Bioenergy Alliance Network of the Rockies

Biomass Technical Advisory Committee

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and many, many others!

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Little bug, big problem

- Mountain & spruce beetles are endemic, but current outbreak driven by:
  - **Management**: Past harvest, fire exclusion
  - **Climate**: Summer drought stress, milder winters
- >42 million acres affected
  - Much of that in BANR 4-state area (CO, WY, MT, ID)
  - Predominantly on federal land

Beetle-kill for bioenergy

- '**Push**' for removal from landscape (fuel reduction, timber salvage, infrastructure protection, restoration)
- Bioenergy '**pull**' to use, rather than burn, residues?

Pros:	Cons:
• Large existing biomass per area • Avoids food-v-fuel issues • Low stumpage costs	• Spotty and episodic • Challenging access (slope, roads) • Expensive logistics
Infrastructure availability? Environmental impacts? Wildfire implications? Habitat? Public perceptions?	

- Critical environmental, social sustainability aspects

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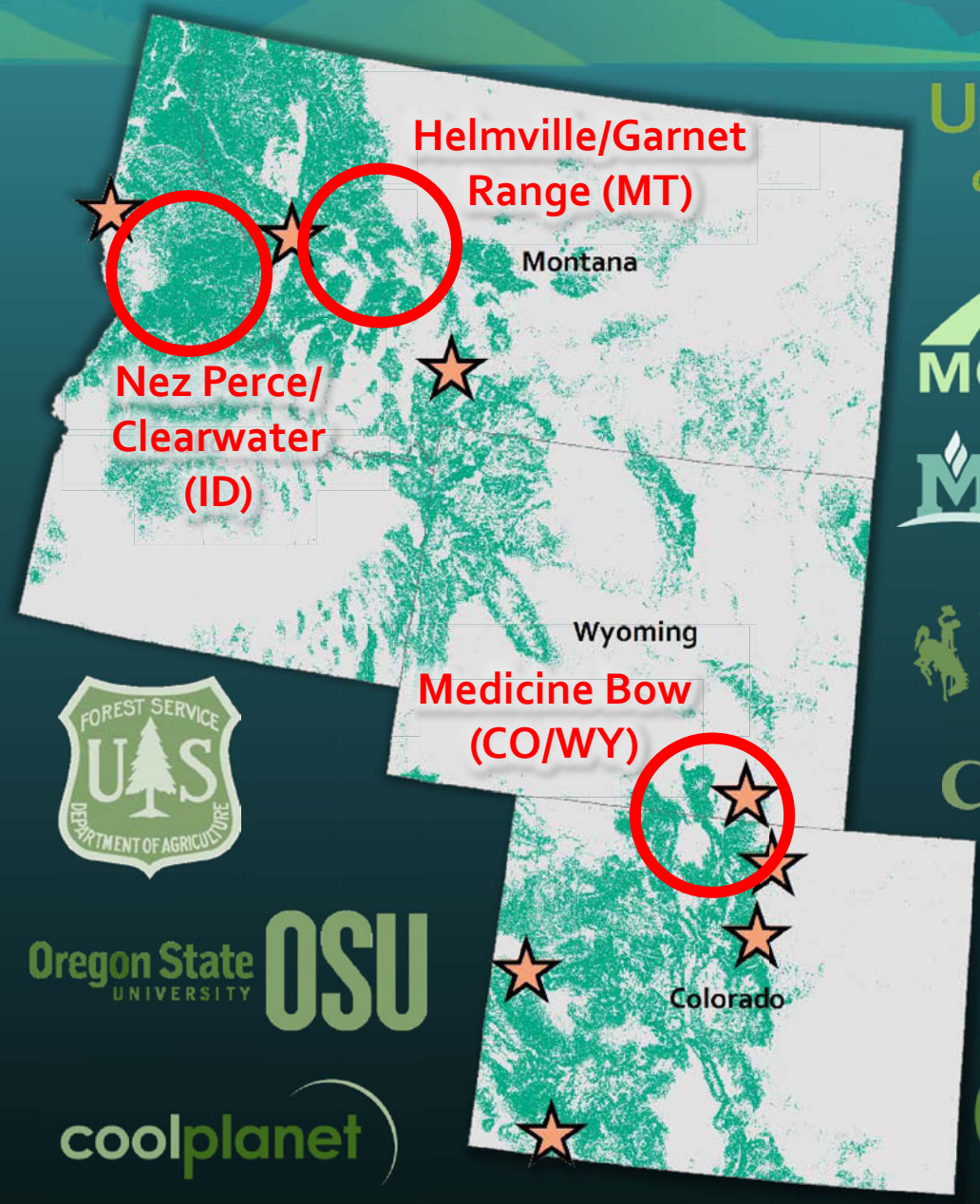
The goal of BANR is to provide **science-based underpinnings** – through targeted research, education, training and extension – to support the development of sustainable biofuel/bio-products from beetle-killed and residual wood feedstocks.



