NARA | GOAL FOUR

August 2011 - March 2013 Cumulative Report

SUPPLY CHAIN COALITIONS

Northwest Advance Renewables Alliance

NARA is led by Washington State University and supported by the Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30416 from the USDA National Institute of Food and Agriculture.

Goal Four: Supply Chain Coalitions

Envision and delineate pilot supply chains within the NARA region

Summary

The NARA project is designed to develop a roadmap for industry to produce biojet and co-products from forest residues. This roadmap can only become reality when regional stakeholders (businesses, government agencies, and private individuals) are empowered to actually build the industry. Involving stakeholders in the research process and using their input to shape the supply chain analysis is an integral step on the pathway to this new industry. We are using the Outreach and Education Teams in key roles toward this end. Regional stakeholders are identified, organized, and/or engaged by the Outreach Team working to develop regional assets and needs. The Education Team then partners with these stakeholders and mentors student teams who analyze and design regional supply chains for potential biofuels production. This two-pronged alliance both engages stakeholders in the research process and develops the regional knowledge and interest to carry the industry forward. Finally, the diverse student teams researching the supply chains develop into the trained workforce of the future.

NARA is building regional capacity to implement a biofuels industry by focusing on three areas:

1. Identifying and engaging key stakeholders and incorporating them into the planning process

2. Cataloging regional supply chain assets, analyzing the logistical and economic relationship among these assets, and providing recommendations and strategies on how best to employ them

3. Communicating researched-based strategies to stakeholders and facilitating business development where feasible

Facilitating the development of pilot supply chains actually engages all NARA members; however, groups within the NARA Outreach and Education Teams have tasks dedicated to this goal. **To identify regional stakeholders and incorporate them in the planning process**, the NARA Outreach Team members delineate key stakeholders and mine existing efforts pertinent to the biomass and biofuels industry. This effort engages stakeholders ranging from landowners and economic development specialists to forest products industry and environmental NGOs.

The Outreach Team assisted in developing surveys and identified over 300 stakeholders to participate in a stakeholder survey coordinated by the NARA EPP Team (Goal 3; Task SM-EPP-1). Additional surveys to assess stakeholder and youth understanding of biofuels were developed and distributed by the University of Idaho Extension (Figures 1-5; Task O-5; each task progress is detailed in progress reports following this summary).

Ruckelshaus Center/DGSS staff interviewed stakeholders to obtain their input on the formation and management of a NARA Advisory Board (Task O-7).

NARA Outreach team members developed a list of 24 communities/bioregions to be considered as a "NARA Community" and collaborated with the NARA EPP and Education Teams to develop a methodology for pilot supply chain selection. The Outreach Team played a significant role in identifying and coordinating stakeholders within the Western Montana Corridor (WMC) to participate in supply chain development. With the supply chain analysis in the WMC maturing, efforts to organize stakeholders on the west side of the Cascades in Oregon and Washington have come into focus (Task O-4).

To envision regional supply chain assets for providing recommendations and strategies on their utility, the Education Team assists the outreach efforts by forming collaborations between students, NARA mentors and stakeholders to provide the analysis. NARA researchers and university students participate in a year long integrated design course called Bioregional Integrated Design Experience (IDX). In this collaborative course, multidisciplinary student teams analyze biofuels supply chain scenarios in partnership with regional stakeholders. This group developed two regional atlases, one that focused on the Clearwater Basin in Idaho and another that focused on the WMC. Each atlas consists of two parts: a profile that outlines regional assets (natural, physical, human, economic, policy and incentives) and an analysis that provides recommendations for capitalizing on existing infrastructure, site, and natural resources. In developing the atlases, extensive participation and review was provided by members of the NARA Outreach Team, particularly by the Bureau of Business and Economic Research (BBER) at the University of Montana, as well as regional stakeholders. For the WMC, the Forest Products Retention Roundtable of the Montana Forest Restoration Committee served as the focal stakeholder group interacting with NARA (Task E-3, O-3).

A similar collaboration of students, NARA mentors, and stakeholders is employed with the regional tribal stakeholders. NARA is working with tribal foresters on biomass and cost of transport assessments that integrate with landscape management goals for the Confederated Salish and Kootenai Tribe (CSKT) reservation (Task E-1; report is listed under goal 5).

Forest residues constitute a majority of the wood biomass supply considered for producing biojet. Another source of wood residue feedstock is construction and demolition debris (C&D) portion of municipal solid waste (MSW). A preliminary assessment was performed that provides available wood waste quantities and identifies MSW and municipal recycling facilities (MRFs) for each state in the NARA region. A more detailed assessment is provided for the WMC. To determine quantities in regions where solid waste sites and inventory are not recorded, a model approach has been developed (Task E-7).

To communicate the researched-based strategies to stakeholders and facilitate business development where feasible, the Outreach Team played a significant role in orchestrating the NARA annual meeting held in Fall 2012 that attracted over 50 stakeholders and provided a forum for NARA members to exchange information. The Outreach Team maintains a database of regional stakeholders used to disseminate relevant NARA information verbally and electronically (Task O-5). Originally GreenWood Resources was tasked to work with stakeholders to develop hardwood resources, but that project was redirected to explore softwood plantation development (Task O-8).

Significant internal outputs to date for this team are listed below. Additional outputs are listed at the end of each progress report.

- NARA Outreach team members developed a list of 24 communities/bioregions to be considered as a “NARA Community” and collaborated with the NARA EPP and Education Teams to develop a methodology for pilot supply chain selection (Task O-1).

- Key regional stakeholders have been identified and are in communication with NARA (Task O-1).

- The two regional atlases serve as a tangible reference and roadmap for NARA members and stakeholders (Task E-3).

- Quantitative data on construction and demolition wood waste have been obtained and fill a critical gap in understanding the regional supply of woody biomass available as feedstock. A sum of 647,000 tons of recycled wood waste has been accounted for by MRFs within the NARA region to date (Task E-7).

Outcomes/Impacts:

Events that cause a change of knowledge, actions of conditions for stakeholders and society.

- Establishing the WMC supply chain motivated stakeholders within the region to organize and promote development of supply chain infrastructure for a wood residue to biojet industry. The WMC Atlas provides stakeholders with biofuels supply chain scenarios that will enable the region to identify potential economic development opportunities. The WMC Atlas is an important resource to increase stakeholder's energy literacy, specifically related to using woody biomass to create liquid biofuels (Task O-1, E-3).

Training

Name	Affiliation	Role	Contribution
Peter Gray	WSU, Economic Sciences	PhD Student	Applying economic modeling and methods to supply chain optimization.
Jinxue Jiang	WSU, Materials Science & Engr.	PhD Student	Developing depot methods for conversion of biomass to feedstock and eventually sugars. Depot sizing and unit operations have resulted from their work.
Yalan Liu	WSU, Materials Science & Engr.	PhD Student	
Natalie Martinkus	WSU, Civil Engr.	PhD Student	Providing the raw GIS data for students to use in their supply chain analyses and GIS technical support for the IDX students.
Nannan Tian	WSU, Materials Science & Engr.	PhD Student	No longer on the project

Daniel Johnson	UI, Bioregional Planning & Community Design Program (BIOP)	MS Student	Leading multi-disciplinary teams to develop regional biofuels atlases and planning documents. Presenting IDX role in pilot supply chain development at conferences.
Kyle Merslich	UI, BIOP	MS Student	
Jill Moroney	UI, BIOP	MS Student	
Lanier Nabahe	UI, BIOP	MS Student	
Geoff Nielsen	UI, Architecture/BIOP Certificate	MS Student	
Navin Risal	UI, BIOP	MS Student	
John Staldine	UI, Masters of Natural Resources /BIOP Certificate	MS Student	
Cade Sterling	UI, Landscape Architecture/BIOP Certificate	MS Student	
Eric Anderson	UI, Law/BIOP	JD/MS	Leading multi-disciplinary teams to develop regional biofuels atlases and planning documents. Presenting IDX role in pilot supply chain development at conferences.
Seth Cool	UI, BIOP	MS Student	
Ryan Hutten	UI, Accounting/BIOP Certificate	MS Student	
Ethan Mansfield	UI, BIOP	MS Student	
Matthew McAnulty	UI, Architecture/BIOP Certificate	MS Student	
Donna Mills	UI, Agricultural Education/BIOP Certificate	MS Student	
Lisa Nichols	UI, BIOP	MS Student	
Christine Schuette	UI, BIOP	MS Student	
Tess Wolfenson	UI, BIOP	MS Student	
Eric Brandon	WSU, Civil Engineering	Undergraduate	Internal Communications Fellow -Manage Google Apps logistics, Document standard operating procedures for class, improving classroom infrastructure, assist in analysis and development of an IDX restructure plan

Nick Linton	WSU, Architecture	Undergraduate	External Communications Fellow -working on IDX branding, developing IDX communications plan, improving classroom infrastructure, working on IDX recruitment, designing new studio layout
Charlie Misner	WSU,	Undergraduate	Technology Fellow - providing software tutorials, presenting software tutorial sessions to class, manage computer lab
Andrea Charette-Bluff	WSU,	Undergraduate	Atlas Fellow – assisting with the development of the WMC Atlas
Gerald Schneider	WSU, Civil Engr.	MS Student	100%
Jillian Moroney	University of Idaho	Ph.D. Student	Assess regional norms about bioimass

Resource Leveraging

Resource Type	**Resource Citation**	**Amount**	**Relationship or Importance to NARA**
Scholarship	China Scholarship Council (CSC)		Support for Yalan Liu and Jinxue Jiang
RA Funding	WSU, Provost Office		Support for Peter Gray and Natalie Martinkus
Resource Type	Resource Citation	Amount	Relationship or Importance to NARA
Grant	Farm Bureau Youth Advisory Board	$100,000	Unfunded
	USFS Woody BUG (Biomass Utilization Grant) for Boiler System for Idaho State Prison	Undetermined	
International Wood Composites and NARA Joint Symposium	IWCS generated budget	$1,500	Dissemination of findings and engaging stakeholders at Joint Symposium with the International Wood Composite Symposium

Education Team

Task E-3: Bioregional Integrated Design Experience (IDX)

Key Personnel	Affiliation
Tamara Laninga	University of Idaho
Michael Wolcott	Washington State University
Todd Beyreuther	Washington State University
Karl Olsen	Washington State University

Task Description

IDX is an integrated design studio experience for graduate students in engineering, design (architecture, landscape architecture, etc.), natural resources, and land use planning disciplines, focusing on technical assistance to communities interested in participating in the emerging biofuel economy. IDX involves a year-long integrated design course delivered jointly through the University of Idaho and Washington State University. The course is a trans-disciplinary planning and design studio that addresses planning and infrastructure needs of communities exploring their role in the biofuel supply chain. Aimed at upper-level BS and MS students, the course is organized around service-learning experiences that link teams of students with communities. Graduate students from NARA with special expertise in required areas will act as consultants to the design teams, improving the level of analysis and providing interdisciplinary experiences to the students.

Five different pilot supply chain regions will be served, one during each year of the project, with a focus on identifying regional supply chain assets, optimizing sub regional biofuels supply chains, and designing interventions at specific locations within the supply chain (e.g., depot sites, conversion facilities, multi-modal transportation hubs, etc.). The goals for this studio are:

- That every student that completes the program exits with strong collaborative research, questioning, and design methods to utilize in their academic and professional work.
- To provide technical analyses to communities interested in participating in the emerging biofuels economy. We will assist these communities in beginning the process of transformation necessary for them to be engaged in the biofuels supply chain.

Activities and Results

Between 2011 and 2013, the UI and WSU jointly delivered their studio courses. Through this collaborative effort, multidisciplinary student teams applied skills and knowledge to understanding and analyzing biofuels supply chain scenarios.

In the IDX studio, students develop, analyze, and optimize regional supply chains during two semesters. A community capitals framework (Emery, Fey and Flora 2006) is used to organize supply chain assets: natural (e.g., biomass feedstock), physical (road; rail networks; existing, idle, decommissioned mill sites), civic (workforce, education, collaboratives), financial (cost of doing business, loans and grant opportunities) and policy (laws and landownership). In the fall, students collect and analyze assets, and identify sub-regional supply chains and potential depot and conversion sites. In the spring, students design interventions for key aspects of the supply chain, including site master plans, architectural and engineering designs for depot and conversion facilities, and transportation options.

2011/2012: Clearwater Basin, Idaho Pilot Biofuels Supply Chain

IDX worked in the Clearwater Basin of North Central Idaho during 2011/2012 (Figure 1). First, students identified supply chain assets and analyzed the region's resources (biomass availability), key nodes (depot and conversion sites), and primary linkages (highways, railroads, and ports) (Figure 2). At the conclusion of fall semester, students had identified a depot site at the former Jaype Plywood Mill near Pierce, ID; a conversion facility at the Lewiston paper mill; and a transportation hub at the Port of Wilma in Whitman County, WA. Second, multidisciplinary teams conducted site assessments, developed schematic site designs and proposed interventions. They developed a chipping and pellet facility at the Jaype site; an addition to or retrofit of the Lewiston paper mill as a conversion facility; and a reorganization of the Port of Wilma site as a multi-modal transportation hub.

