Opportunities For Biochar Production To Reduce Forest Wildfire Hazard, Sequester Carbon, and Increase Agricultural Productivity of Dryland Soils

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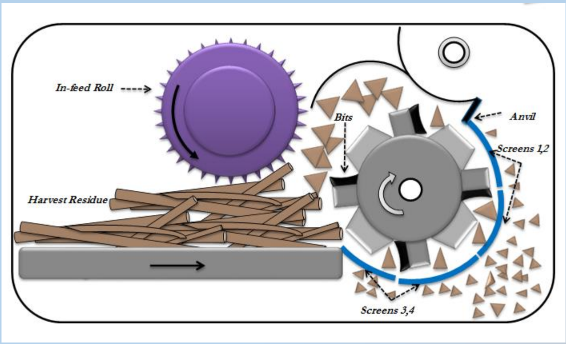
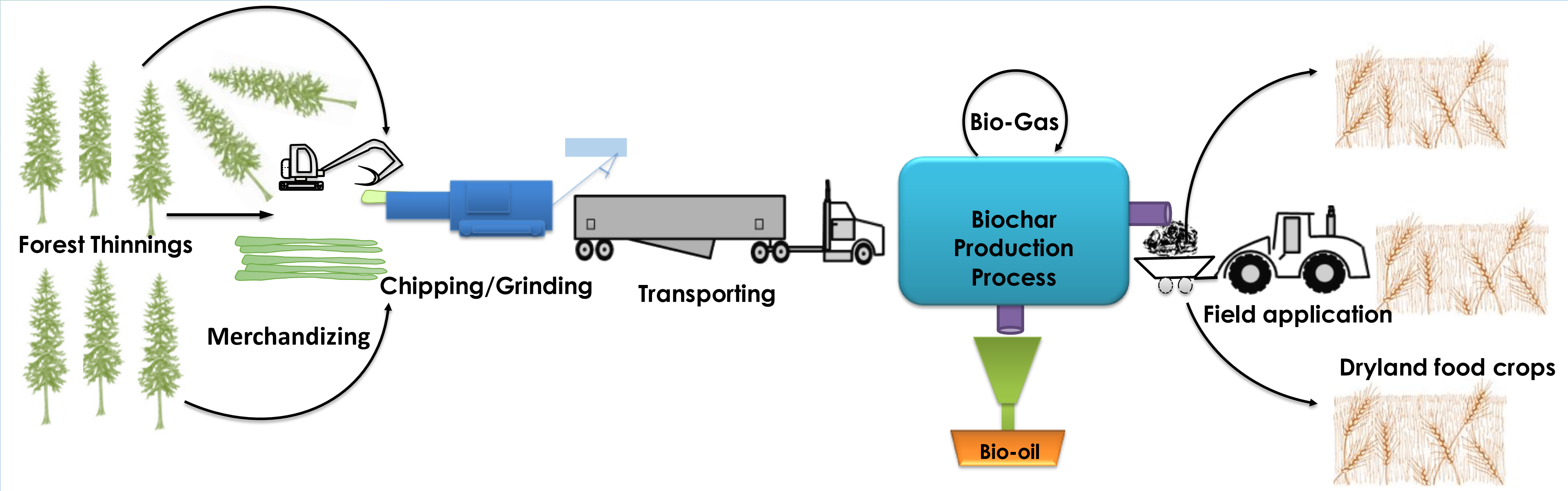
Overview