BANR

University of Idaho

University of Montana

Montana State University

University of Wyoming

Colorado State University

Forest Service U.S. Department of Agriculture

Oregon State University OSU

coolplanet

confluence energy

coolplanet ENERGY SYSTEMS

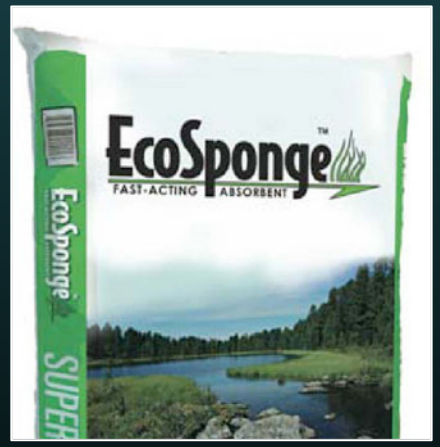
confluence energy™

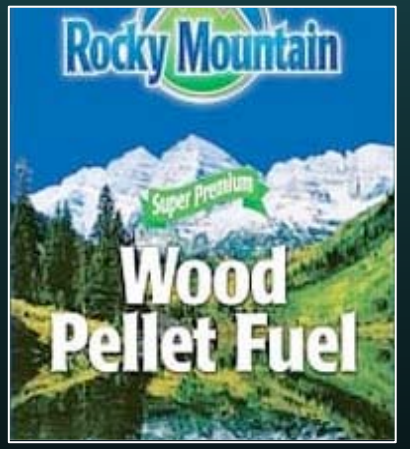
BANR

Pilot-scale fuel unit

Dedicated biochar unit

Facilities in Kremmling & Walden CO





BANR Objectives

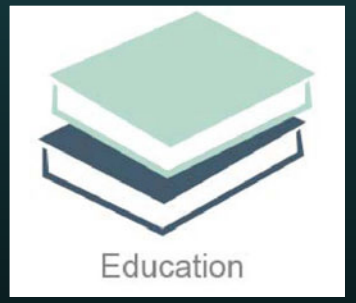
COULD we harvest?

1) Compile a regional General Feedstock Atlas & select Site-Specific Biomass Inventories
2) Develop Feedstock Specifications and Low-Cost Harvest and Processing Systems

SHOULD we harvest?

3) Quantify Local-Scale Economics & Environmental Sustainability Limits
4) Determine Wider Economic & Climate Value of Biofuel Products and Biochar Co-Product
5) Articulate Social & Policy Barriers, Make Recommendations

6) Develop Education Curricula, Extension/Outreach Program, Health & Safety Guides