2012/2013: Western Montana Corridor Biofuels Supply Chain

IDX worked in the Western Montana Corridor (WMC) during 2012/2013 (Figure 3). During the Fall semester, WSU students identified natural and physical supply chain assets, while UI students focused on the civic, financial, and policy assets. WSU students also identified sub-regional supply chains within the WMC, examining potential conversion facility locations at Libby, Flathead, and Frenchtown, MT. Students presented posters at an Open House hosted by the NARA Outreach and Education/IDeX teams on January 17 in Missoula, MT. IDX received suggestions from the Montana Forest Products Retention Roundtable to drop the Flathead location and focus on conversion sites in in Libby and Frenchtown. The supply chain team identified several depot sites in the WMC to supply feedstock to both potential conversion facilities (Figure 4). The depot sites were classified into: working mills with a co-located depot; idle mills with infrastructure; and decommissioned mills with little or no infrastructure. These were further classified into brown and grey fields as well as by location within or outside of city boundaries, and proximity to conversion sites. During Spring semester, students were divided into seven teams to conduct site assessments, identify site opportunities and constraints, and develop site programming maps for conversion plants in Libby and Frenchtown, and four depot sites located near Colville, WA (working/greyfield); Bonners Ferry, ID (idle/greyfield); Thompson Falls, MT (decommissioned/greyfield); and Pablo, MT (idle/brownfield).

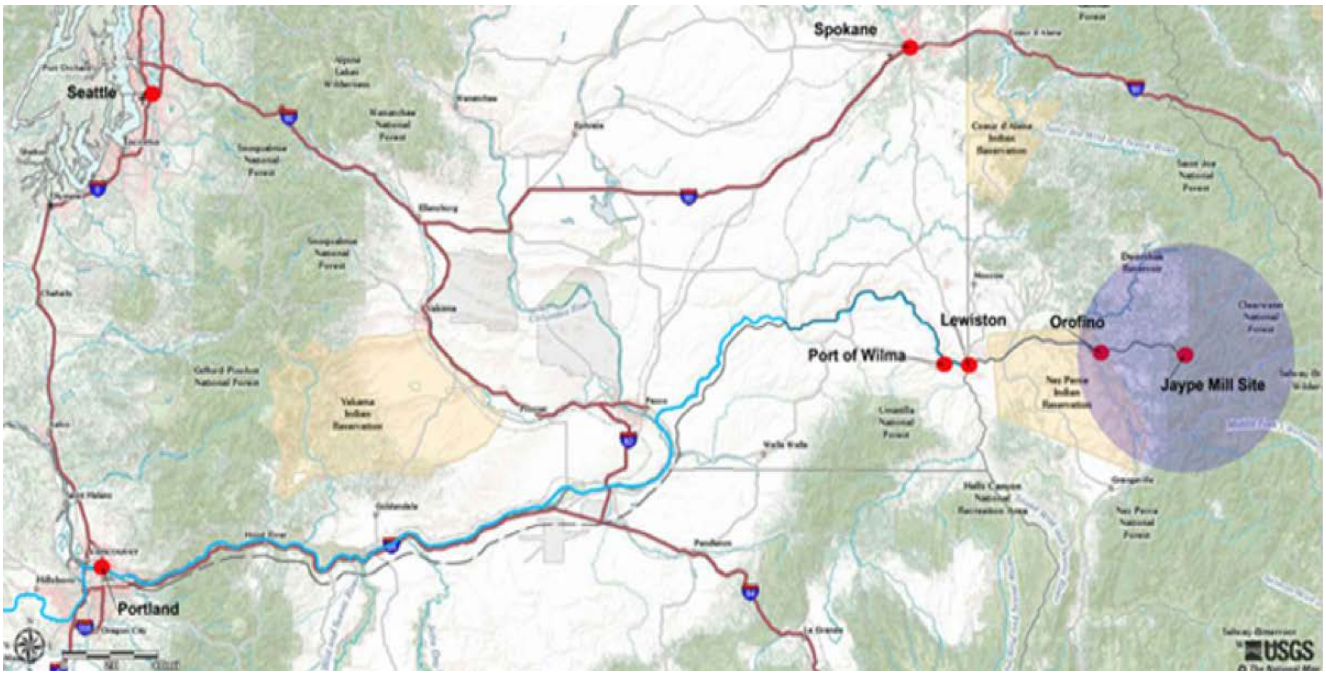

Figure 1. Clearwater Basin, Id: IDX analysis and design focused on Jaype Mill site (depot), Clearwater Paper Mill (conversion) and Port of Wilma (multi-modal transportation hub).

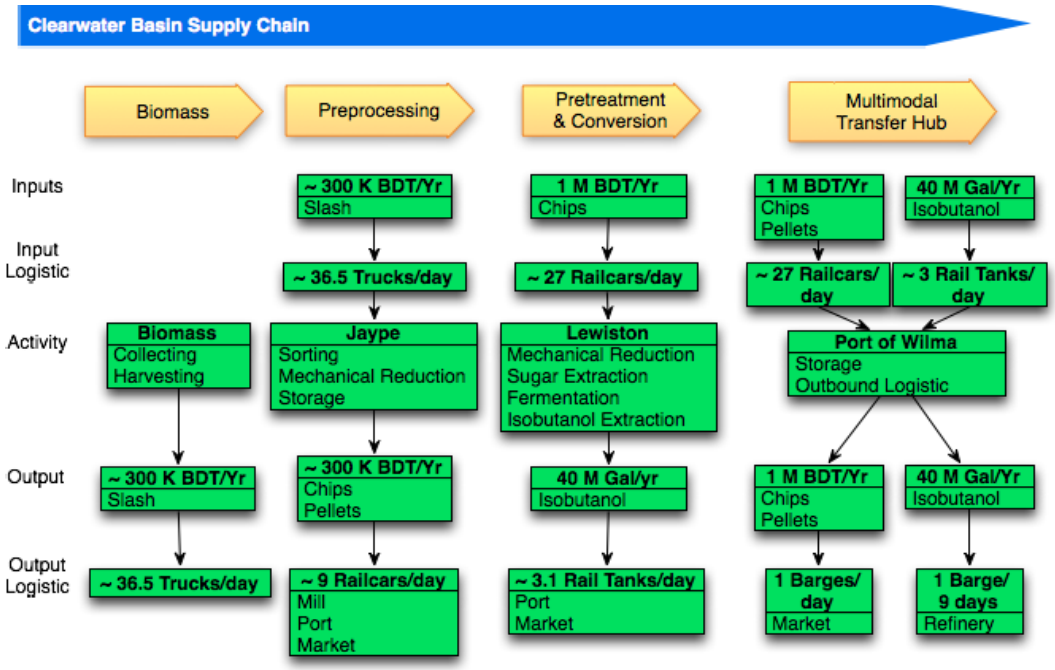

Figure 2. Clearwater Basin Supply Chain Diagram

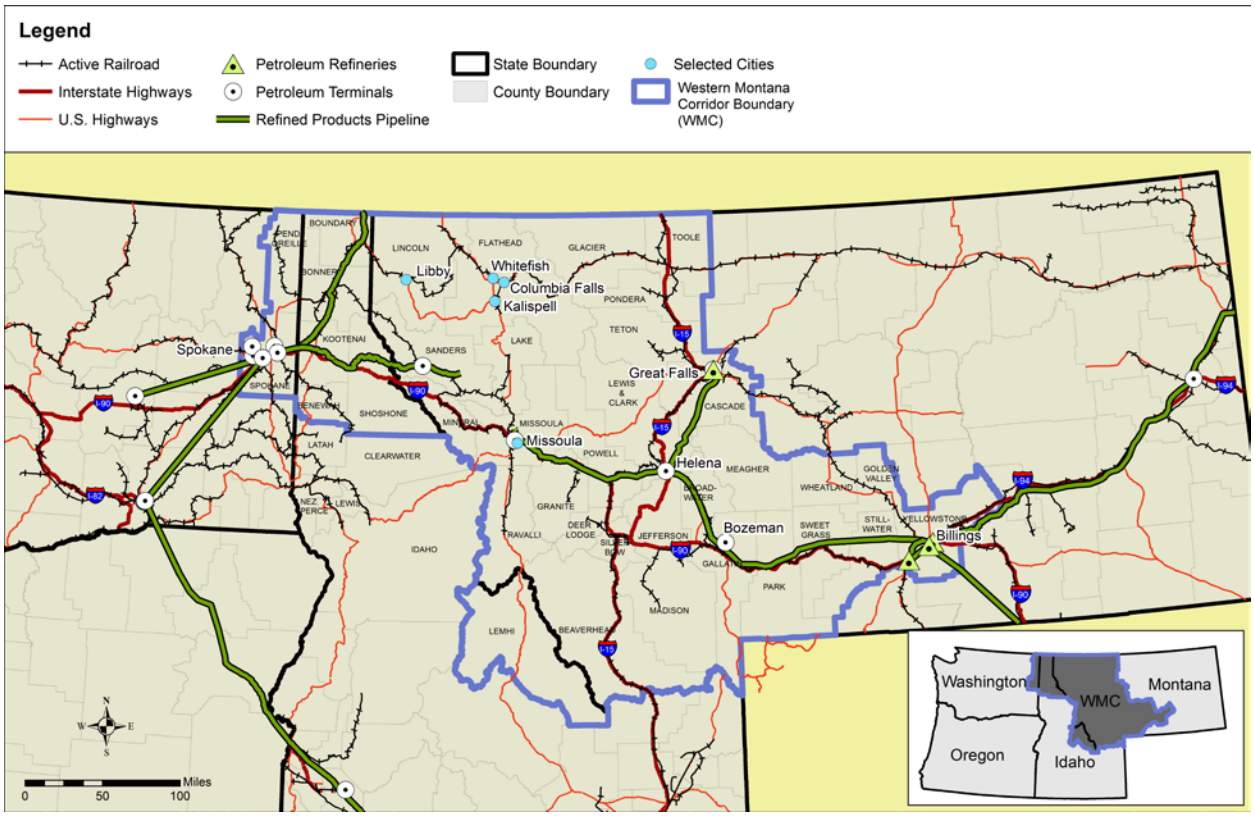

Figure 3. Western Montana Corridor (Northeast Washington, Northern Idaho and Western Montana)

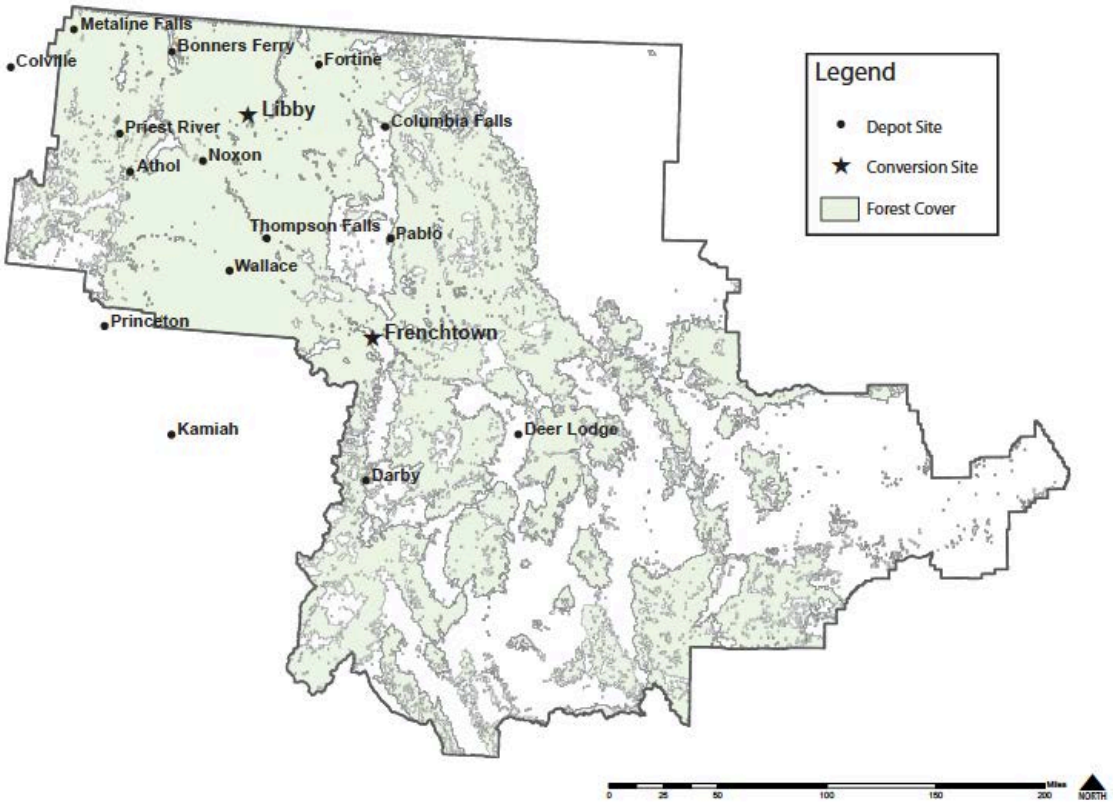

Figure 4. Western Montana Corridor Conversion and Depot Sites

Emery, M., S. Fey and C. Flora. 2006. Using Community Capitals to Develop Assets for Positive Community Change. Community Development Practice. 13: 1-19. http://www.comm-dev.org/commdev/collection/2006%2013.pdf.

Recommendations/Conclusions

Supply Chain Recommendations

IDX is working to develop a pilot supply chain that will provide each hypothetical conversion facility with a supply of 300,000 to 1 million BDT/year. Based on this quantity range, the IDX team developed several recommendations.