- Project Goals
- Project Activities
- Status
- Next Steps
- Conclusions



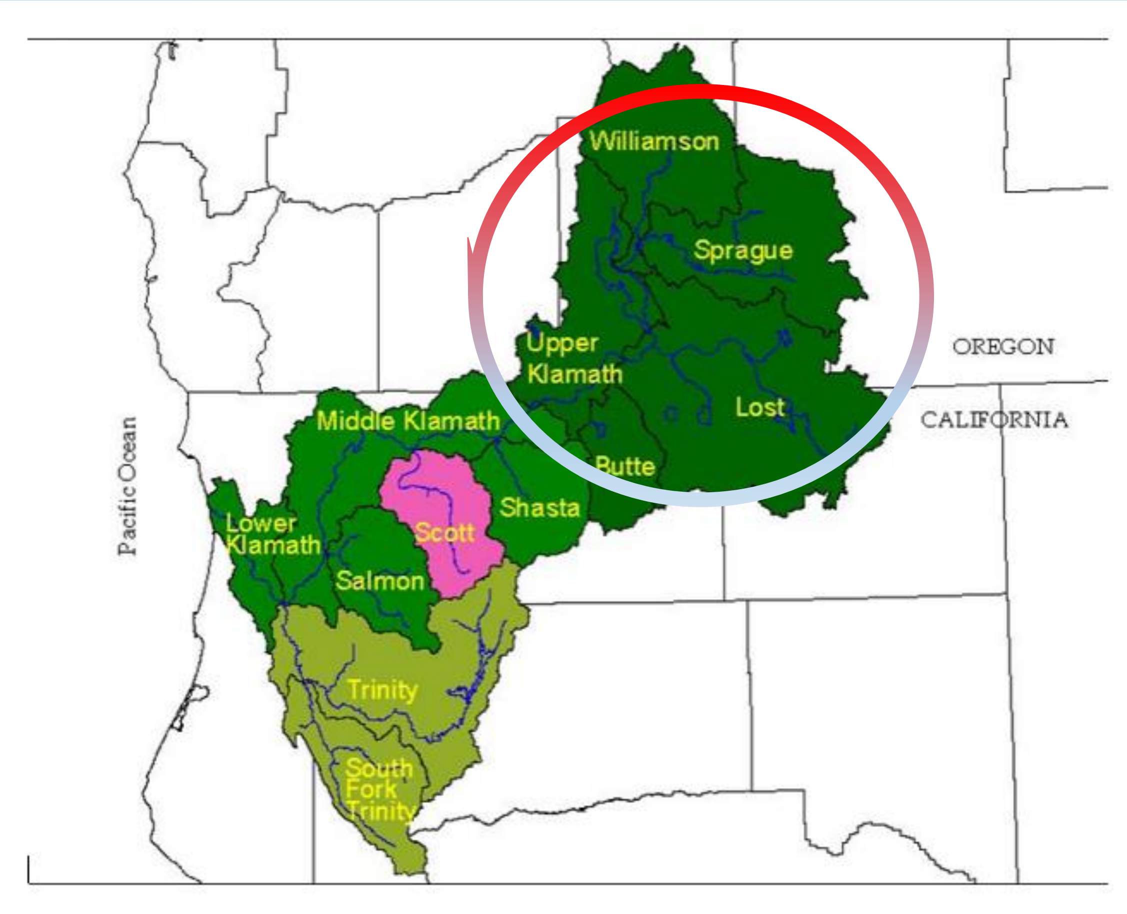
Overall Approach: Evaluate the biochar supply chain from forest-to-farm at a landscape scale



Develop Pro Forma Operating Budget for Biochar

- At scale of 15,000 tons of biochar per year
- Utilize lower quality biomass from treating 5,000 acres per year
- Evaluate one or more brown/green field sites in Upper Klamath Basin

