Building Northwest Biochar Markets

Tom Miles
T.R. Miles, Technical Consultants, Inc.

Olympia, WA
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Objectives

1. Bring together key biochar leaders in business, government, research and advocacy to craft an action agenda aimed at placing real biochar projects on the ground.

2. Create action plans to grow markets in gardening, agriculture, forestry, bioremediation, bioenergy and ecological services.

3. Build a regional network that will carry out plans to ramp up market demand for biochar in the Northwest
NW Biochar Producers or Suppliers

Washington
- Biochar Supreme, Everson
- Carbon Cultures*, Olympia
- EcotracOrganics, Wenatchee
- Olympic Designs, Winthrop
- Seachar, Seattle
- Whitfield Biochar*, Mt Vernon
- Yakama Nation, Toppenish

Idaho
- Char King, New Plymouth
- Conichar, Donnelly
- IdaChar, Caldwell
- Salmon Biochar, Salmon

Oregon
- BioLogical Carbon, LLC., Philomath
- International Tech Corp*, Prineville
- Permamatrix, LLC., Portland
- 3 Dimensional Timber, Gold Beach
- Walking Point Farms, Tigard

Montana
- Algae Aqua-Culture Technology, Whitefish
- Montana Advanced Biofuels LLC, Great Falls
- Montana Biochar Products LLC, Hot Springs
- Real Montana Charcoal, Hamilton
- Tricon Timber, St. Regis

*Biochar and Equipment Attending
NW Biochar Producers or Suppliers

http://goo.gl/maps/kR0La
PNW Biochar Products

Conichar
www.conichar.com

Garden Char/Blue Sky Biochar
www.internationaltechcorp.net

IdaChar Inc.
Biochar Marketing & Sales
Calhoun, IA 50619-9760
www.idachar.com

Ecofeed
5-2-3 Organic Fertilizer
ecotracorganics.net

Whitfield Biochar
www.whitfieldbiochar.com

Char King
www.char-king.com

CarbonCultures
www.carboncultures.com

PNW Biochar Products
**Biochar Producers**

- Small companies (<10 employees)
- Abundant enthusiasm
- Varying experience in commodity markets
- Varying business (including start-up) management experience
- Continuous product development (seek high value, low volume)
- Low production capacity (50-200 lb/hr; <4 tpy, 24 CY or 1000 20 qt bags; max 50 tpy, 300 CY)
- No contracts or off-take agreements
  - (Except. Biochar Solutions, The Biochar Company)
- Low capital investment (<$1 million)
- Marginal profitability
- Limited cash (undercapitalized, e.g. working capital)
- Limited access to financing (vendor financed)
- May be extension of an existing business
- Good technical product value (biochar “works”)
- Unlimited optimism
## What Do We Know About Biochar Markets?

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<th>Agriculture</th>
<th>Biomass/Organics</th>
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<th>Stormwater Remediation</th>
<th>Ecosystem Services</th>
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<td>Sales Forecasts</td>
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<td>Products 1&quot;, 1/4 &quot;, fines, blends</td>
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<td>Product Research</td>
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<td>Promotion</td>
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<td>Advertising Research</td>
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<td>Personal Selling</td>
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<td>Distribution</td>
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<td>Distribution channels</td>
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<td>Location Analysis</td>
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<tr>
<td>Pricing</td>
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<tr>
<td>Price $0.01-$1.00/lb</td>
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<td>Price Policy</td>
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<td>Other</td>
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<td>Industry Analysis/Competition</td>
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Market Development Questions

Short Term market development:
1. What do you see as the most immediate market opportunity in your sector?
   • Research, demonstration projects, policy, and production could all be themes from the initial question.
   • What needs to happen to build that market?

2. Prioritize the top three or four action steps to meet those needs.

Longer Term market development:
1. What do you see as the longer term market opportunity?

2. What needs to happen to build long term markets?

3. Prioritize the most important three or four action steps to get this market developed.
Agriculture
– as source and market for biochar.