Satellite Depot Sites and Conversion Facilities

First, for a conversion facility to operate efficiently, satellite depot sites are necessary. Included at each conversion plant would be its own local depot for handling biomass within economic trucking range for unprocessed or lightly processed biomass. The team has developed a conversion/depot model, which recognizes that to ensure an economically and environmentally sustainable supply of feedstock, a

conversion facility must rely on several depot sites to collect, store, sort, and densify feedstock for shipment to the conversion facility in a continuous stream.

Supply Chain Costs Analysis incorporating Geographic and Market Scenarios

Second, supply chain cost analysis requires geographic as well as market scenarios. The team, working with P. Gray, a PhD student funded on the project, is conducting cost analyses based on geographic combined with market scenarios. The team settled on three geographic scenarios: one plant at Frenchtown, one at Libby, and a third scenario with plants at both proposed sites. For each geographic scenario, the three market scenarios are represented by prices ($40, $80, and $120 per BDT of chips or pellets) at the conversion plant gate. These prices should span the range of current market prices for such biomass, as well as higher prices that could arise from future market and/or policy changes. This model results in nine illustrative scenarios, each with a proposed selection of depot sites and transport networks, and each with a biomass and biofuel output estimate. The model should serve as a platform for more refined results based on improved future understanding of conversion plant economies of scale. It can also be used for developing more accurate cost functions and more sophisticated depot selection methods. Figure 5 shows an analysis that examines available biomass in the WMC that is within a two-hour drive time of proposed depot and conversion sites.

Multi-Modal Transportation System

Finally, a multi-modal transportation system that relies on a combination of highway, rail, barge, and pipeline transport is important for cost effectiveness. Transportation analyses in the Clearwater Basin and the WMC suggested that using highway trucks might be the most effective transportation mode up to a distance threshold of 100-150 miles (Figure 6). Subsequent analyses have indicated that the truck/rail break-even distance could be less than 100 miles. The teams also found that, in the Clearwater Basin, access to port and barge transportation represents a significant cost savings for transporting chips or liquid. In the WMC, the main transport modes are off-highway truck, highway truck, rail, and pipeline. The team analyzed pipeline costs for transporting isobutanol from each potential conversion plant to a refinery in Great Falls, and found that pipeline transport costs would be a very small contributor to total per-gallon cost. However, there are some indications from biofuel industry partners that transforming isobutanol to biojet at the conversion plant might be an even more efficient method. In that scenario, a dedicated pipeline to an oil refinery would be unnecessary, and the final product could go more directly to market.

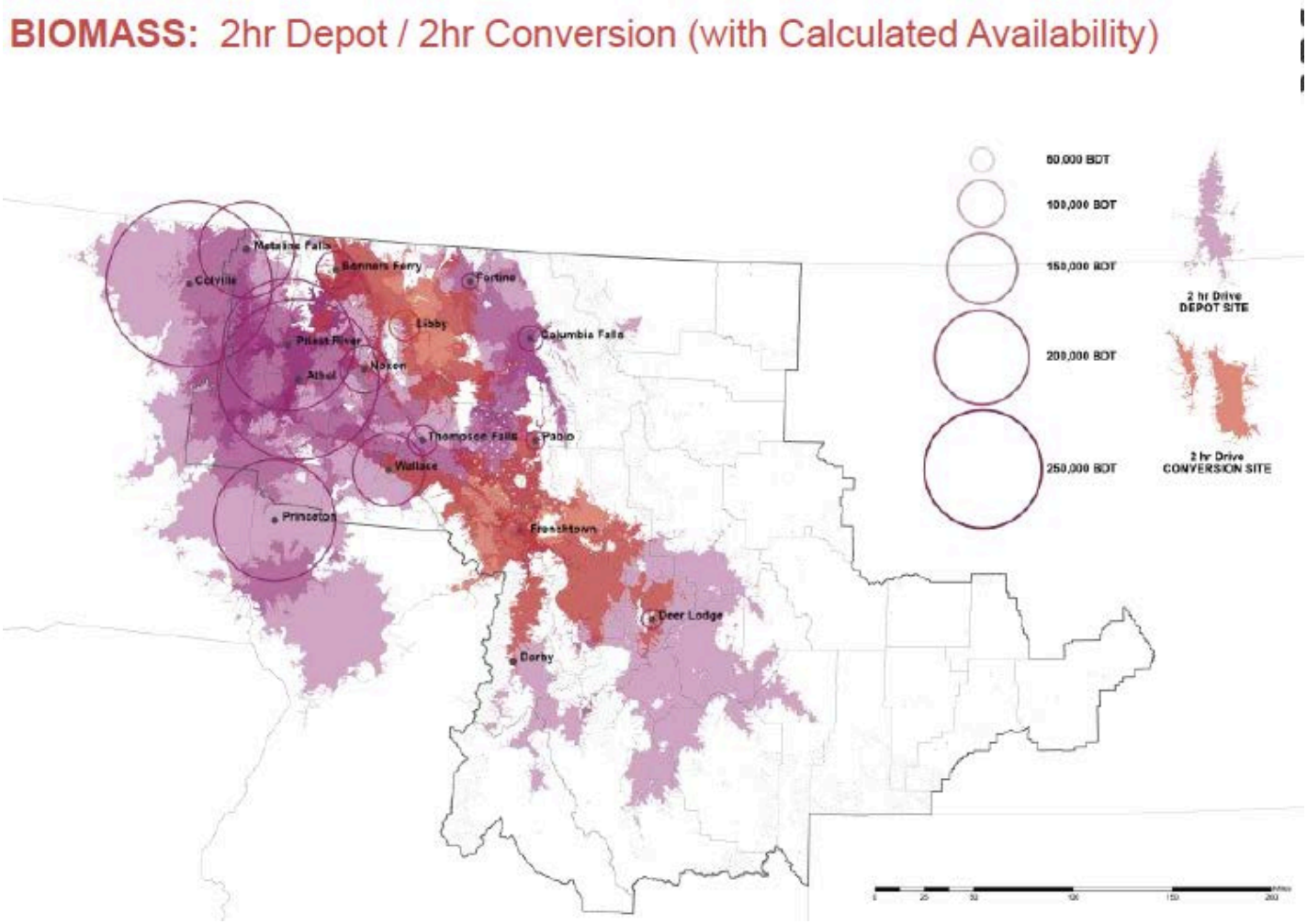

Figure 5. Biomass availability in the Western Montana Corridor within two-hour drive of proposed depot and conversion sites.

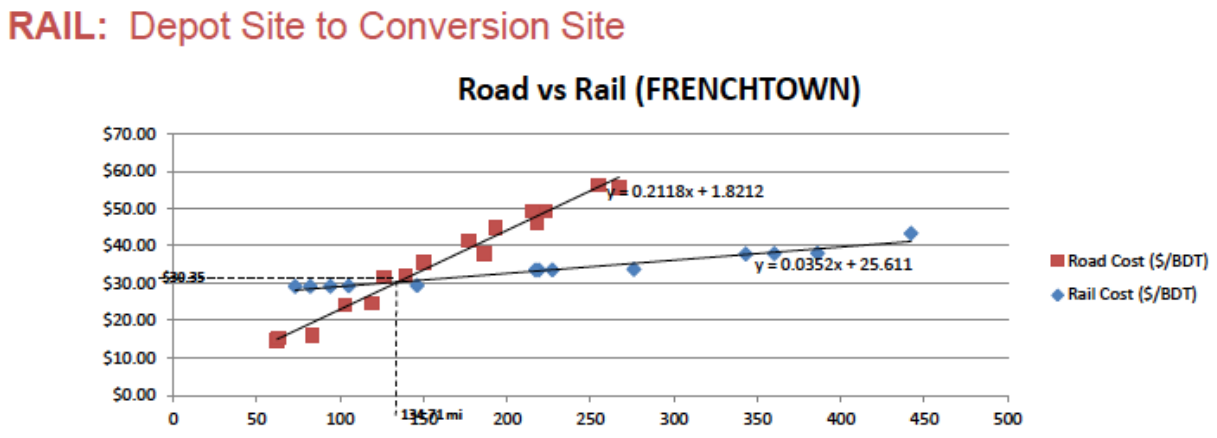

Figure 6. Road vs. Rail Costs from Depots to Conversion Facility at Frenchtown Mill Site.

Collaboration Recommendations

For a successful collaboratory, a distributed research effort that can include multiple physical sites and disciplines (see: http://en.wikipedia.org/wiki/Collaboratory), requires time and commitment from faculty. The IDX collaboration consists of 7 faculty and 3 PhD students. IDX is organized through a virtual infrastructure that allows for collaboration among faculty, students, other NARA team members, and supply chain partners. IDX is using the Google Apps platform, relying on Google Drive to share and jointly work on documents; using Google Hangout for meetings (e.g., weekly faculty meetings); Google Sites for posting syllabi, assignments, and class resources; and Google Community for posting items of interest to the group.

After working together for two years, IDX is streamlining and articulating its goals for each region. The main IDX output is a regional atlas consisting of three parts:

1. Profile (outlines regional supply chain assets)
2. Analysis (optimization of the supply chain and identification of depot and conversion facility locations)
3. Design (interventions and case studies at specific locations)

IDX has also gone outside of the original two courses, ENGR 420 and BIOP 520, to bring in allied courses with added expertise including architecture and landscape architecture. We are identifying additional allied expertise in forest operations and supply chain management in the coming year.

Finally, an important outcome from the IDX collaboratory is the collection of data that can be used for extending research into various aspects of the supply chain by faculty and students. Furthermore, faculty and PhD students are able to use the research findings from IDX to apply in other contexts. For example, P. Gray could present on supply chain modeling and results from WMC that can be applied elsewhere, T. Laninga on refined understanding of capitals, community/stakeholder assets, N. Martinkus on GIS, and T. Beyreuther on integrated design on post-industrial sites.

Physical and Intellectual Outputs

Research Presentations

IDX. 2011. *Clearwater Basin Biomass Atlas*. Final Review. University of Idaho. Moscow, ID. December 14.

Beyreuther, T. 2012. *Design Programming for Post-Industrial Site Reus*e. Plenary Speaker. Brownfields and Land Revitalization Conference. Spokane, WA. June 21-22.

Beyreuther, T. 2012. *Crafting an Integrated Model for Architectural Education*. AIA Western Mountain Region / Northwest and Pacific Region Joint Conference. Tucson, AZ. October 10-13.

Beyreuther, T. 2012. *Sustainable Community Design*. Center for Environmental Research, Education, and Outreach (CEREO) Advisory Board Annual Meeting. Washington State University: Pullman, WA. October 14.

IDX. 2012. *Clearwater Basin Bioenergy Assessment Project*. Final Review. University of Idaho: Moscow, ID. April 30.

IDX. 2012. *Western Montana Corridor Atlas*. Final Review. University of Idaho: Moscow, ID. December 7.

Poor, C., and T. Beyreuther. 2012. *Integrate Site Redevelopment*. Panel Presentation at NARA Annual Meeting. Missoula, MT. September 14.

Gray, P. 2012. S*upply Chain Economics: A Modeling and Research Plan*. Panel Presentation at NARA Annual Meeting. Missoula, MT. September 14.

Laninga, T., and M. Vachon. 2012. *Pilot Supply Chain Coalitions: The Role of Asset Mapping and Community Capitals Framework*. Panel Presentation at NARA Annual Meeting. Missoula, MT. September 14.

Laninga, T., and M Vachon. 2012. *From Wood to Wing: Wood-based Energy Options*. Idaho Chapter, American Planning Association Annual Conference. Boise, ID. October 10-12.

Laninga, T., J. Moroney, and M. Vachon. 2012. *Clearwater Basin Pilot Biofuels Supply Chain Project*. Clearwater County Economic Development Board Meeting. Orofino, ID. October 17.

Laninga, T. 2012. *Life-Place Planning: Fostering Vibrant Communities throughout the Pacific Northwest*. University of Idaho Geography Department Research Seminar. Moscow, ID. November 6.

Martinkus, N. 2012. *GIS as a Decision Support Tool for Supply Chain Analysis in the Western Montana Corridor*. Panel Presentation at NARA Annual Meeting. Missoula, MT. September 14.

Olsen, K., T. Beyreuther, C. Poor, T. Laninga, and M. Wolcott. 2012. *IDeX Studio Design*. Panel Presentation at NARA Annual Meeting. Missoula, MT. September 14.

Beyreuther, T. 2013. *Northwest Advanced Renewables Alliance (NARA): Resource Assessment & Supply Chain Analysis*. Panel Presentation at the Small Log Conference. Coeur d'Alene, ID. March 14. http://nararenewables.org/templates/hubbasic/docs/small-log/beyreuther.pdf

Martinkus, N. 2013. *GIS as a Decision Support Tool for Supply Chain Analysis in the Western Montana Corridor.* Panel Presentation at the Small Logs Conference. Coeur d'Alene, ID. March 14. http://nararenewables.org/templates/hubbasic/docs/small-log/martinkus.pdf

Wolcott, M., and T. Laninga. *Western Montana Corridor Atlas Overview*. 2013. Montana Wood Products Retention Roundtable. Missoula, MT. January 18.

Research Posters

Gray, P. 2012. *Economics of an isobutanol supply chain – research plan*. Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

Jiang, J., J. Wang and M. Wolcott. 2012. *Preconversion of sodium sulfite treated wood with taguchi method*. Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13..

Johnson, D. 2012. *Clearwater Basin Biomass Atlas*. Poster presentation at International Wood Composite Symposium. Seattle, WA. April 11-13.