Upper Klamath Basin Study Area

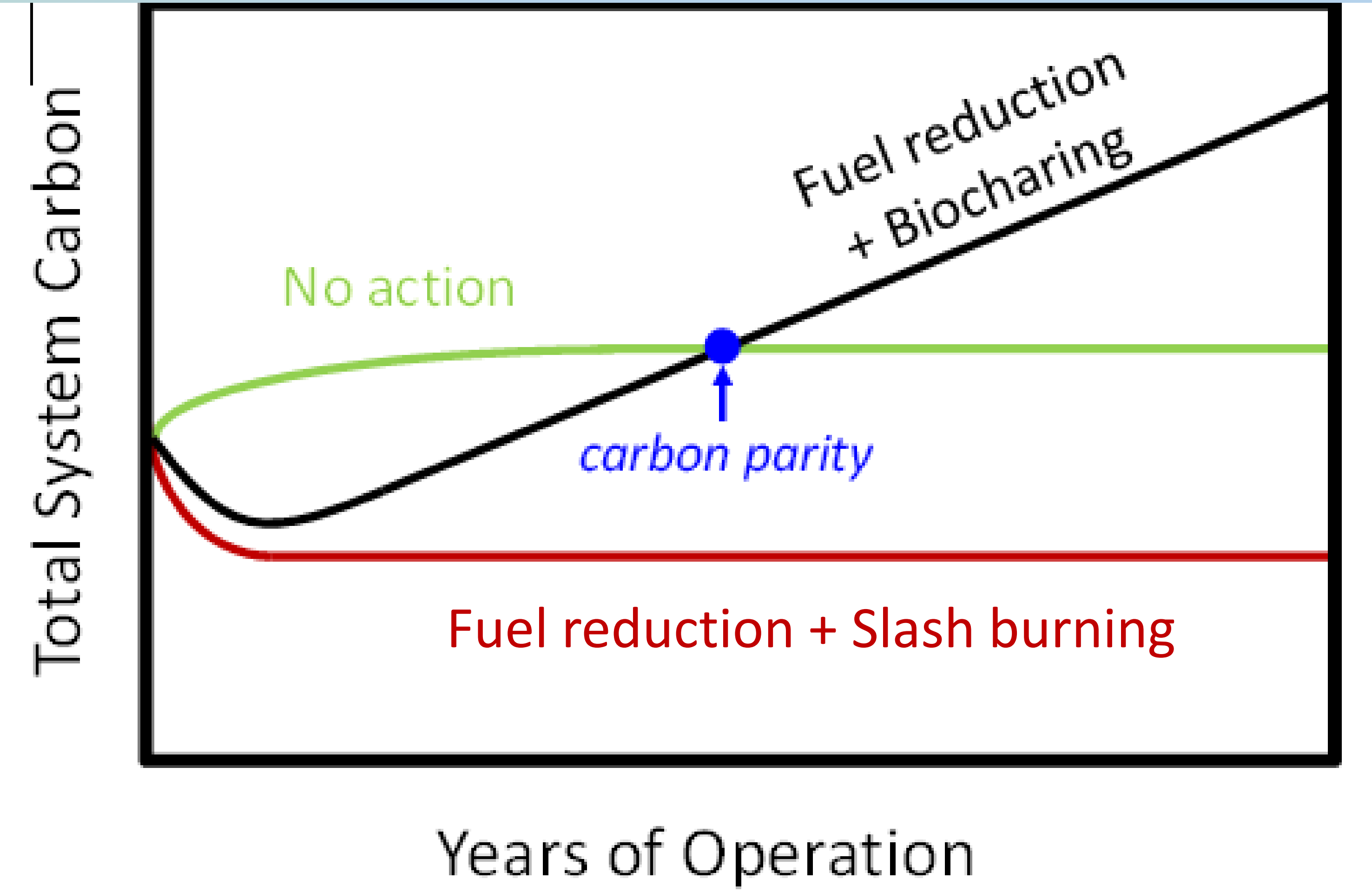


Goal 1: Improve Forest Resilience

Before Treatment

After Treatment

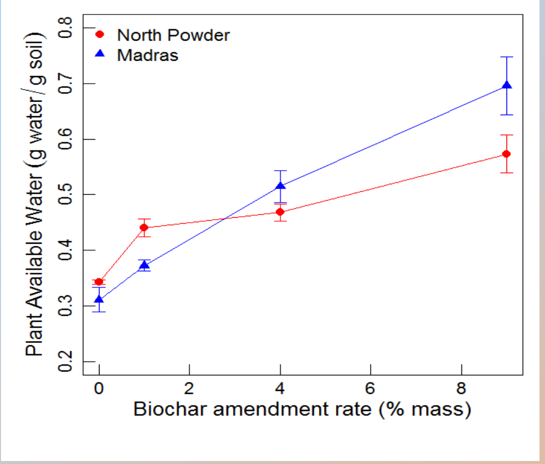
Goal 2: Sequester Carbon



Goal 3: Improve Agricultural Soils

- Biochar can increase the productivity of agricultural soils by modifying soil properties

- Modest amounts of biochar can increase soil moisture by 20-30%



- Can forest-origin biomass increase plant available water to mitigate drought in the Klamath Basin?

Five Activities

- *Develop* biomass transportation and biochar production and delivery models
- *Describe* biochar properties to identify target soils, application rates, and crop response.
- *Formulate* a forest landscape-level hazard reduction optimization model to assign forest treatments.
- *Identify* the level of a wildfire hazard reduction program whose direct costs could be offset by forest products, agricultural productivity increases and carbon credits.
- *Quantify* the carbon sequestration potential of forest-origin biochar.

