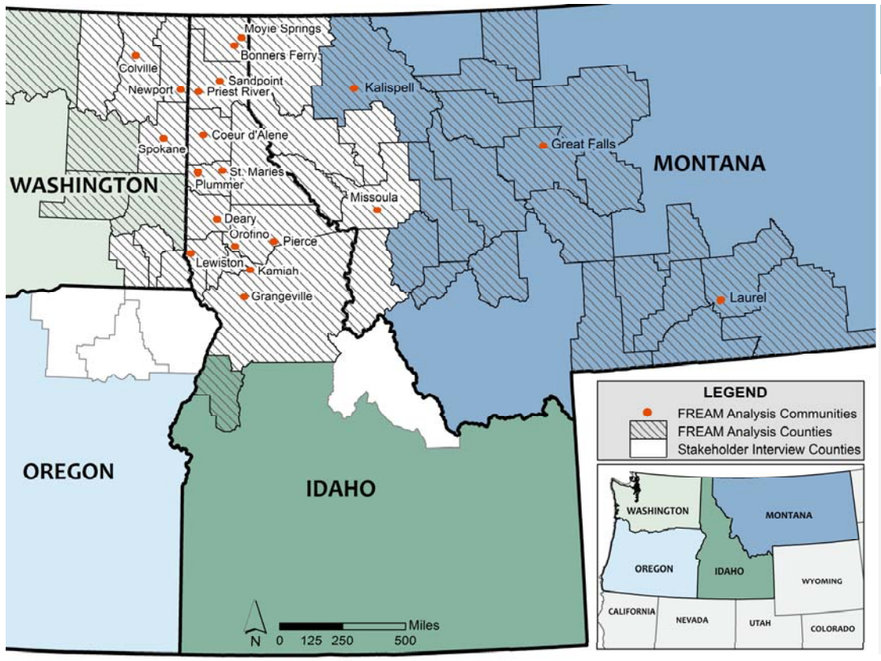
STUDY REGION



DELIVERABLES

RESEARCH FINDINGS
One journal article was published, two are pending, and three are in development.

STUDENTS
Two MS students graduated, and one student continued to a PhD program building on project research.

PUBLIC BENEFITS
Data and information were provided to two pellet facility feasibility studies. One facility is currently being developed.

ONGOING
The FREAM model continues to be used to evaluate transportation costs and supply availability for facility locations.

Contact Us

OFFICE OF GRANT AND PROJECT DEVELOPMENT

Darin Saul, Director
cals-grants@uidaho.edu 208-885-1536
www.uidaho.edu/cals-bioenergy

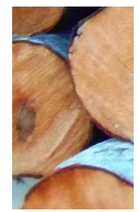
University of Idaho

USDA

Socioeconomic Impacts of Wood-based Bioenergy Development Strategies: Northwest US

University of Idaho

USDA



CONTEXT

Due to potential benefits—including renewable energy production, reduced wildfire risk, economic development, and improved forest health—wood-based bioenergy production in the northern Rocky Mountain forests of the northwest United States has gained significant interest in recent years. The feasibility, benefits, and tradeoffs of different options need to be better understood to maximize benefits to rural communities. This project provides research to inform bioenergy planning and development efforts at state, regional, and federal levels.

PROJECT OVERVIEW

GOALS
1) To understand the social and economic opportunities and challenges wood-based bioenergy development poses to rural communities in the Inland Northwest
2) To provide useful information for public and private decision makers

TEAM: University of Idaho

FUNDED BY: United States Department of Agriculture (USDA) National Institute of Food and Agriculture (NIFA) Agriculture & Food Research Initiative (AFRI)

DURATION: 2012-2016

STRATEGY

In May 2013, the University of Idaho project team worked with stakeholders from industry, tribes, and local, state, and federal government agencies to develop three scenarios to evaluate forest-based bioenergy production options from a real-world perspective.

The scenarios were based on current bioenergy research and development projects in the region. Researchers gathered input from additional regional stakeholders about primary concerns, perceived obstacles, and preferred scenario. Besides stakeholder feedback, available woody biomass, fossil fuel prices, transportation costs, and other data were incorporated in the model to evaluate each scenario.

A project of the Agriculture and Food Research Initiative: Socioeconomic Impacts of Wood-Based Biofuels Development Strategies on Northern Rocky Mountain Communities in the Northwest. NIFA AFRI Award # 2013-67010-20399

PROJECT TEAMS

COMMUNITY OUTREACH
Darin Saul (Project Director)
Soren Newman
Debbie Gray

The **Community Outreach Team** gathered input from regional stakeholders to better understand the economic and political context for bioenergy production using woody biomass. Stakeholders helped develop three scenarios for biofuel production. A stakeholder advisory committee provided local and regional perspectives and helped interpret and disseminate research results.

ECONOMIC IMPACTS
Steve Peterson

The **Economic Impacts Team** analyzed regional and local economic impacts of each scenario. The team examined how incomes would be affected by bioenergy development (using a social account matrix input/output model), forecast potential effects of bioenergy development on local economies, and compared benefits and tradeoffs of each production method.