Johnson, D., K. Merslich, J.M. Moroney, and L. Nabahe. 2012. *Clearwater Basin Biomass Supply Chain Challenges and Opportunities*. Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

Johnson, D., K. Merslich, J.M. Moroney, and L. Nabahe. 2012. *Clearwater Basin Biomass Atlas*. Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

Liu, Y., J. Wang and M. Wolcott. 2012. *Factors affecting wood pellet densification*. Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

Martinkus, N., T. Morgan, and M. Wolcott. 2012. *GIS as a Decision Support Tool for Supply Chain Analysis in the Western Montana Corridor*. Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

Merslich, K., and L. Nabahe. 2012. Clearwater Basin Biomass Supply Chain Challenges and Opportunities. Poster presentation at International Wood Composite Symposium. Seattle, WA. April 11-13.

Moroney, J.M., and D. Johnson. 2012. *Clearwater Basin Bioenergy Survey*. Poster presentation at International Wood Composite Symposium. Seattle, WA. April 11-13.

Moroney, J.M. and D. Johnson. 2012. *Clearwater Basin Bioenergy Survey.* Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

Olsen, K., and C. Poor. 2012. *Bioregional Mapping Analysis using ArcGIS.* Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

Poor, C., T. Beyreuther, K. Olsen, and M. Wolcott. 2012. *Integrated design pedagogy in higher education.* Poster presentation at NARA 2012 Annual Meeting. Missoula, MT. September 13.

IDX. 2013. *Western Montana Corridor Atlas*. NARA Open House and Student Poster Session (50 Posters). Rocky Mountain Elk Foundation. Missoula, MT.

Other Publications

IDX. 2011. *Clearwater Basin Community Profile*. University of Idaho: Moscow, ID.

IDX. 2011. *Clearwater Basin Biomass Atlas*. Washington State University and University of Idaho: Pullman, WA.

IDX. 2012. *Clearwater Basin Bioenergy Assessment Project*. Washington State University and University of Idaho: Pullman, WA.

IDX. 2012. *Western Montana Corridor Community Profile*. University of Idaho: Moscow, ID.

IDX. 2012. *Western Montana Corridor Bioregional Atlas*. Washington State University and University of Idaho: Pullman, WA. http://goo.gl/OmLSc

Task E-7: Feedstock Supply Chain Analysis – MSW

Key Personnel	Affiliation
Karl England	Washington State University

Task Description

Our task is to inventory and assess the biomass within the municipal solid waste (MSW) and construction and demolition (C&D) supply chain throughout the NARA region. Research focus will be placed upon developing an overall inventory of the woody construction debris biomass in the Northwest (especially NARA communities), developing strategies to increase the recovery this material, establishing QC/product specifications, and identifying where these materials fit within the wood utilization supply chain.

Activities and Results

Task E-7.1: Develop MSW/C&D woody biomass inventory in NARA region

A preliminary MSW and wood waste assessment was performed to determine quantities for each state within the NARA region, which is presented in Table 1. US waste information was acquired through an EPA report accessed online. Montana, Oregon, and Washington waste information was obtained through state databases provided online or by state employees (references included in figures). Idaho information was acquired at the county level, but not all counties have yet been contacted. Figure 1 illustrates MSW distribution by county and by landfill within the NARA region. MSW includes all household and commercial waste that is not hazardous in nature. Depending on the landfill or transfer station, recyclable items such as plastic, metal, glass, and wood are sorted and separated from non-recyclable MSW.

Wood waste can be disposed of in MSW landfills or reused/recycled at MRFs and be used to create products such as reclaimed timber, composites, compost, or hogged fuel for energy recovery. A preliminary list of MRFs was originally created using state databases and internet searches regarding wood recycling. In all, a list of 53 MRFs that recycle C&D wood waste was compiled for the NARA region. Quick-fact information regarding the MRFs is represented in Table 2. Wood waste quantities collected from MRFs were obtained in units such as board foot, C&D ton, cubic yard of loose scrap wood, and cubic yard of shredded wood; conversion factors can be viewed in Table 3. A list of MRFs and their pertinent data is represented in Table 4, and recycled wood waste distribution per county and MRF can be viewed in Figure 2. In total thus far, a sum of **646,729 tons** of recycled wood waste has been accounted for by MRFs within the NARA region.

To ascertain a more accurate description of where the wood is located within the C&D waste streams, a model approach is being implemented. To develop the model, ideal communities that have a very complete inventory of wood in their C&D waste streams will be identified and used as baseline data. These communities will cover the population spectrum from large cities to small communities and tribal lands. Based upon the wood waste numbers in these target communities, a model that maps wood

wastes to translate to other similar communities will be used. Development of this model will be iterative and supported with actual inventories. By identifying characteristics of the communities, i.e. housing starts, retail sales, industry framework, etc. that will influence the amount of wood in the C&D waste streams, the model can be refined and become more accurate. Databases within the US Census website can be used to identify the metrics to define the communities throughout the NARA region.

Task E-7.2: Inventory of NARA Communities (NC)

Task E-7.2.1 WMC: The Western Montana Corridor (WMC) was the primary focus of work to date. As a review, our research has indicated that separated landfill wood waste data within the WMC is predominately categorized into three categories: inert waste, C&D waste, and wood waste (a phrase that usually refers to clean wood). Ascertaining wood waste quantities within inert waste totals is difficult and no modeling technique has currently been determined. Wood waste derived from C&D waste on average can be quantified as 31% of total C&D waste, and 34% within C&D wood waste is untreated, unpainted, or comes from pallets. Table 1 indicates MSW, C&D, and wood waste totals from counties within the WMC. There are currently five known counties within the WMC that quantify clean wood waste, and there are four known counties that quantify C&D waste. In summary, 8,456 tons of usable C&D wood waste and 15,413 tons of clean wood waste were collected by participating counties within the WMC, creating a total of **24,639.5 tons** of estimated wood waste a year. Figure 4 is an updated map representing known landfills that separate wood within the WMC. Further maps will indicate MSW, C&D, and wood waste quantities per county.

Figure 3 is a map that represents MRFs within the WMC. Wood waste and C&D wood waste have been identified with two separate shades of green to show the known wood quantities from the estimated wood quantities (C&D). MRF research within the WMC is nearly complete; further information regarding two MRFs within the WMC is still anticipated. There are currently eleven known MRFs within the WMC, which include building salvage stores, reclaimed timber mills, wood grinding service companies, and general wood recyclers. Specific years for collected data may vary. Reclaimed timber mills collected a total of 2,824 tons of wood a year. Wood recyclers collected 6,477 tons of wood a year. Building salvage stores compiled 5,375 of C&D wood waste. In total, WMC MRFs compiled **15,413 tons** of wood waste a year. This total, however, may include wood that is utilized in other markets.

Task E-7.2.2 Western NARA Region: Although a NARA community has not yet been established in the western NARA region, our research indicates that the majority of C&D wood waste accrues in areas of higher population densities, most notably Seattle, WA and Portland, OR. Figure 4 represents the distribution of wood waste per county and MRF within the western NARA region. Of the 53 MRFs in the NARA region, 41 MRFs are located east of the Cascade Mountains. Out of the 646,729 total tons of the MRF recycled wood waste quantified thus far, **546,832 tons (83%)** derive from the western NARA region. Recycled wood waste in this region is primarily used for energy cogeneration in the form of hogged fuel; other uses include composites, compost, and pulp.

Task E-7.3: Identify recovery strategies of woody biomass from MSW and C&D streams

A Supply Chain Management (SCM) network was established and is essential for determining the viability of wood waste as a biofuel feedstock. SCM includes four aspects: Sourcing, Logistics, Operations, and Marketing. Sources of wood waste include MSW, industrial waste, construction and demolition (C&D) waste, and land clearing debris. Wood waste is often collected and separated at MRFs, landfills, and transfer stations; transportation methods include municipal self-haul, residential/commercial route trucks, and commercial drop-boxes. Although landfills are known for burying waste, there are many landfills that

separate recyclable materials in order to prolong the lifespan of the landfill. Recyclable materials, such as wood waste, are often subcontracted or sold to MRFs for further recycling. MRFs recycle wood waste and produce products such as reclaimed timber, engineered wood, compost, paper pulp, soil amendment, and hogged fuel for energy recovery. Figure 5 represents a supply chain flow chart of the wood waste supply chain.

Table 1: MSW and Wood Waste quantities per State within NARA region. Generated waste is equal to the sum of recycled and disposed wastes.

	Generated Municipal Solid Waste		Generated Wood Waste	
	Tons/Year	LBS/Person/Day	Tons/Year	LBS/Person/Day
United States [1]	249,860,000	4.43	15,880,000	0.28
Idaho [2]	Not yet determined			
Montana [3]	1,323,343	7.26	Not yet determined	
Oregon [4]	4,740,561	6.71	376,798	0.53
Washington [5]	8,860,856	7.17	1,203,074	0.98

Sources

[1] Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Tables and Figures for 2010. *U.S. Environmental Protection Agency. Office of Resource Conservation and Recovery.* December 2011. www.epa.gov Accessed 8/15/12.

[2] Henderson, Mary. MT_LF-tonnage-req.xcl. *State of Montana Department of Environmental Quality.* File received via email: 8/14/12

[3] Solid Waste in Washington State: 20th Annual Status Report. *Waste 2 Resources Program*. December 2011. Publication #11-07-039. www.ecy.wa.gov Accessed 8/6/12

[4] WasteComp200910StateWide .xcl *State of Washington Department of Ecology*. http://www.deq.state.or.us Accessed 2/10/12

[5] Standard Volume-to-Weight Conversion Factors. EPA. http://www.epa.gov/smm/wastewise/pubs/conversions.pdf Accessed 8/22/12

Table 2: Quick facts regarding MRF research within the NARA region.

MRF DATA PER STATE					
State	Total Known MRFs	Total MRFS with Data Unknown	Total MRFs with Volume Data Unknown	Estimated MRF Wood Quantities (tons/year)	Recycled Wood Majority Market
Idaho	4	0	0	44,979	Reclaim Timber
Montana	7	1	2	6,812	Reclaim Timber
Oregon	18	3	6	100,280	Hog Fuel
Washington	24	2	8	494,658	Hog Fuel
Total	53	6	16	646,729	Hog Fuel

Table 3: Table of conversion factors that were used during the wood waste assessment.

WOOD VOLUME CONVERSION FACTORS		
Volume Type	Conversion	Source
Board Feet [BF]	BF * [0.008 Ton/1 BF]	Cunningham, Kyle. *Converting Board Feet to Tons*. University of Arkansas Division of Agriculture. http://www.arnatural.org/News/Timber_Report/Converting_Weight_Board_Feet.pdf Accessed 4/11/2013
Clean Wood within C/D Waste	C/D Tons * [0.115 Clean Wood/CD ton]	2007 Massachusetts Construction and Demolition Debris Industry Study, Final Report. *DSM Environmental Services, Inc.*, 5/16/2008. www.mass.gov/dep/recycle/reduce/07cdstdy.pdf Accessed 01/04/2013
Cubic Yard [CY]: Shredded Wood Chips	CY * [500 lbs/1 CY] * [1 ton/2000 lbs]	*Standard Volume-to-Weight Conversion Factors*. U.S. Environmental Protection Agency. http://www.epa.gov/smm/wastewise/pubs/conversions.pdf Accessed 8/22/2012
Cubic Yard [CY]: Wood Scrap, Loose	CY * [329.5 lbs/1 CY] * [1 ton/2000 lbs]	*Standard Volume-to-Weight Conversion Factors*. U.S. Environmental Protection Agency. http://www.epa.gov/smm/wastewise/pubs/conversions.pdf Accessed 8/22/2012

Table 4: List of MRFs within NARA region listed by state.