Feedstock sources: Woody biomass including on-farm prunings, crop residues, manures and bedding litter.

Biochar markets and uses: Retail garden, high-end horticulture and nursery, organic agriculture, field crops, agricultural soil remediation (activated carbon substitute), nutrient/manure management in dairy, egg and poultry production, odor control in animal production, co-compost biosolids from anaerobic digestion, liming in no-till soils, carbonize solids from dairy waste, dairy wastewater filtration, soil inoculation (effective organisms, bacteria/fungi), electromicrobiology, turf and landscape management.

Products: biochar, formulated biochar such as biochar + effective organisms or fungal spores, biochar organo-mineral complex (biochar+clay+nutrient), biochar-compost blends, biochar compost, and other.

Technologies: pyrolysis, gasification, staged combustion (mobile and stationary)

Packaging: 20 qt bags or buckets, 50 gal drums, 1-2 CY Bags, bulk
Main reasons for improving levels of soil organic carbon

1. Solving problems or threats to soil health.

2. Maintenance of a healthy soil through increasing the stable carbon fraction of the soil which in turn will potentially improve factors such as soil microbial function, soil water holding capacity, improved soil pH and suppression of soil borne disease.

3. Reduction of production system inputs such as fertilizers.

4. Potential for generation of income through carbon sequestration.

(Biochar in Horticulture: prospects for the use of biochar in Australian horticulture, New South Wales Department of Primary Industries and Horticulture Australia, 2012.)
Small Scale Biochar Production and Use

BioChar TLUD Cook Stove
Seachar.org

Greenhouse scale
NE Biochar
Heat+ 300lb BC/10h
www.newenglandbiochar.com

Jolly Roger Ovens
www.youtube.com/watch?v=Kg95YrH8Pc

“J-RO” UBI TLUD
Jolly Roger TLUD Retort
www.biochar-international.org/regional/ubi

Biochar Amendment to Compost
Combined Heat and Biochar - Whitfield Continuous Flow Biochar Reactor for Greenhouse Heating

Commercial Scale Reactor
50 lb/hr BC + 600,000 Btuh

Dryer-Feeder
Biochar
Renewable Thermal Energy

www.whitfieldbiochar.com
### Agriculture – Initial Thoughts

<table>
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<tr>
<th><strong>Most Immediate Market</strong></th>
<th><strong>Needs to Build Market</strong></th>
<th><strong>Action Steps</strong></th>
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<tbody>
<tr>
<td><strong>Short Term</strong></td>
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<tr>
<td>Retail garden</td>
<td>Develop Product Market demo</td>
<td>Consumer education Investor/lender education</td>
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<tr>
<td>Specialty soils-nutrients/microbes</td>
<td>Product development Consistent biochar</td>
<td>R&amp;D with nutrient suppliers Improve QA/QC</td>
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<tr>
<td>Manure management</td>
<td>Demo Monetize benefits</td>
<td>Farmer education GHG benefits</td>
</tr>
<tr>
<td>Building Heat – greenhouse, poultry</td>
<td>Commercial demo heat + biochar</td>
<td>Financing</td>
</tr>
<tr>
<td><strong>Long Term</strong></td>
<td></td>
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<tr>
<td>Vermiculite/peat substitute</td>
<td>Product development, demo and testing</td>
<td>WSU/OSU Hort</td>
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<tr>
<td>Turf, landscape</td>
<td>Field testing Factsheets Low cost</td>
<td>Turf Management Education Landscape contractor</td>
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<tr>
<td>Large scale landscape</td>
<td>Technology development and scaling</td>
<td>Investor education Low cost resource and technology</td>
</tr>
</tbody>
</table>
Biomass Energy
– including *Organics Recycling* as source and market for biochar.

