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
Goal 2: Sequester Carbon

- Fuel reduction + Slash burning
- Biochar

Years of Operation

Total System Carbon

Fuel reduction + Biocharing

No action

Carbon parity

Fuel reduction + Slash burning
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.
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 than 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

Ground Slope 20-60%

Dry, Loose, Thin, Soils

Timber Sale Purchaser
Collins Pine
Lakeview, Oregon

Logging Contractor
Miller Timber Services
Philomath, Oregon

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

Logging Contractor
Miller Timber Services
Philomath, Oregon
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

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

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<th>Ultimate Bulk Dens. lb/ft³</th>
<th>Overs, %</th>
<th>Mids, %</th>
<th>Fines, %</th>
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<th>3&quot; - 6&quot;</th>
<th>6&quot; - 12&quot;</th>
<th>&gt;12&quot;</th>
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Chips From Bark Free Logs
Hog From Ground Whole Trees

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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
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Thank you! Questions?

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Trace Carbon from forest-to-farm