IDAHO					
MRF	Location	Volume	Reach	Tipping Fees	Market
Building Material Thrift Store	Hailey, ID	25,000 tons Building Materials per year	No Data	No Data	Timber/Lumber Reuse
Cannon Hill Industries	Post Falls, ID Spokane, WA	ID: 32,000 green tons WA: 15,000 green tons	100 miles	No Data	Hog Fuel sent to Clearwater Paper Corporation
Ross Lumber	Shoshone, ID	600 tons/year	Supply: Through U.S. Distribution: Pacific Northwest	No Data	Timber/Lumber Reuse
Trestlewood	Blackfoot, ID	9504 tons/year	Supply: Western U.S. Distribution: Throughout U.S.	Bid Based	Reclaim Timber
MONTANA					
MRF	Location	Volume	Reach	Tipping Fees	Market
Big Timberworks	Gallatin Way, MT	35 tons/year of wood waste residue	Throughout U.S.	Bid Based	Reclaim Timber
Eko Compost	Missoula, MT	No Data	Supply: Bonner, ID No Distribution	$1/bag $7/pickup or small trailer $15/ large trailer $50/semi load No charge for pre-chipped	Compost Firewood

Heritage Timber	Bonner, MT	2800 tons stored	Supply: 250 miles Distribution: Pacific Northwest	No Data	Reclaim Timber
Home ReSource	Missoula, MT	1977 tons/year through	Eastern Montana and Idaho	All is donated Tax Class 501C3	Mostly Reuse Small Pieces sent to Eko Compost
Johnson Brothers Recycle	Missoula, MT	No Data	No Data	No Data	No Data
Montana Reclaimed Lumber Company	Gallatin Gateway, MT	16,000 tons stored	No Data	Bid Based	Reclaim Timber
Resource Site Services	Bozeman, MT	2000 tons/year	100 miles service reach, no distribution	Bid based	Mobile Wood and Construction Material Grinding
OREGON					
MRF	Location	Volume	Reach	Tipping Fees	Market
Allwood Recyclers	Fairview, OR	No Data	No Data	$7/yard $12 minimum	Hog Fuel
Bar 7 Trucking Wood Recycling	Redmond, OR	1,685.62 BDT/year	50 mile service reach, no distribution	$2/cubic yard	Hog Fuel
Best Buy in Town	Hillsboro, OR	No Data	No Data	No Data	No Data
Biomass One	White City, OR	252,000 BDT/year Total 2,500 BDT/year clean C/D	Supply: 30 miles Distribution: Oregon	No Fees	Hog Fuel Energy
Clackamas Compost Products	Clackamas, OR	No Data	10-20 miles	$10/cubic yard	Urban Wood: Hog Fuel Land Clearing: Compost
Clayton Ward	Salem, OR	No Data	Supply: 50 miles	3 cents/pound	Hog Fuel
Environmentally Conscious Recycling	Portland, OR	No Data	No Data	No Data	No Data
Greenway Recycling	Portland, OR	16,200 tons/year	15 miles most of time, but will reach to 75 miles	$81/ton commingled $35/ton clean wood	Hog Fuel
Hilton Landscape Supply	Central Point, OR	Average 8,000-10,000 tons/year	Supply: 40 miles	No charge for dumping. Drop Boxes are bid based.	Hog Fuel Compost
JB Wood Recyclers	Monmouth, OR	300 ton/year	Supply: 35 miles	$6/yard	Hog Fuel
KB Recycling	Clackamas, OR	No Data	Supply: 5 miles	$25/ton	Hog Fuel
McFarlane's Bark	Milwaukie, OR Vancouver, WA	5,120 tons 2012	30 miles	$10/yard retail $9/yard commercial	Hog Fuel

Northwest Wood and Fiber Recovery	Portland, OR	19,500 tons/year	Supply: 5 miles Distribution: 40-50 miles	$5/cubic yard non-commercial $1/cubic yard commercial	Hog Fuel to paper company for energy co-generation
Northwest Environmental and Recycling	Cornelius, OR	No Data	No Data	No Data	No Data
Recology	Portland, OR West Linn, OR	40,000 ton/year everything 20,000 tons/year urban wood waste	Supply: 15 miles	$45/ton	Hog Fuel
SH Landscape Supplies and Recycling	Tualatin, OR Hillsboro, OR	Tualatin: 12,750 tons/year Hillsboro: 2,250 tons/year	Supply: 20 miles Distribution: Oregon	$7/cubic yard for clean urban wood waste	Hog Fuel
Trails End Recovery	Warrenton, OR	3,600 tons urban wood waste 2012	Supply: 25-30 miles	$82.50/ton mixed $45.90/ton clean wood	Hog Fuel
Wood Waste Management	Portland, OR	7373.75 tons 2012	Supply: 50 miles	$26/yard first two yards $13/yard after that	Hog Fuel
WASHINGTON					
MRF	Location	Volume	Reach	Tipping Fees	Market
All Wood Recycling	Redmond, WA	"Hundreds of thousands of mixed—clean wood and inert wood" NOTE: Recording as 100,000 tons/year	Supply: 50 miles	$30/ton clean wood	Hog Fuel
Allen Shearer Trucking & Landscape Supply	Belfair, WA	"A couple hundred tons per year"	Supply: 200 miles	$30/ton	Hog Fuel
Bobby Wolford Trucking and Demolition	Woodinville, WA	14,879 tons 2012	Supply: 50 miles	Bid Based	Hog Fuel
Busy Bee Wood Recycling	Spokane, WA	No Data	Spokane County	$8/cubic yard	Hog Fuel
CDL Recycle	Seattle, WA	32,760 tons/year average	Supply: Pierce and King Counties Distribution: 110 miles	$20/ton clean $55/ton mixed wood $95/ton commingled C/D	Hog Fuel, Mulch, "a little of everything"
Cedar Grove Composting	Maple Valley, WA	No Data	Supply: 75 mile	$10/ton urban wood waste	Compost
City Bark LLC	Vancouver, WA	4708.75 tons 2012	Supply: 50 miles	$11/yard	Hog Fuel
Diversified Wood Recycling	Spokane, WA	260 tons/year	No Data	$6/cubic yard	Lumber Reuse Hog Fuel

Eastside Wood Recycling	Moses Lake, WA	8,000 tons urban wood waste per year	Supply: 150 miles	Bid Based	Hog Fuel
Gillardi Logging and Construction	Elbe, WA	No Data	Supply 75 miles	$8/cubic yard drop off Pick-up fees vary	Hog Fuel
Glacier Recycle [Waste Management]	Auburn, WA	88,440 tons/year NOTE: Volume given by Veneer Chip Transport	No Data	No Data	No Data
H&H Wood Recyclers	Vancouver, WA	28,000 tons/ year	Supply: 50-75 miles	$7/cubic yard clean lumber $3.5/cubic yard pallets	Hog Fuel Compost
Lautenbach Industries	Mount Vernon, WA	19,500 tons/year	Supply: 30 miles	$55/ton	Hog Fuel for Port Townsend Paper Mill
Mason County Wood Recyclers	Shelton, WA	No Data	Supply: 150 miles	$10/pick-up load	Hog Fuel
Pacific Northwest Timbers	Port Townsend	No Data	No Data	No Data	Reclaim Timber
Pacific Topsoils	Everett, WA	No Data	Assuming 100 miles	$22-44/cubic yard depending on location	Hog Fuel for various purposes
Pallet Services	Mount Vernon, WA Pasco, WA Tacoma, WA	Wood Waste Residue: Pasco: 2,600 tons/year Tacoma: 15,600 tons/year	Supply: 355 miles	No data	Good Wood: Pallet construction Residue: Hog Fuel sent to Port Townsend Paper
Sunshine Recycling	Spokane Valley, WA	No Data	Spokane County	$45/ton C/D Bid Based	Hog Fuel Compost
Rainier Wood Recycling	Fall City, WA Covington, WA	Fall City: 49,600 tons Covington: 74,400 tons	Supply: 200 miles	$7.50/cubic yard, although may vary	Hog Fuel Mulch Composites Pulp Bedding
Recovery 1	Tacoma, WA	2012 Report: 27,968.22 tons commingled const. 3,214 tons commingled demo. 7033.63 tons bright mixed (lumber, ply, particle board, etc.) 2,065.64 tons land-clearing	125 miles	$65/ton commingled C/D $15/ton Bright-Mixed $20/ton Land-clearing	Hog Fuel Mulch Composites
Resource Woodworks	Tacoma, WA	No Data	No Data	No Data	No Data

RW Rhine	Tacoma, WA	21,600 tons stored	Supply: 2500 miles	C/D Bid Based	Reclaim Timber
Veneer Chip Transport	Tacoma, WA	Under Pallet Services and Glacier Recycle	No Data	No Data	Transport
West Van Material Recovery Center	Vancouver, WA	5800 tons	30 miles	$62.57-60.66/ton clean urban wood waste	Hog Fuel

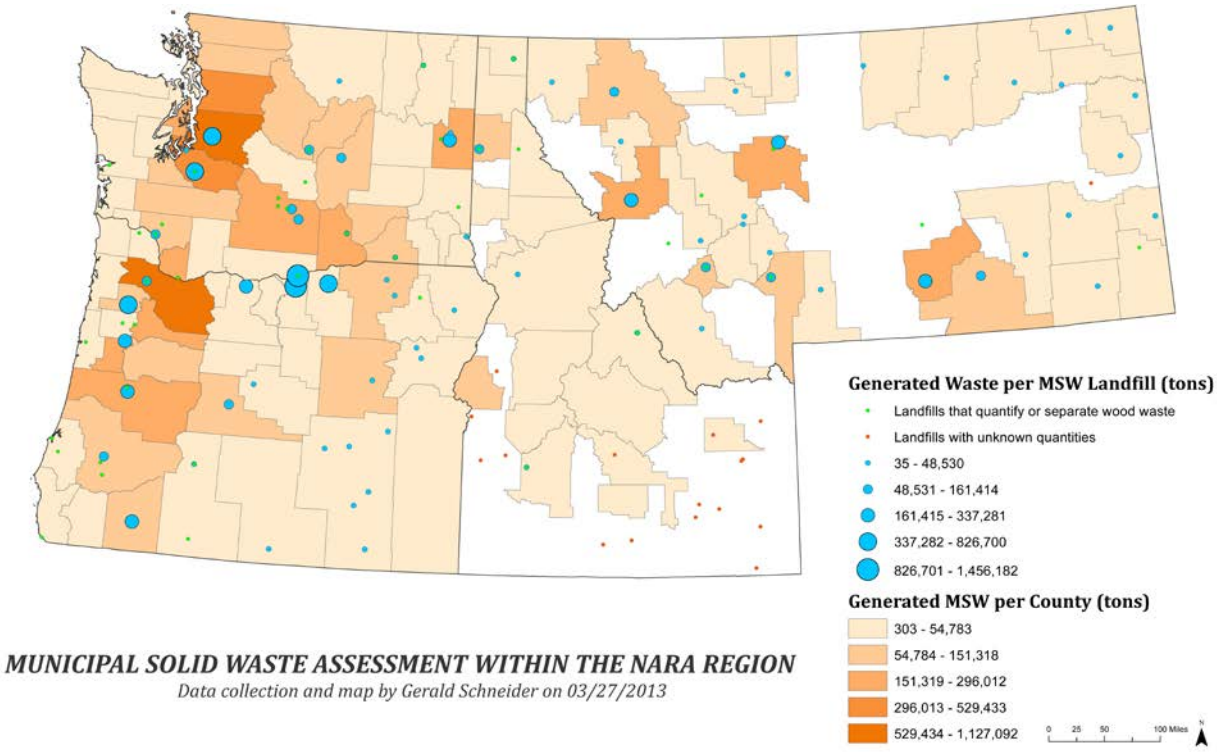

Figure 1: MSW distribution by county and landfill within the NARA region.

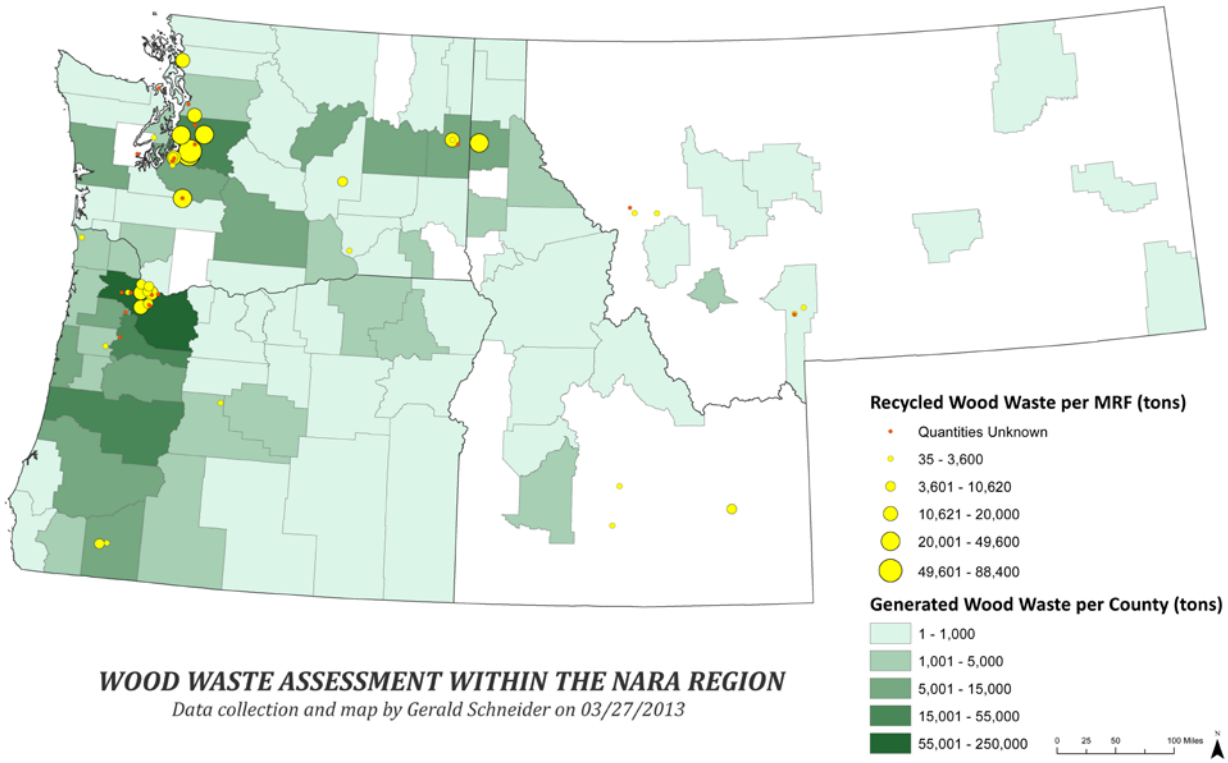

Figure 2: Wood waste distribution by county and MRF within the NARA region.

Table 5: Wood waste and C&D clean wood waste totals for counties within the WMC.