**Feedstock sources:** Woody biomass including hogged wood waste, urban wood waste from organics (green waste) recycling and volume reduction, high carbon flyash from biomass plants, biochar as a co-product for heating facilities and for CHP facilities, byproduct char from biofuels production

**Biochar Markets and uses:** Retail garden, high-end horticulture and nursery, field crops, agricultural soil remediation (activated carbon substitute), soil amendment for stormwater and erosion control projects, turf and landscape management

**Products:** Bulk delivery of biochar or biochar-ash blends.

**Technologies:** pyrolysis, gasification, staged combustion (mobile and stationary)

**Packaging:** 1-2 CY Bags or in bulk supply
Biochar as a Co-product of Thermal Biomass Energy Conversion

FEEDSTOCKS
Biochar production processes utilize cellulosic biomass such as wood chips, corn stover, rice and peanut hulls, tree bark, paper mill sludge, animal manure and most urban, agricultural and forestry bio-mass residues.

OUTPUTS
Besides biochar, bioenergy is also produced in the form of either synthetic gas (syngas), or bio-oils, which can be used to produce heat, power or combined heat and power.

www.biochar-international.org/technology
Prototype Pyrolysis Development

Prototype Gasifier and Carbonizer
Thompson Timber, Philomath, OR
Small Scale Wood Chip Biochar Gasifier

1 CY BAGS

Biochar Solutions/Biochar Now
www.biocharsolutions.com
Scaling Up – Continuous or Batch?

Commercial Batch Kiln (Brazil) with high efficiency afterburner

Industrial Batch Kilns, France (CarboFrance www.carbofrance.fr)

Continuous Mobile Kilns $300k BIGCHAR www.bigchar.com.au

<table>
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<th>Production (ton/month)</th>
<th>Kiln Capacity (ft³)</th>
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<tr>
<td>75</td>
<td>530</td>
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<tr>
<td>150</td>
<td>1,060</td>
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<tr>
<td>375</td>
<td>3,530</td>
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<tr>
<td>750</td>
<td>7,060</td>
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<tr>
<td>1,500</td>
<td>10,590</td>
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</tbody>
</table>
Gasification to Heat, Power and Biochar

1-4 TPH + 2-5 Mwe, 30,000-50,000 TPY
7,500-12,500 CY/yr

ICM 200 tpd Gasifier Wood, Straw, Stover
www.icminc.com
<table>
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<tr>
<th><strong>Biomass and Organic Recycling – Initial Thoughts</strong></th>
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<tr>
<td><strong>Most Immediate Market</strong></td>
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<td><strong>Short Term</strong></td>
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<td><strong>Long Term</strong></td>
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Forestry
– as source and market for biochar.

**Feedstock sources:** Forest residues and slash, invasive species

**Biochar markets and uses:** in-forest soil remediation, restoration, erosion control, biochar as delivery vehicle for seed and fertilizer, biochar use in out-planting seedlings, biochar and biochar compost in soil-less media for forest nursery (vermiculite and peat substitute). E.g. WA 50 million seedlings/yr.

**Products:** Bulk delivery of biochar or biochar-compost, seed coated with biochar blends, biochar as delivery vehicle for nutrients (P), spores etc.

**Technologies:** pyrolysis, gasification, staged combustion (mobile and stationary)

**Packaging:** 1-2 CY Bags, bulk
Scaling Up - Biochar at the Landing
40-100 tpd available

2 ton biochar/4 hours
Earth Systems (Aus)
$200k
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<th>Most Immediate Market</th>
<th>Needs to Build Market</th>
<th>Action Steps</th>
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</thead>
<tbody>
<tr>
<td><strong>Short Term</strong></td>
<td>Slash- reduce air pollution, extend season</td>
<td>Demo, Research</td>
<td>Emission Testing</td>
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<tr>
<td></td>
<td>Reforestation, amend soil for out-planting</td>
<td>Demo, Research</td>
<td></td>
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<tr>
<td><strong>Long Term</strong></td>
<td>Replace Activated Carbon in Seeding</td>
<td>Demo, Research</td>
<td>USFS Collaboration</td>
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<tr>
<td></td>
<td>Forest Nursery – vermiculite, peat substitute</td>
<td>Demo, Research</td>
<td></td>
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</tbody>
</table>
Stormwater and Remediation
– includes stormwater cleanup, street and retention basin cleanup, disturbed soil stabilization, remediation and erosion control.