Biomass Collection and Delivery

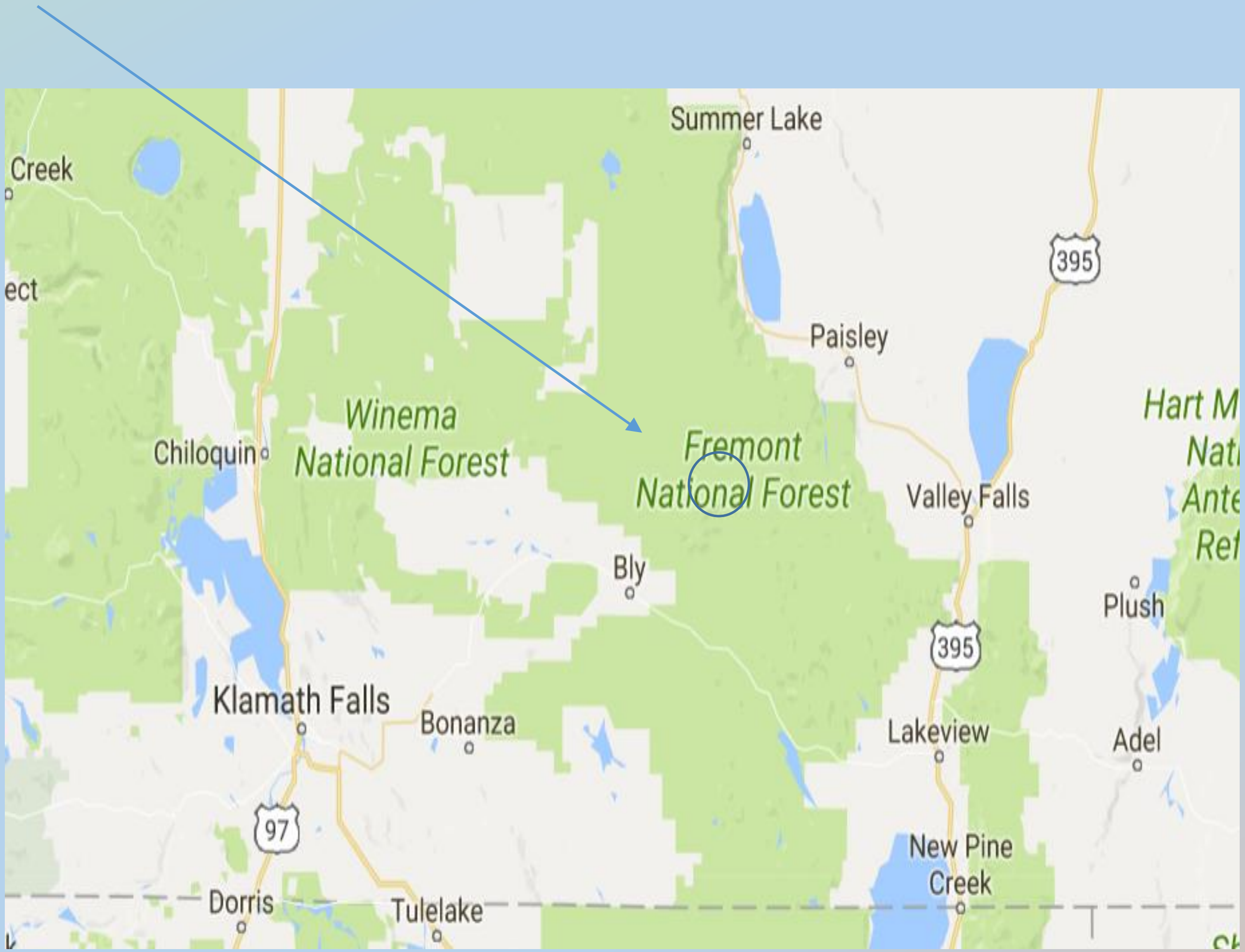
Challenges:

- High harvesting costs on steeper ground, for even sawlogs, makes recovery marginal in many dry forests,
- Lack of pulp markets for many dry forests leaves about a 16-ft top log, defective logs and non-commercial species in forest.

Opportunities:

- Cut-to-length harvesting technology coupled with integral winches to provide traction assistance have been gaining increasing acceptance. More the half of the world's industrial wood is cut with cut-to-length systems and tethers have been available for about 15 years.