State	County	Population (2011)	MSW (tons)	C&D (tons)	C&D Wood* (tons)	Wood (tons)
	Bonner[1]	40,808	33,330	0	0	2,500
	Boundary[2]	10,804	4,500	0	0	318
ID	Kootenai[3]	141,132	121,171	0	0	10,899
	Lemhi[4]	7,967	9,048	644	74.06	0
	Shoshone[5]	12,672	5,691	0	0	1,390
MT	Gallatin[6]	91,377	108,647.37**	6,807.3	782.84	306

[1] *Bonner County Solid Waste Department*. Received via telephone questionnaire: 8/22/12
[2] *Boundary County Solid Waste Department*. Received via telephone questionnaire: 8/22/12
[3] 2011 Solid Waste Analysis. *Kootenai County Solid Waste Department*. Coeur D'Alene, ID. Provided by Kootenai County Solid Waste Department: 8/22/12
[4] *Lemhi County Solid Waste Management*. Received via telephone questionnaire: 8/22/12
[5] *Shoshone County Solid Waste Department*. Received via telephone questionnaire: 8/22/12
[6] Gallatin Solid Waste Management District. Fiscal Year 2010—2011 Annual. Provided by Gallatin Solid Waste Management District: 8/02/12

	Silver Bow[7]	34,383	75,679**	13,060	1,501.90	0
WA	Spokane[8]	473,761	314,355.91	59,719.12	6,867.70	0
					9,226.50	*15,413*
			TOTAL		*24,639.50*	

**Clean C&D Wood figured as11.5% of C&D total.*

***MSW quantities provided by State of Montana*[9]

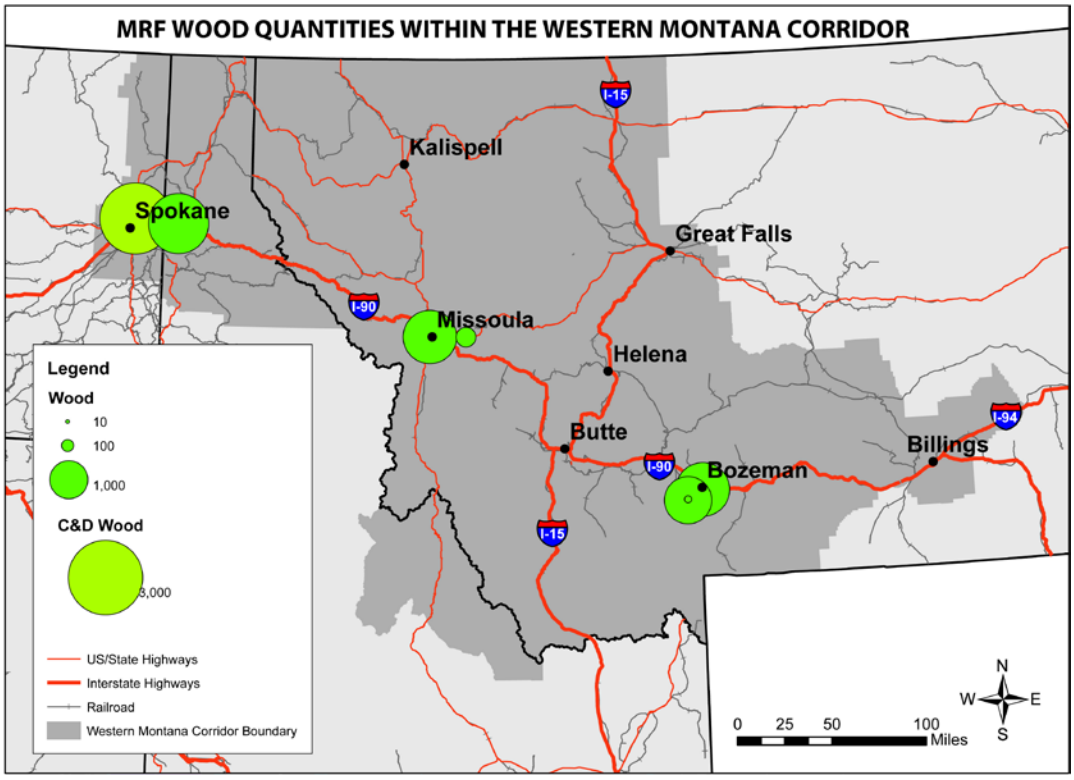

Figure 3: Wood waste distribution per MRF within Western Montana Corridor.

[7] *Butte Silver Bow Rocker Landfill*. Received via telephone questionnaire: 8/02/12
[8] CountyTotals11.xcl. State of Washington Department of Ecology. http://www.ecy.wa.gov/programs/swfa/solidwastedata/ Accessed 1/07/13
[9] MT—LF-tonnage-reg.xcl. *State of Montana Department of Environmental Quality*. Received 8/14/12

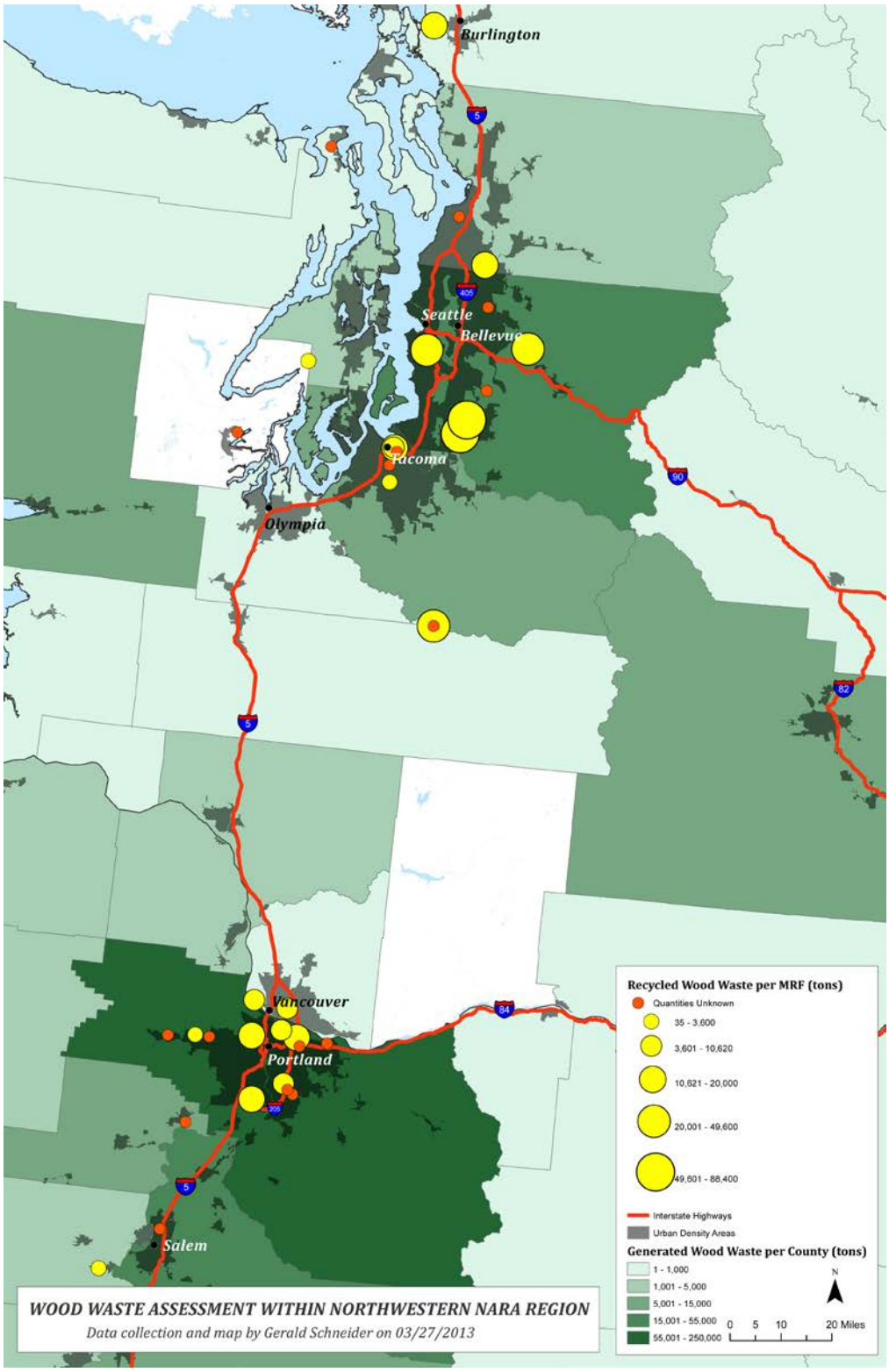

Figure 4: Wood waste distribution near urban density areas within western NARA region.

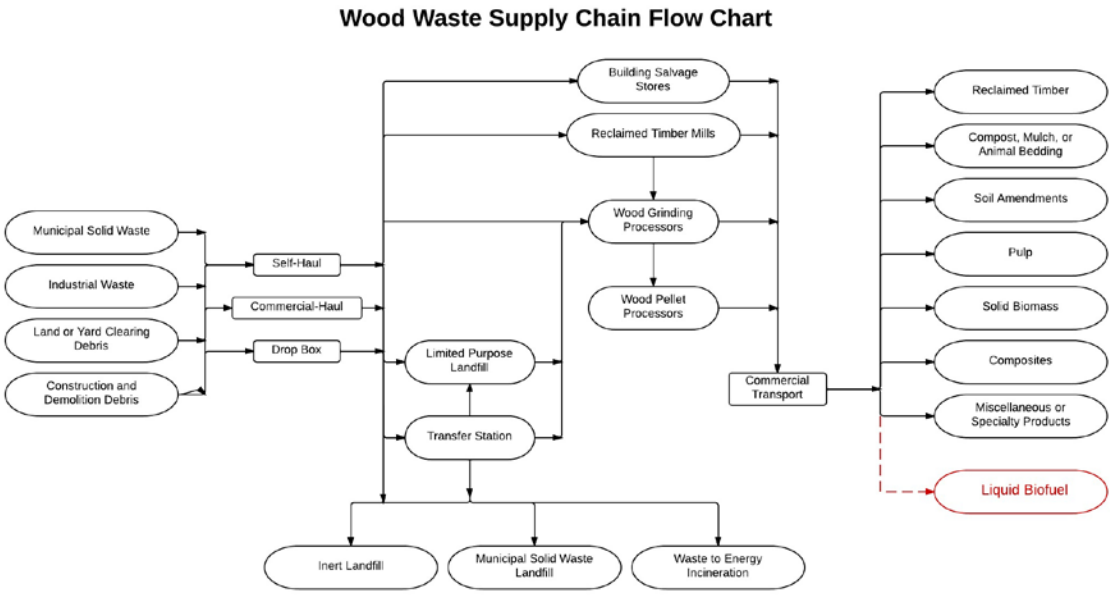

Figure 5: Illustrated flow chart of the wood waste supply chain.

Recommendations/Conclusions

Wood inventories within the C&D and MSW streams continue to be compiled between the states and communities of the NARA region. ArcGIS is being used to map the wood waste locations and databases are being develop that can be incorporated into the NC assessment study. Efforts are being made to develop empirical models to predict the waste wood inventories in communities that do not have sufficient data.

Physical and Intellectual Outputs

Oral Presentation

*Englund, KR. 2013. Waste Wood and Plastics: Where does/can it all go? UI President's Sustainability Symposium. North Idaho College - Coeur d'Alene, ID March 20.

Poster Presentation

Schnieder, G.A. and K. Englund. 2013. Wood Waste Assessment within the Construction and Demolition Industry. Poster presented at 2013 International Wood Symposium hosted by Washington State University, Seattle, WA, April 3-4.

Outreach Team

Task O-1: Washington State University NARA Extension Initiatives

Key Personnel	Affiliation
Vikram Yadama	Washington State University
Karl Englund	Washington State University

Task Description

NARA teams, along with research, extension and industry members, will act as partners and facilitators with the ultimate goal of empowering the stakeholders to plan and implement the changes needed to build, develop, and sustain a biorefinery infrastructure. The goal of the outreach team is to promote stakeholder bioenergy literacy and build regional supply chain coalitions for development of a framework of biofuel and co-products production from woody biomass. End outcomes of this goal are sustainable production of biojet fuel, co-products and rural economic development. Following are the objectives of the outreach team to reach this goal:

Task O-1.1 Bioenergy Literacy, where we: a) disseminate the research-based information on technology and markets to our industrial stakeholders and understand the technical challenges regarding implementation at industrial scale (industry-focus); b) relate the feedstock development and logistics information to our resource-based stakeholders (local communities, forest landowners, forest managers) and hear their concerns regarding the type of information that will assist them in keeping their costs low and marketable value high (resource-focus); and c) engage the organizations and partnerships in connecting with public-interest groups and policymakers (public-focus). These activities will be carried out via a variety of communication mechanisms, including social media, newsletters, briefing papers, extension publications, workshops/seminars, conferences, field trips, and stakeholder meetings. Bioenergy literacy to professionals will be achieved through the following tasks:

1) Develop a bioenergy literacy platform for flow of information and knowledge between NARA research teams and the stakeholders
2) Implement targeted outreach activities for engaging stakeholders and advancing bioenergy literacy to professionals
3) Catalog activity outcomes and benchmark reports and studies

Task O-1.2 Build Supply Chain Coalitions (logistical support and stakeholder development and engagement). We will form working groups with stakeholders at community and bioregion levels to

involve them through collaboration across the supply chain: forestland owners and managers, environmental NGOs, businesses, regulatory facilitators, and community infrastructure working groups to interact with and inform policymakers at regional, state, and federal levels. These stakeholders will be internal and external focused around the NARA communities (NCs) selected in the four-state region. This process will rely on support from other teams, such as Education and EPP, and consider physical and social assets along with practical aspects in narrowing down the list to a manageable number of communities with the four-state region. A long list will be shortened through surveying community-based stakeholders in the PNW and intermountain region to strategically choose several NCs for studying the viability of a biofuel-based infrastructure. Once communities are identified, focus group meetings involving a wide variety of stakeholders will be held at each community to discuss feedstock specifications and logistics, technology adoptions within the existing infrastructure, and viable strategies practical and beneficial for the communities. This process will involve industrial stakeholders and NARA industry partners as well. Establishing a meaningful dialogue about what local experts perceive to be the barriers and opportunities for establishing a biorefinery infrastructure in their community is critical. Building supply chain logistics consists of three major tasks:

1) Defining stakeholders and articulating stakeholder communication mechanism
2) Establishing NARA pilot supply chain (PSC) study regions and stakeholder development to engage in compiling supply chain assets, analyzing potential regional supply chain structure, and forming regional alliances
3) Assisting EPP with PSC selection process and support index study to develop a decision support tool

Activities and Results

Task O-1.1. Bioenergy Literacy

Task 1: A comprehensive stakeholder communication plan utilizing conventional channels, as well as social media for a two-way interaction between NARA stakeholders and NARA team members has been implemented (Figure 1).