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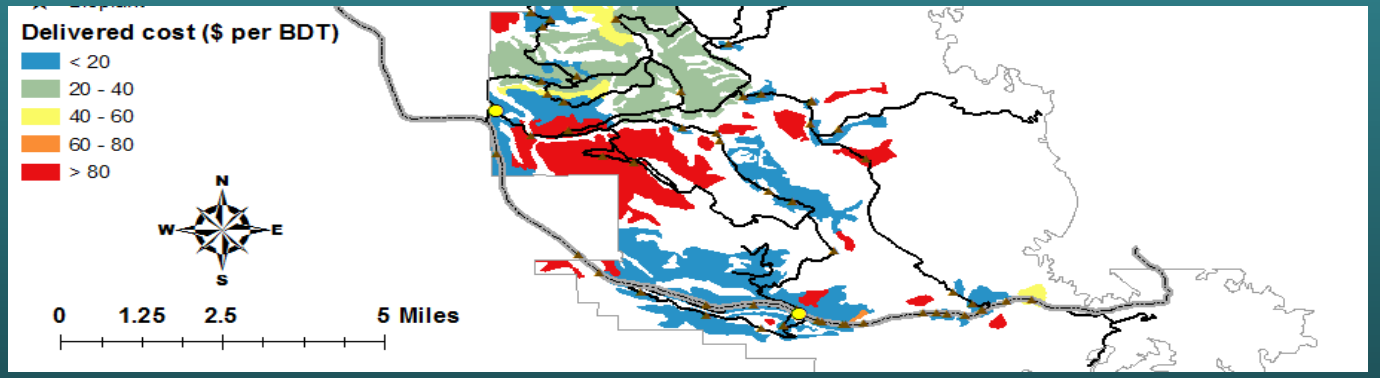
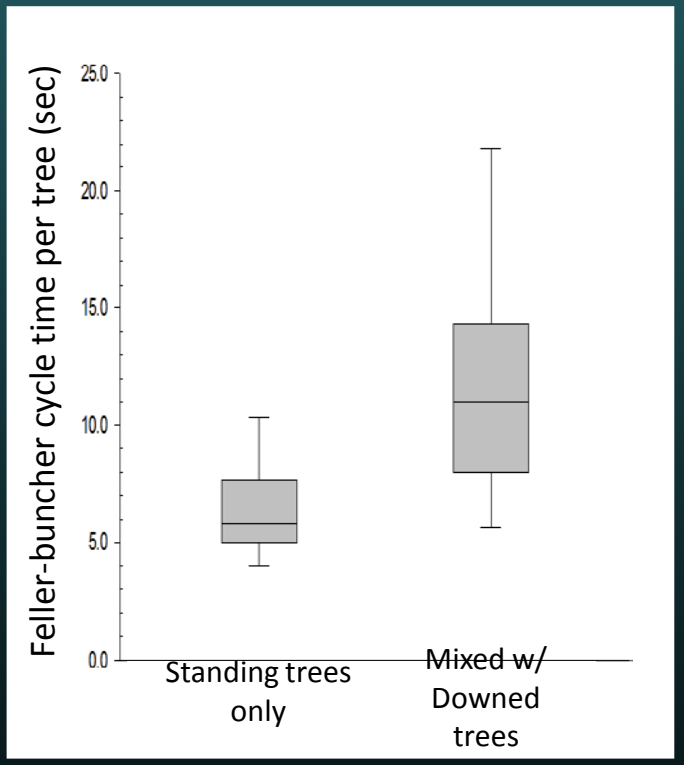
Harvest Logistics

- Lop & Scatter vs. Whole-Tree
  - Maximizing residue collection requires centralized tree processing (**Whole Tree**)
  - Stand-level quantification of cost differential over in-woods processing (**Lop & Scatter**)
- Time post-mortality
  - Feller-buncher cycle time is highly affected by **downed trees**
  - Increases harvest times, costs by ~2X





Results from the application of the Tactical Procurement Module to the RMRS Raster Utility ArcGIS add-in.

Feedstock Processing- CPES system testing

- Evaluating variety of biomass samples
  - Bark/needle content
  - Age post-mortality
  - Fire salvage
- Beetle-kill performs as well as southern pin mill residue they designed for
  - And its lower-moisture!
- Produced 10 gal of beetle-kill-derived blend-stock
- Produced several tons of beetle-kill-derived biochar

BANR High Octane Fuel

Engineered Biocarbon

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Technoeconomic Analysis (TEA)

- Estimating NPV based on:
  - Industrial partners' conversion efficiencies
  - Costs of inputs (biomass) & product prices

Boulder Country Parks and Open Space

Gypsum Biomass Power Plant

Photo: Colorado Public Radio

Technoeconomic Analysis Results

PRODUCTION DATA	CAPITAL COSTS	OPERATING COSTS	ECONOMIC VARIABLES
• Feedstock processing capacity • Product conversion rate	• Equipment • Buildings • Construction & Engineering • Land • Working capital	• Feedstock • Labor • Maintenance • Utilities • Consumables	• Discount rate • Plant life • Financing • Product selling prices • Depreciation • Taxes

	Mean NPV (feedstock $40 tonne^{-1})	Max bearable feedstock cost^{-1} dry tonne
Liquid Biofuels and Biochar	$76.0 million	$227
Wood Pellets and Biochar	$22.4 million	$97
Institutional Heating	-$24,000	$39
Electric Power Production	-$8.3 million	$26

Thank You!

To learn more:

- Website: http://banr.colostate.edu
- Twitter: @BANR_Bioenergy
- YouTube: https://www.youtube.com/user/banrbioenergy