Pilot Timber Sale, Bly Ranger District



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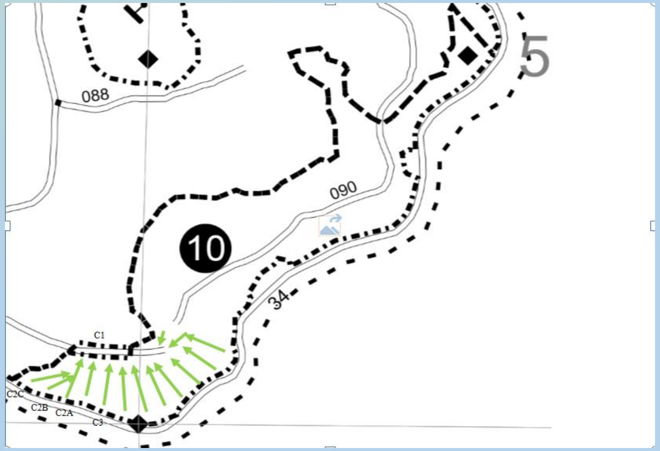
Pilot Timber Sale

Dry, Loose,
Thin, Soils



Timber Sale Purchaser
Collins Pine
Lakeview, Oregon

Ground Slope
20-60%

Logging Contractor
Miller Timber
Services
Philomath, Oregon

(a)

(a) Non-merchantable material
(b) Tethered Harvester
(c) Tethered Forwarder
(d) Wheel tracks with lugs

(b)

Logging Contractor
Miller Timber Services
Philomath, Oregon

(c)

(d)

Ground Disturbance on 40-60% slopes

Estimating Feedstock Availability: BioSum 5.0

Optimization Model Applying Treatments to FIA Plots
(Jeremy Fried, USFS PNW Station)

Applied in 2005 to evaluate potential cogeneration plant sites in central/southern OR.

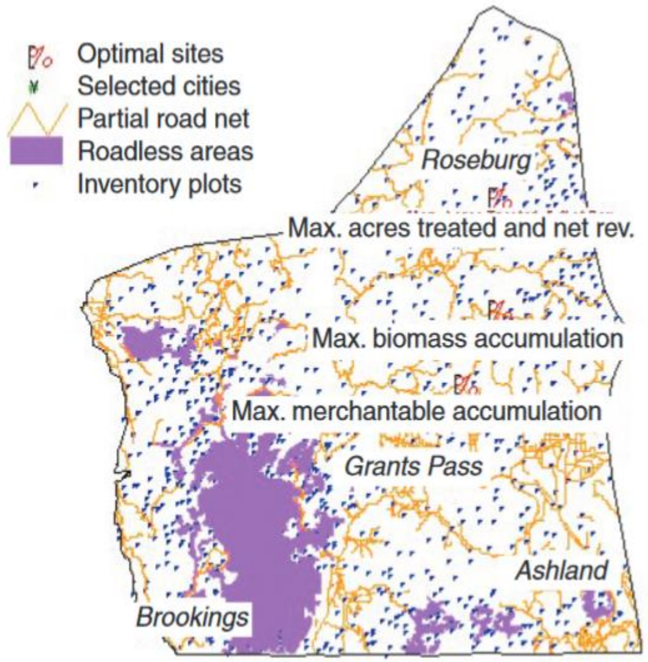
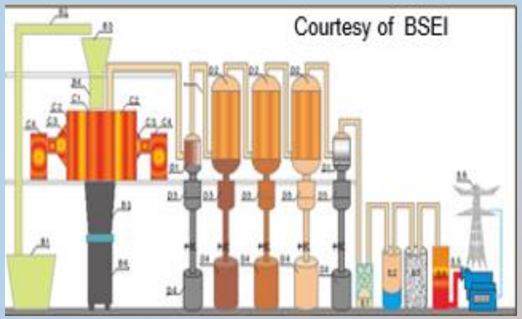


Figure 1. **Optimal sites for locating biomass-based energy generation facilities by four different criteria in the Klamath ecoregion of southwestern Oregon, when the 125-square-foot residual basal area fuel treatment is applied to all acres that would generate zero or positive net revenue.**

Testing Two Biochars

"Conventional Pyrolysis" Biochar processed by Karr Group, WA

"Microwave Pyrolysis" Biochar processed by CHON, Inc, China (operating as BSEI in USA)



Feedstock From Study Area

Green Diamond/Lane Forest Products

Nov. 5, 2015 (revised)
Oregon State University
Corvallis, OR USA

- A 3:1 Chips:Hog, Coarse grind
- B 1:3 Chips:Hog, Coarse grind
- C 3:1 Chips:Hog, Fine grind
- D 1:3 Chips:Hog, Fine grind