A web-based mechanism was also established on the NARA web site for stakeholder engagement, self-identification, and categorization. Through this engagement platform, unbiased and vetted NARA-related information and activities are communicated to our stakeholders. NARA affiliates also include NARA activities on their websites. Other NARA social media communications include:

- Twitter (https://twitter.com/NARA_Renewables/)
- Facebook (http://www.facebook.com/pages/NARA/232111166837523), and
- YouTube (http://www.youtube.com/nararenewables).

The state extension personnel from each of the four states, USFS personnel, Forest Business Network (FBN, an industry association partner), and the Ruckelshaus Center engage stakeholders in communicating project scope, findings, and activities as well as hearing their concerns and input. Four NARA newsletters have been distributed to 231 subscribers. The newsletter is now on a monthly distribution schedule. Thirty-four independent news events (newspaper articles, web articles, television news) featuring NARA were generated. The NARA project has been featured on a display at the Future of

Flight Aviation Center and Boeing Tour and at the 2012 Smithsonian Folklife Festival at the Washington Mall.

NARA has co-hosted and participated in three symposia/conferences in 2011 and 2012. NARA was also represented at several other conferences, workshops, and meetings. 35 news articles, a video news story and an E-newsletter were presented to the general public. Eight "NARA one-pagers" or fact sheets have been generated and distributed.

A Knowledge Base repository was established and linked to the NARA website. Proceedings of the symposia/conferences that NARA has co-hosted have been catalogued in this repository.

Task O-1.2. Build Supply Chain Coalitions

NARA's stakeholders have been identified along with ways to communicate with them (Figure 2).

The Outreach team worked with Integrated Design Experience (IDX) in developing a biomass atlas for the Clearwater Basin, Idaho, during the first year. In the second year, NARA's first official pilot supply chain study (PSC) region (Western Montana Corridor**)** was established where the outreach team is facilitating IDX and EPP team with engaging stakeholders and conducting supply chain analysis. We are in the process of establishing a second PSC study region in western Oregon and Washington.

Simultaneous to working in defined PSC study regions, the outreach team collaborated with the EPP and Education teams to develop a scientific method for PSC selection processes. As per established methodology, a survey of the NARA Outreach team members was conducted to develop a long list of potential NCs. A total of 24 communities/bioregions have been nominated.

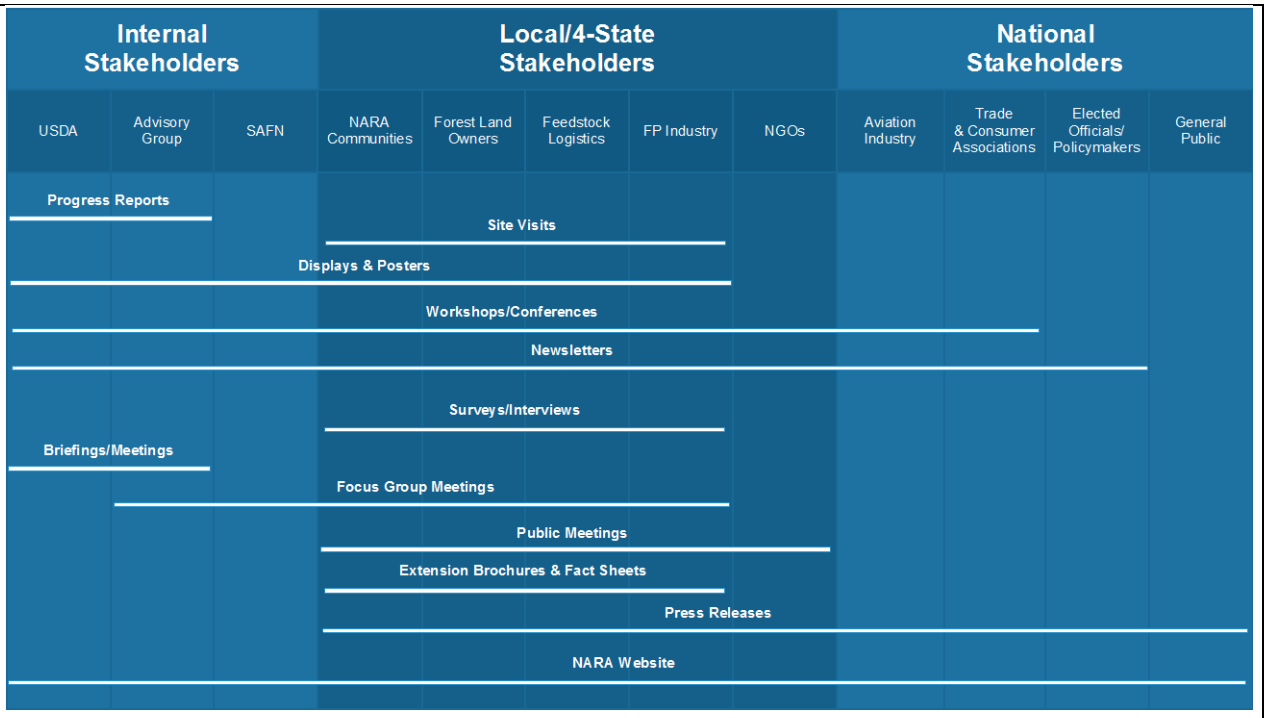

Figure 1. NARA's communication platform with stakeholders at different interaction levels.

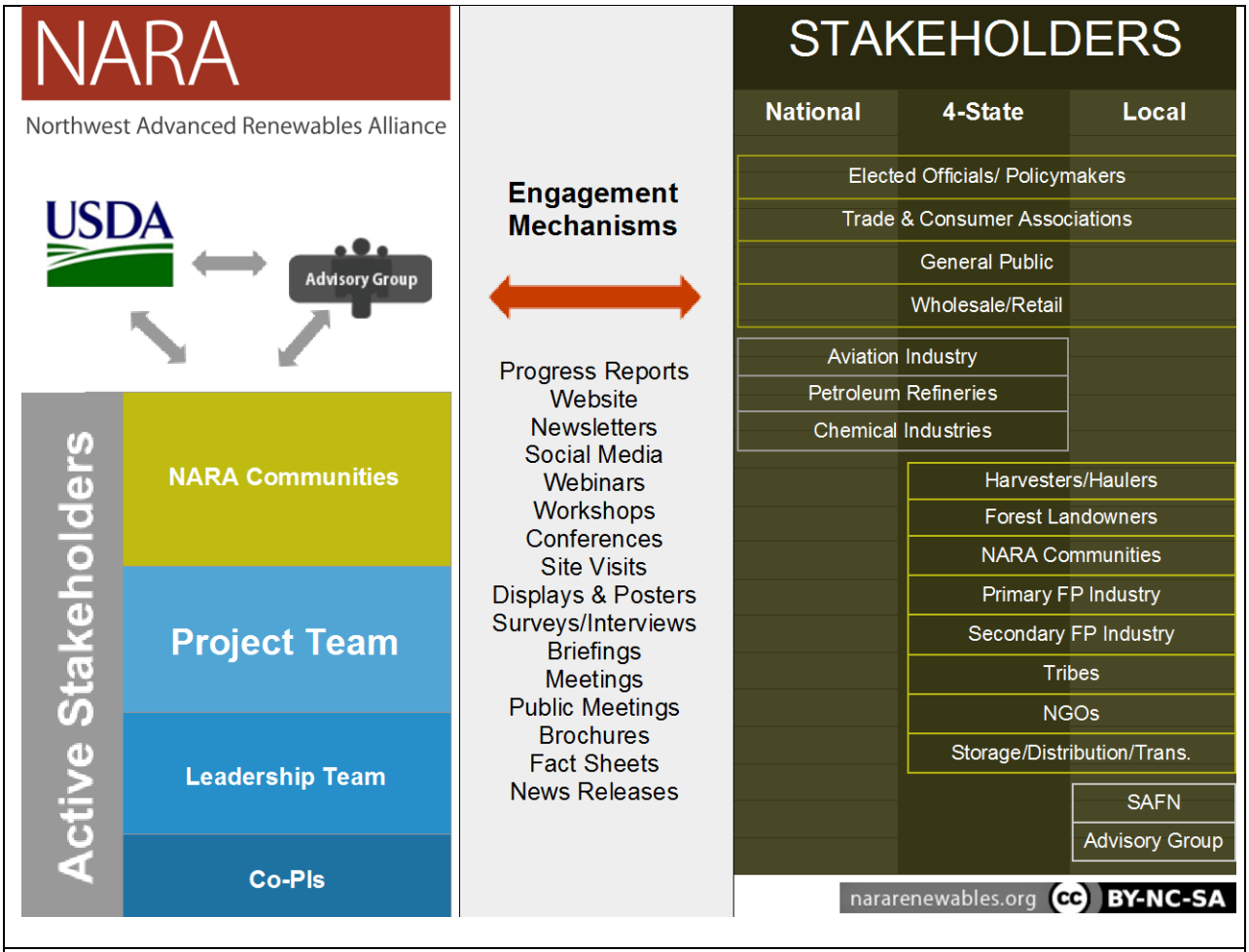

Figure 2. NARA stakeholders and defined levels of interaction with them.

Recommendations/Conclusions

Based on the interactions with stakeholders, the outreach team has learned the following:

1. It is critical to communicate to the stakeholders the description of NARA's feedstock.
2. Forestland owners and managers are very much in favor of finding value-added options for excess post-harvest biomass from the forest floors. Based on anecdotal evidence, there is plenty of underutilized forest residuals, but it is scattered and needs a cost-effective solution to transport.
3. It is critical to communicate that NARA is developing pathways to convert forest residuals and C&D waste into biofuels and not bioenergy (wood pellets).

4. Stakeholders are enthusiastic and eager to help when they realize that NARA's efforts involve development of value added co-products (such as lignin co-products) besides biojet fuel.

5. Feedstock stakeholders are concerned about biomass transportation costs.

6. It is essential to involve and engage ENGOs for the project to succeed.

7. Resource-based communities are ready to find alternative uses for forest residuals and C&D wood waste; however, many communities are also eager to find value-added options for small diameter timber from forest thinning operations (as these have no profitable markets currently).

8. Forest industry is mostly favorable to finding value-added markets for underutilized residuals as long as the supply to current industry is not affected.

9. There is a need to communicate the option of examining sugars from wood as a potential market.
10. The conversion process of wood into biojet fuel has to be articulated better to the stakeholders.

11. There is a general appreciation for supply chain analysis as one of the essential elements for stimulating biofuel development from woody biomass.

12. Many resource-based and economic development organizations have begun to take inventory of supply chain assets and understand the need to develop programs that help existing sites to retool for renewable industries based on woody biomass.

13. Pilot supply chain study regions are necessary to engage stakeholders in the process of designing, planning, and monitoring of supply chain activities.

14. Working through PSC study regions is critical to establishing credibility and access to existing datasets as well as realistic data for supply chain analysis.

In general, the Outreach tasks for Bioenergy Literacy and Building Supply Chain Coalitions goals are on schedule. We are collaborating with other teams to develop educational/outreach tools for stakeholders to communicate research findings and other relevant information. Four NARA affiliates, Montana State University, Oregon State University, the US Forest Service, Pacific Northwest Research Station, and the Forest Business Network include NARA activities on their websites. Since the inception of the NARA website, it has had 20,539 visits with 83,270 page views from all 50 states in the US and from 114 countries. The Knowledge Base repository contains unbiased information that covers all aspects related to the NARA project. It is available to the general public and to date has had a total of 1710 visits from 23 states and 10 countries. To reach professionals, NARA has co-hosted and participated in three symposia/conferences that include a track on Managing the Woody Biomass Supply Chain at the International Wood Composites Symposium, Northwest Bioenergy Research Symposium and Future Energy Conference, and Small Log Conference. Additionally, FBN (www.forestbusinessnetwork.com) posts NARA related topics and activities (such as biomass, biofuels, tax credits) at their web site and distribute their weekly newsletters to over 10,000 readers. The Outreach team will be organizing a NARA conference in Year 3 to disseminate project findings to the stakeholders and to hear their feedback.

