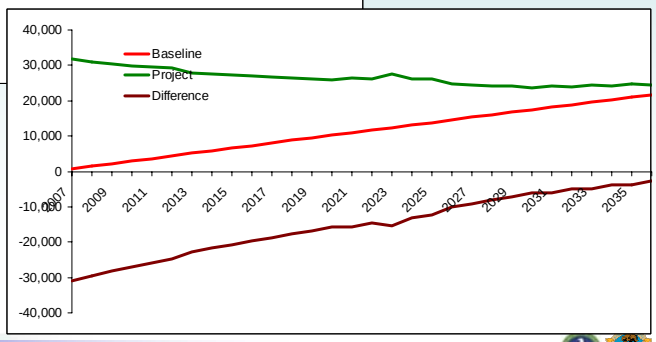
Sensitivity of energy source replaced

3



32% to biomass

Replace coal



32% to biomass

Replace natural gas

However…

3

- The constant baseline of % burned per year is not really what happens
  - Treatment does not prevent fires; reduces intensity and spread

What next?

3

- Work at a larger scale:
  - Strategically placed treatments to maximize risk of burning and shadow effect—how large can this effect be and under what conditions?
  - Treatments across counties or even state
    - Greatly increase probability that one or more treated areas will burn
- Ongoing work on these topics…..