Properties	MC, %	Bulk Density, #/fts	Ultimate Bulk Den. #/ft3	Particle Size Distribution									
				Overs, %	Mids, %	Fines, %	<3"	3" - 6"	6"-12"	>12"	Fines, <1/8"	Fines, >1/8"	Non-Wood, %
A	17%	13.4	13.7	1%	84%	15%	56%	42%	2%	0%	81%	19%	19%
B	14%	17.0	18.4	5%	63%	32%	22%	55%	23%	0%	78%	7%	26%
C	15%	14.0	15.4	0%	82%	18%	93%	7%	0%	0%	82%	18%	18%
D	12%	18.5	19.6	0%	54%	46%	94%	6%	0%	0%	82%	18%	34%

Chips From Bark Free Logs

Hog From Ground Whole Trees

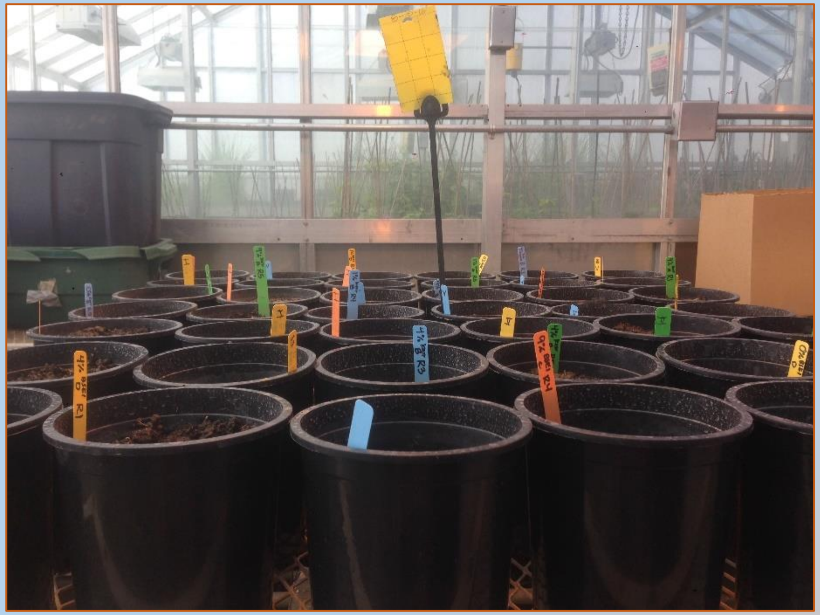
Biochar Testing and Evaluation

- Laboratory tests to compare biochars (proximate, spectroscopy, bulk density, elemental, plant-available nutrients, pH, char conductivity)
- Pair biochar properties with agricultural soils to optimize effect of biochar application
- Conduct greenhouse studies to determine biochar application rates
- Outreach to growers to conduct field experiments through Klamath Basin Experiment Station, extension agents

Greenhouse Trials

How does each of the biochars impact growth of irrigated alfalfa in a 150 day potted GH trial?

- **Grow alfalfa** at 0, 1, 4, and 9% (by mass) biochar amendment rates.
- **Compare plant biomass**, plant tissue chemistry, and soil chemistry at harvest
- **Determine impacts** on plant-available water at these amendment rates
- **Evaluate** impact of biochar on three pools of soil carbon



Collecting Soil Sample at Klamath Basin Research and Extension Farm (KBREC)

NEXT STEPS

- Complete Harvesting Data Collection/Analysis
- Develop Stand Treatments
- Evaluate Biochar Production Plant Sites
- Develop Production Costs
- Assemble Landscape Allocation Model
- Complete Carbon Model

Concluding Comments

If successful, this landscape-scale biochar supply chain could define a pathway to

- More resilient forests
- Higher carbon storage
- Increased agricultural productivity

Acknowledgements

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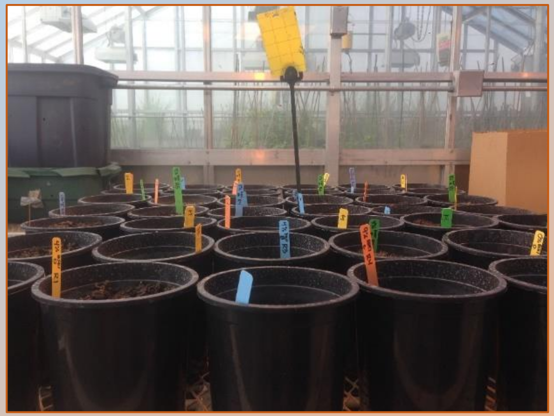
Thank you!   Questions?



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Trace Carbon from forest-to-farm