Feedstock sources: Woody biomass, crop residues, manures and litter

Biochar markets and uses: Bioretention facilities such as bioswales, green roofs, Public contracts roads, parks etc.), private industrial contracts (industrial parks, etc.), BMPs (Best Management Practices), site remediation, e.g. WASHDOT 30,000 CY compost/yr

Products: biochar, biochar mulch/hydromulch (e.g. Permamatrix), biochar-compost socks, bulk (blower truck) application of biochar-bark/compost mix,

Packaging: 1 CF bags, 1-2 CY Bags, bulk in blower trucks.
Biochar in Soil Mix for Bioretention Needs BMP

Biofiltration tested in mesocosms replicate bioretention facilities.

Biochar: Quantity? Composition? Compost?

Street runoff filtered through vegetation and soil

Bioretention Testing WSU Puyallup

Bioswales

HIGH POINT, SEATTLE, WA
# Stormwater, Remediation – Initial Thoughts

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<th>Most Immediate Market</th>
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<th>Action Steps</th>
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<tr>
<td><strong>Short Term</strong></td>
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<tr>
<td>Bioretention</td>
<td>Fund Demos, Research</td>
<td>Test Market</td>
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<tr>
<td>Stormwater</td>
<td>TAPE Specifications/BMP Identify Demo Site Low Cost Scale Commercialization Grants</td>
<td>Public Program</td>
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<tr>
<td>Erosion Control</td>
<td>Supply Specifications/BMP</td>
<td>Demo</td>
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<tr>
<td>Mine reclamation</td>
<td>Demo, Scale, Cost</td>
<td>Demo</td>
</tr>
<tr>
<td>Remediation</td>
<td>Low cost and volume supply Demonstration</td>
<td>Demo sites Funding</td>
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<tr>
<td><strong>Long Term</strong></td>
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<tr>
<td>Stormwater</td>
<td>Education</td>
<td>ASCE, etc.</td>
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</table>
Ecosystem Services – markets for carbon, wildlife, climate.

**Ecosystem services** “benefits that human communities enjoy as a result of natural processes and biological diversity.” Ecological values are defined as “clean air, clean and abundant water, fish and wildlife habitat and other values that are generally considered public goods.”

**Ecosystem services market** is “a system in which providers of ecosystem services can access financing to protect, restore and maintain ecological values, including the full spectrum of regulatory, quasi-regulatory, and voluntary markets.” (OR)

- 100 million tons biochar on landscape by 2020

**Biochar Products:** carbon offsets from a bio-based carbon sequestration projects in forest, soil or wetlands (OR); monetized carbon benefits, carbon sequestration, sustainability, impact investing, potential brokers, buyers, policy support.

**Products:** carbon credits, sustainability, fertility, or other ecological and climate metrics
# Ecosystem Services, Sustainability—Initial Thoughts

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<th>Action Steps</th>
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<td><strong>Short Term</strong></td>
<td>Carbon offset</td>
<td>Protocol</td>
<td>Public policy</td>
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<td>Offset Consumer</td>
<td>Carbon Targets</td>
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<td>Define products</td>
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<td>Impact investment</td>
<td>Market identification</td>
<td>Funding</td>
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<td>GHG reduction</td>
<td>Data, protocol</td>
<td>Educate investors</td>
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<td>.e.g. manure</td>
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**Long Term**
How Can Public Policy Help Create Biochar Demand?