REGIONAL OPTIMIZATION
Stephen Devadoss
Elijah Kosse (MS student)

The **Regional Optimization Team** developed a nonlinear optimization model to evaluate scenarios using different production technologies, varying fuel product pricing, and varying levels of production subsidies.

SIMULATION AND MODELING
Robert Keefe
Ryan Jacobson (MS student)
Scott Metlen

The **Simulation and Modeling Team** developed the Forest Residue Economic Assessment Model (FREAM) to determine the overall viability and profitability of the scenarios. Models map each scenario from biomass source to bioproduct point of sale and estimate the number of jobs created and other potential benefits.

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BIOENERGY PRODUCTION SCENARIOS

LOCAL SCENARIO (Gasoline and Biochar System)
Small, mobile conversion stations produce drop-in fuels and biochar via a catalytic process from 200,000 BDT yr^{-1} of biomass. Chips and hog fuel processed within stands or at log landings from logging residues, small diameter trees, and lodgepole pine killed by mountain pine beetle outbreaks are transported directly to conversion sites without further intermediate processing. Gasoline and biochar products are transported by truck or rail to nearby locations of their end use.

REGIONAL SCENARIO (Aviation Biofuel System)
A single, very large facility produces aviation biofuel from 800,000 BDT yr^{-1} of biomass. Chips or hog fuel from commercial logging residues and small diameter trees removed in thinning operations are transported to a regionally located facility in Colville, WA, or western WA. Possible use of intermediate pre-processing plants (or depots) where biomass is upgraded to wood pellets to increase transportation cost-effectiveness was included in the analysis. This scenario builds on the Northwest Advanced Renewables Alliance (NARA) biofuels project analysis for the northern Rocky Mountain region. NARA website: ***nararenewables.org***

INTERNATIONAL SCENARIO (Wood Pellet System)
A mid-sized pellet mill produces wood pellets from 300,000 BDT yr^{-1} of biomass. Commercial logging residues and small diameter trees from thinning operations are transported directly to a large wood pellet manufacturing facility located in communities such as Colville, WA, Lewiston, ID, and St. Maries, ID. Wood pellets are shipped via truck, rail, or barge to coastal ports and then to international markets where significant demand exists. This scenario is modeled after similar high production pellet facilities in the southeastern US and Vancouver, BC.

PROJECT RESULTS

SOCIAL SCIENCE AND STAKEHOLDER ENGAGEMENT

- Participants interviewed tended to support wood-based bioenergy development in the Inland Northwest. However, most predicated that support on evidence that projects would promote forest health and directly benefit local communities.
- Stakeholders' primary concerns were the potential to overharvest woody biomass, negatively impact air quality during manufacturing or fuel burning, and leakage of economic benefits away from rural, forest-dependent areas.
- Stakeholders' perceived obstacles to a wood-based bioenergy industry included availability and accessibility of forest biomass, economic feasibility, lack of public support, and declining forest industry infrastructure and workforce.
- Many participants preferred forest-based bioenergy production, including ownership, be kept as local as possible. These participants believed local or community-scale projects are most likely to secure public acceptance and maximize benefits for local communities and forest health over the long term.

FOREST OPERATIONS ANALYSIS

- Local liquid biofuel and biochar production costs for gasoline started at \$23.33 $MMBTU^{-1}$*.
- Production costs for aviation fuels started at \$35.83 $MMBTU^{-1}$.
- Production costs for pellets started at \$9.53 $MMBTU^{-1}$.

**price per million British thermal units (MMBTU) is calculated by dividing the produced volume by the BTU per unit of the fuel and multiplying by one million*

REGIONAL OPTIMIZATION MODELING

- Only wood pellets are profitable at current fossil fuel prices.
- Pellets have established and growing international and domestic markets.
- Liquid biofuel and biochar and regional aviation biofuel require either extensive subsidies or a significant increase in fossil fuel prices to be profitable.

ECONOMIC IMPACTS

- Potential economic impacts for each scenario vary depending on location of landings, depots, and conversion facilities.
- On average, estimated production of the local, smaller-scale gasoline and biochar scenario would contribute \$19.1 million in gross regional product, \$12.1 million in total wage compensation, 280 jobs, and \$1.5 million in taxes annually.
- On average, estimated production of the regional-scale aviation biofuel scenario would contribute \$152.0 million in gross regional product, \$102.4 million in total wage compensation, 2,382 jobs, and \$10.5 million in taxes annually.
- On average, the estimated production of the wood pellet scenario would contribute \$25.3 million in gross regional product, \$17.1 million in total wage compensation, 406 jobs, and \$1.6 million in taxes annually.
- Regional-level job impacts would be relatively low. However, impacts for individual rural towns would be high.
- Average total compensation per job is about \$43,000.
- Bioenergy development could complement the struggling wood product industry and provide important economic cluster effects to help revitalize the industry and local communities.

CONCLUSIONS

- **International markets and profitability exist to support pellet production.**
- **Stakeholders had the most interest in local, smaller-scale production strategies, although many supported all three scenarios.**
- **The production strategies are potentially complementary. Once developed, pellet production can support other biofuel production systems as they become profitable.**
- **Biofuel production as a tool for improving forest health and reducing fire impacts and costs could drive development faster than profitability alone.**