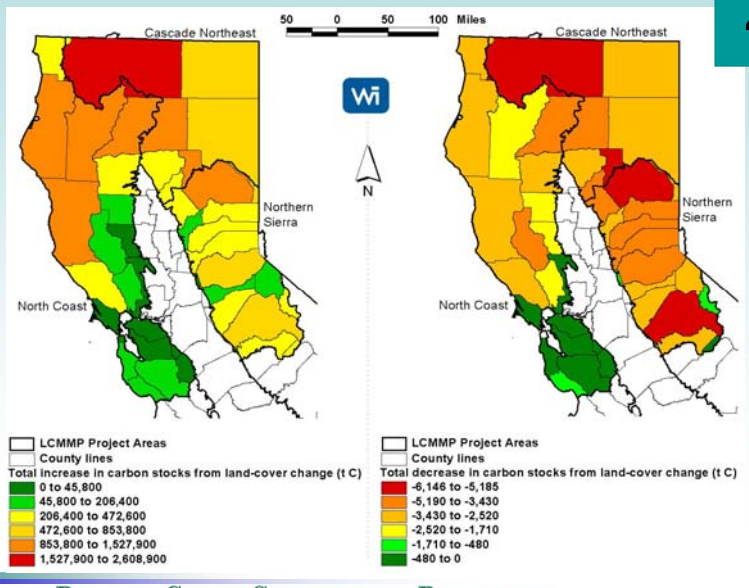
4. Regional Characterization

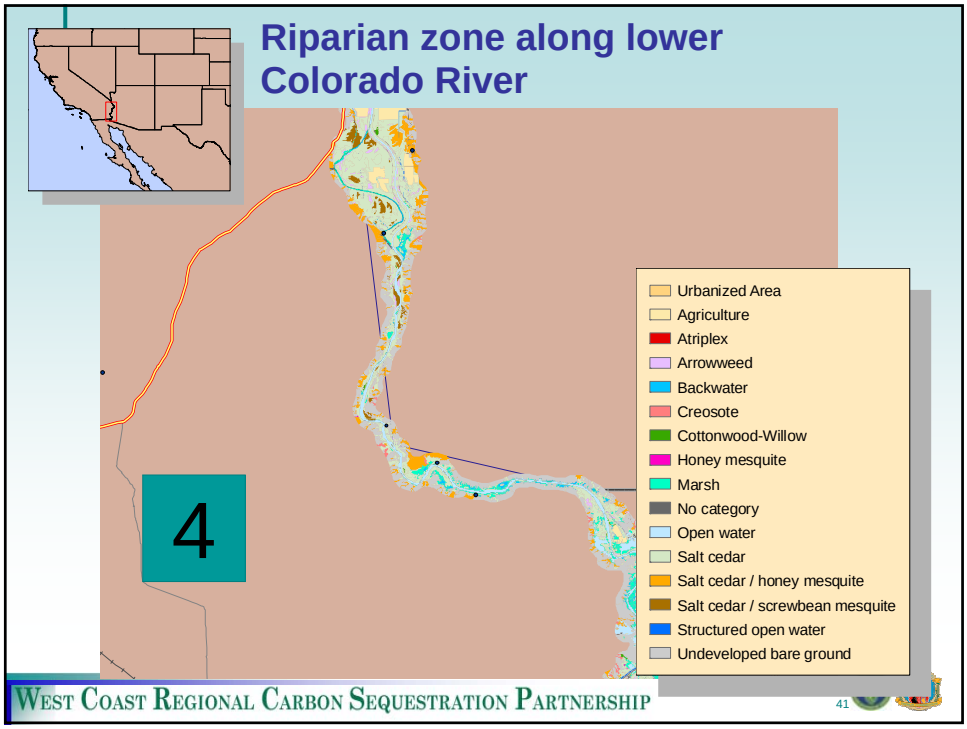
4

- Complete California baseline analysis using previously unavailable LCMMP data
- Fast-growing plantation species suited to dry-site afforestation: assessment of regional site suitability
- Explore potential projects in AZ: afforestation in riparian zones
- Explore potential projects in WA: life cycle analysis of forest products

California Baseline

4



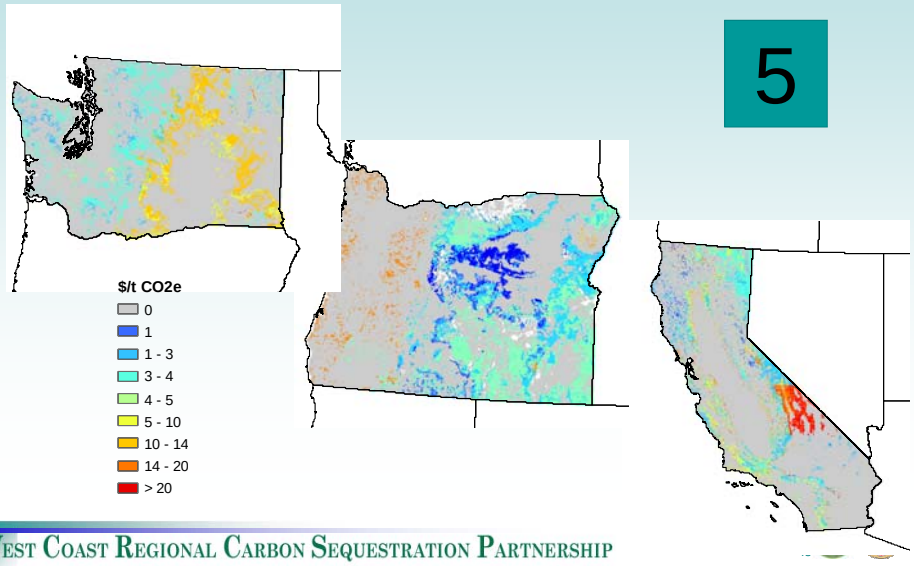


5. Data from Winrock to Carbon Atlas

- For CA, WA, OR
  - Baseline carbon map
  - Carbon accumulation potential on agriculture and range after 20, 40, and 80 years
  - Conversion costs for agriculture and range lands after 20, 40, and 80 years
- Some example maps. . .

5

Marginal cost after 40 years of sequestrating carbon by afforestation $ per metric ton carbon



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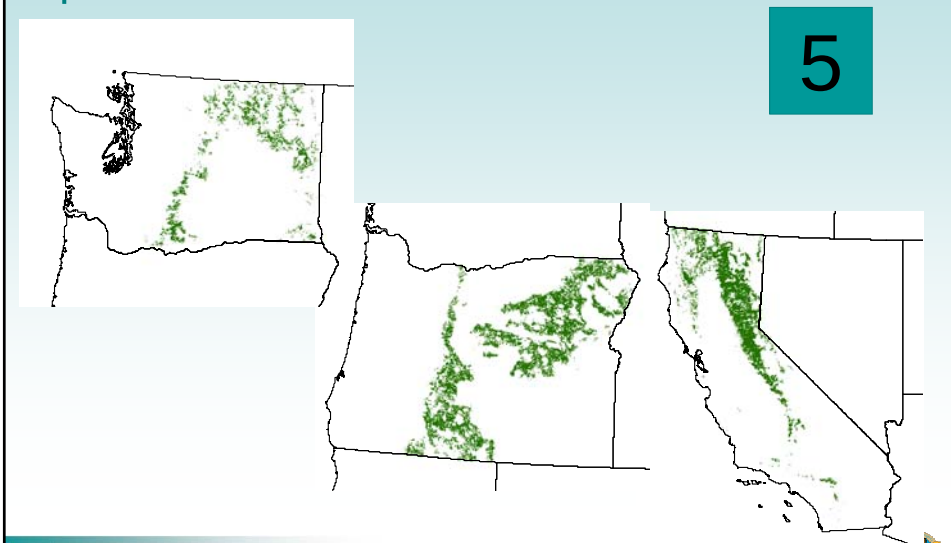
Forest lands suitable for biomass fuel removal



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