- Procurement – materials, carbon credits
- Policy – carbon goals, soil goals
- Grants – economic development
- Loan Guarantees
- Research

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<th>Local: City, County</th>
<th>State</th>
<th>Federal</th>
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<td>Agriculture</td>
<td>WA DA, ODA</td>
<td>USDA</td>
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<tr>
<td>Forestry</td>
<td>ODF, WDF</td>
<td>USFS, BLM</td>
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<td>Transportation</td>
<td>WASHDOT, ODOT</td>
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<tr>
<td>Ecology/Environment</td>
<td>Portland Bureau Environmental Services</td>
<td>WADOE, ODEQ</td>
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<td>Economic Development</td>
<td>Innovate WA, OR BEST</td>
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<td>Energy</td>
<td>ODOE</td>
<td>USDOE</td>
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<tr>
<td>Education/Research</td>
<td>WSU, OSU, UI, UM</td>
<td>USDOE/Sun Grant</td>
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<tr>
<td>Extension</td>
<td>WSU, OSU</td>
<td>ARS</td>
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Public Agencies Attending

• Washington
  – Department of Natural Resources, Rachel
  – Department of Transportation, Mark Maurer
  – Department of Ecology, Doug Howie, Mark Fuchs
  – Department of Commerce, Peter Moulton, Terry Lawhead
  – Innovate Washington

• Oregon
  – Department of Energy, Matt Krumenauer
  – Department of Forestry, Marcus Kauffman
  – City of Portland, Henry Stevens
Organizations in Biochar Research Attending

• Washington
  – Washington State University,
    • Engineering, Manuel Garcia-Perez
    • Agriculture (CHNRS), David Grananstein
    • Energy, Dave Sjoding
  – WSU USDA ARS, Hal Collins
  – University of Washington, Forestry
  – PNNL, Jim Ammonette

• Oregon
  – Oregon State University,
    • USDA ARS, - Gary Banowetz
    • Soil and Water, Myles Gray
  – OSU Extension, Forestry, Frank Burris
  – USFS

• Idaho
  – University of Idaho Natural Resources, Mark Coleman
  – USFS Rocky Mountain Experiment Station
Biomass Suppliers and Consultants, NGOs Attending

• Washington
  – Climate Solutions, Patrick Mazza, Rhys Roth, Clark Gilman
  – US Biochar Initiative, Gloria Flora
  – Agroforestry Associates, Michael Maki
  – Environ Corp., Scott Luchessa
  – Land Profiles, Inc., Phil Small
  – Recovery One, Terry Gillis
  – The Remediators, Howard Sprouse

• Oregon
  – Climate Trust, Peter Weisberg
  – Kennedy Jenks, Portland, Jeff Hart
  – L&C Carbon, Dave Ford, Matt Delaney
  – Oregon BEST, Sue Safford
  – Kelpie Wilson, Biochar Consultant
NW Biochar Producers or Suppliers Attending

**Washington**
- Biochar Supreme, Everson – Ranel Anderson, Jim Wright
- Carbon Cultures*, Olympia – Jenny Knoth
- Olympic Designs, Winthrop – Hans Sholtz
- Whitfield Biochar*, Mt Vernon – Jerry Whitfield
- Yakama Nation, Toppenish – Isaac Everett

**Oregon**
- BioLogical Carbon, LLC., Philomath – John Miedema
- International Tech Corp*, Prineville – Tom Grissom, Mike Ballantine
- Permamatrix, LLC., Portland – Robin Cook
- 3 Dimensional Timber, Gold Beach – Frank Burris

**Idaho**
- Char King, New Plymouth – Alma Olsen
- Conichar, Donnelly – Luis Miller
- IdaChar, Caldwell – Clark Torell
- Salmon Biochar, Salmon – Steve Adams
Can Regional Organizations Stimulate Markets?

- Education
- Branding
- Collaborative Research and Demonstration
- Information Exchange
- Policy support/education/lobbying
- Business model for organization? Funding, staff, budget.
- Role of Existing organizations?
  - International Biochar Initiative
  - US Biochar Initiative
  - PNW Biochar Initiative
  - Agricultural, Forestry, Environmental Organizations eg. Extension
  - Private Foundations
TR Miles Technical Consultants, Inc.
1470 SW Woodward Way
Portland, OR 97225
tmiles@trmiles.com
www.trmiles.com
503-292-0107
503-780-8185 mobile

Design and development of energy and environmental processes

Industries
Biomass energy
Pollution control
Materials handling
Feed, Food and Fuels