The outreach team has taken measures to ensure that the objectives and scope of the project is conveyed to general public as well through NARA displays at the events discussed above. The Flight Museum attracts over 225,000 regional, national, and international visitors annually. An additional 75,000 people visit the facility to participate in a special event—activities surrounding delivery of Boeing aircraft,

receptions, and school activities. The 2012 Smithsonian Folklife Festival at the Washington Mall attracts over one million visitors each year.

In an effort to reach regional and national stakeholders, NARA was represented at the Society of American Foresters National Convention, the Clearwater Forestry and Conservation Practices Tour, the National eXtension Conference, Montana Forest Council, local Society of American Forester chapters, the Spokane Tribe, Forest Owners Field Days, Montana and Idaho Loggers Associations, the Council on Forest Engineering, and at monthly Montana Forest Restoration Committee meetings.

We are also working with the Decon 13 conference to look at waste products from municipal solid waste streams for recycled products and energy production. Various commercial forest operations that generate residue feedstock were videotaped to develop educational vignettes used to convey NARA's objectives, scope, and findings to our stakeholders, who include students, community leaders, public, and forest products industry. Vignettes and targeted one-page fact sheets are in production. The Ruckelshaus Center has distributed two quarterly briefing papers designed to inform over 1,200 local, regional, and national policy-makers about the project's progress. This has included simultaneously distributing quarterly briefing papers for the Advanced Hardwoods Biofuels Northwest (AHB) project, to avoid stakeholder confusion surrounding these two complementary projects.

As for developing a PSC selection process with EPP team, follow-up assessments of the communities that have been nominated will be carried out with assistance of the EPP and Education teams to narrow the list down to selected NCs with which to work closely during the remainder of the project. The selection methodology will be validated with the work being conducted in the pilot supply chain study regions. In the PSC study regions, the outreach teams in working closely with the IDX and EPP teams in compiling regional supply chain assets, analyzing feedstock supply scenarios, conducting LCA, performing conversion site analysis and community impact analysis for developing a framework of competitive infrastructure.

What is needed now is interaction with other NARA teams and industry partners to draft future outreach activities in different research areas. In addition, we need to aggressively pursue setting up an effective blog to have two-way communications with our stakeholders.

Physical and Intellectual Outputs

Physical

- Four NARA newsletters have been distributed to 231 subscribers. The newsletter is now operating on a monthly distribution schedule. (https://nararenewables.org/news/newsletter)

- The NARA website, www.nararenewables.org, had 20,539 visits with 83,270 page views. Viewership came from all 50 states and from 114 countries.

- The Ruckelshaus Center has distributed two quarterly briefing papers designed to inform policy-makers to over 843 regional and national policymakers.

- The Knowledge Base repository contains unbiased information that covers all aspects related to the NARA project. It is available to the general public and to date has had a total of 1710 visits from 23 states and 10 countries. (https://nararenewables.org/knowledgebase)

Conference Proceedings and Abstracts from Professional Meetings

Tichy, R., Yadama, V., Englund, K., Lowell, E., Leavengood, S., and Rawlings, C. 2012. *Managing Woody Biomass Supply Chain.* Proceedings of the International Wood Composites and NARA Joint symposium, Seattle, WA, April 11-12 (http://www.nararenewables.org/2012-iwcs)

WA Department of Commerce. 2012. *Northwest Bioenergy Research Symposium.* Proceedings of 2012 Northwest Bioenergy Research Symposium, Seattle, WA, November 13 (http://pacificbiomass.org/BioenergyResearchSymposiums/BioenergyResearchSymposium2012.aspx)

Forest Business Network. 2013. *Small Log Conference.* Proceedings of the 2013 Small Log Conference, Coeur d'Alene, Idaho, March 13-15 (http://www.forestbusinessnetwork.com/our-events/slc/proceedings/)

Research Presentations

Wolcott, M.P. 2012. *The Northwest Advanced Renewables Alliance: A supply chain to aviation biofuels and environmentally preferred products*. Invited Speaker. Pacific West Biomass Conference & Trade Show, San Francisco, CA, January 17.

Yadama, V. 2012. *Scope of the outreach activities within NARA*. Montana Stakeholder Meeting, Missoula, MT, March 21.

NARA Outreach Brochure 1: *Northwest Advanced Renewables Alliance*. 20 June 2012.

Yadama, V. and Englund, K. 2012. *Conversion of woody biomass to biofuels and co-products*. Oral Presentation, Spokane Tribe, Wellpinit, WA, August 24.

Yadama, V. 2012. *Bioenergy Literacy to Professionals*. 1st NARA Annual Meeting, Missoula, MT, September 13.

Gaffney, M., Englund, K., Kern, M., Leavengood, S., Arno, M., Moulton, P., Lowell, E., Kolb, P., Perez-Garcia, and Yadama, V. 2012. *Rural Economic Development & Stakeholder Engagement*. 1st NARA Annual Meeting, Missoula, MT, September 14.

Zhu, R., Yadama, V., and Englund, K. 2012. *Hot water extraction (HWE) as a pre-conversion technique for Douglas-fir wood chips.* Poster, National Convention of the Society of American Foresters, Spokane, WA, Oct. 24-28.

NARA Fact Sheet 1: *Taking Wood To New Heights.* 17 October 2012.

NARA Outreach Team. 2012. *Selection process of potential NARA Pilot Supply Chain coalitions in the Pacific Northwest Region.* Poster, NW Bioenergy Research Symposium, Seattle, WA, Nov. 13.

NARA Fact Sheet 2: *Woody Biofuels Initiative in the Pacific Northwest*. 16 November, 2012.

NARA Fact Sheet 3: *NARA Supply Chain.* January 2013.

USDA FS PNW. 2013. *Northwest Advanced Renewables Alliance (NARA): A Supply Chain to Aviation Biofuels and Environmentally Preferred Products*. Briefing Paper, March 2013.

Zhu, R. and Yadama, V. 2013. *Impact of hot water extraction (HWE) pretreatment conditions on the physiochemical characteristics of Douglas-fir (DF) wood chips*. Poster, Small Log Conference, Coeur d'Alene, Idaho, March 13-15.

Other Publications

A press release has been sent out by Charles Burke regarding the joint symposium "Managing the Woody Biomass Supply Chain," in Seattle, WA.

Weaver, M. 2012. *Woody biomass alliance holds first meeting*. Capital Press, September 11 (http://www.capitalpress.com/newsletter/mw-Woody-biomass-meeting-091112).

Styles, G. 2012. *Jet fuel from trees (or almost anything else)*. The Energy Collective, September 13, (http://theenergycollective.com/geoffrey-styles/112611/jet-fuel-trees-or-almost-anything-else).

Baker, D.S. 2012. *What's happening in the Woody Energy Market?* Pallet Enterprise, August 1 (http://www.palletenterprise.com/articledatabase/view.asp?articleID=3716)

Dorminey, B. 2012. *Flying on woody biomass and camelina: consortium seeks biofuel answers*. Renewale Energy World.COM, August 21 (http://goo.gl/0RQCM)

Missoula Economic Partnership. 2012. *Biojet Project Takes Off in Missoula* (http://goo.gl/EpNNe)

Seale, A. 2012. *Biomass – fueling aviation*. Clean Energy (An independent supplement from MediaPlanet to the Seattle Times, September (http://goo.gl/RpZQK)

Burke, C. 2012. *Western Montana Corridor: Putting the Pieces Together*. NARA Newsletter, August (http://nararenewables.org/news/newsletter)

FBN Blog maintained by Craig Rawlings: http://www.forestbusinessnetwork.com/17751/naras-woody-biomass-biofuels-effort-hits-close-to-home-and-how-you-can-help-fuel-the-momentum/

Chaney, R. 2012. *Group looks to turn forest waste into fuel for jets*. The Missoulian, June 16. (http://missoulian.com/business/local/group-looks-to-turn-forest-waste-into-fuel-for-jets/article_e9560970-b774-11e1-8c83-0019bb2963f4.html#comments

Videos and Webinars

Video news story on NARA's First Annual Meeting (http://goo.gl/u4NFM)

Trainings, Education and Outreach Materials

Managing Woody Biomass Supply Chain. 2012. Joint symposium with International Wood Composites Symposium, Seattle, WA, April 11-12 (http://www.nararenewables.org/2012-iwcs)

Yadama, V. 2012. *WSU Biofuels Project*. Forest Owners Field Day, August 18, Maytown, WA.

Yadama, V. and Rawlings, C. 2012. *NARA: A Supply Chain to Aviation Biofuels and Lignin Co-products*. Oral Presentation, Montana Loggers Association, Lubrecht Experimental Forest Station, MT, September 15.

2012 Northwest Bioenergy Research Symposium, Seattle, WA, November 13, 2012 (http://pacificbiomass.org/BioenergyResearchSymposiums/BioenergyResearchSymposium2012.aspx)

Yadama, V. 2013. *Using Biomass to Create Jet Fuel*. 21st Annual Family Foresters Workshop, January 18, Coeur d'Alene, Idaho.

Yadama, V. 2013. *From Sticks to Jet-Stream: Using logging slash to create Jet Fuel*. Northeast Chapter Annual Winter Meeting, Washington Farm Forestry Association, February 9, Chewelah, WA.

Small Log Conference, Coeur d'Alene, Idaho, March 13-15, 2013 (http://www.forestbusinessnetwork.com/our-events/slc/proceedings/)

The NARA project, in connection with WSU, is featured on a display at the Future of Flight Aviation Center and Boeing Tour. The Museum attracts over 225,000 visitors annually. Of these guests, roughly 1/3 are from the immediate region, 1/3 from the balance of the United States, and 1/3 are international. An additional 75,000 people visit the facility to participate in a special event—activities surrounding delivery of Boeing aircraft, receptions, school activities, and so on

The NARA project, in connection with WSU, was featured at the 2012 Smithsonian Folklife Festival at the Washington Mall. This event attracts over one million visitors each year.

A NARA exhibit booth has been generated and used at the Small Wood Conference, CdA

Task O-2: Montana State University NARA Extension Initiative

Key Personnel	Affiliation
Peter Kolb	Montana State University

Task Description

Montana State University (MSU) Extension Forestry will assist with the NARA Extension Working Group by providing information about the NARA program and research updates to Montana stakeholders including industry, logging and landowner professional organizations and conferences. In addition we will produce and publish brochures, popular articles and guidelines for these groups, as well as assist with the scoping process and development of a test bed site.

Milestones Year 1:

Meet with NARA extension group and develop guidelines for selecting test bed sites. Cooperate with NARA team to develop and launch web site. Meet with Montana interest groups including Montana biomass working group, Montana Logging Association, Montana Forest Council, Montana Tree Farm, Montana Forest Owners Association and introduce the NARA project and scoping for test bed site in Montana. Develop outline for woody biomass harvesting guidelines for forest landowners.

Milestones Year 2:

Develop draft of woody biomass harvesting guidelines for review by multiple Montana interest groups. Meet with stakeholders in various communities for outline and discussion of possible test bed sites. Organize several field trips for field reviews of potential test bed sites. Write three articles on NARA project for statewide media outlets. Contribute towards NARA website.

Activities and Results

Montana State Extension Forestry assisted with the development and implementation of an educational and logistical support program across Montana for the development of a forest residue-to-energy industry. Forest landowners, managers, agency, industry and multiple western Montana community representatives have learned about the process and raw material requirements for a potential industry that converts woody debris into isobutanol – a drop-in ready jet fuel alternative. Multiple articles in landowner and professional newsletters, as well as presentations at potential partner-industry board meetings, have outlined the process and requirements. This has resulted in reaching more than 3000 private forest landowners, 8 major forest products companies, major logging contractors and tribal, state and federal forestry personal representing forest inventories on more than 2 million acres of private lands, 800,000 acres tribal lands, 800,000 acres state trust lands and 12 million acres of federal lands with wood

harvesting potential. Based on conference and communications feedback, most of these stakeholders are today optimistic about the potential of selling woody debris that is a current byproduct of wildfire hazard reduction, forest restoration and traditional logging operations, and are ready to assist if further conversion research shows a feasible solution. An MSU Extension web page and a biomass stakeholder list-serve inclusive of other woody biomass conversion research and entrepreneurship has been developed and is used to update western Montana constituents of any new developments regarding forest biomass markets.

Recommendations/Conclusions

There is a surplus of woody biomass available across Montana that would benefit from an economically viable market. Such a market would increase healthy forest conservation efforts, private enterprise and rural communities. Continued research into developing a technological solution that converts forest residue into a transportable drop-in-ready liquid fuel is essential.

Physical and Intellectual Outputs

Physical:

100 lbs each of ground ponderosa pine needles and branches from: 1) fresh pine, 2) recently beetle killed, and 3) 6 month-old beetle killed were delivered to the WSU Bioproducts, Sciences & Engineering Laboratory for analysis of secondary metabolites.

Other Publications

Kolb, Peter F. 2012. The future of biomass in Montana, Montana Family Forest Spring Newsletter.

Kolb, P., 2012. The Future of Forest Biomass 2012, Montana Forest Owners Spring Newsletter

Kolb, P., 2012. Is Biomass a Future Market in Montana, Northwest Woodlands Fall 2012, Volume 28. No.4.

Kolb, Peter. 2013. Managing for Forest Soil Productivity, Montana Family Forest News, Issue No. 40.

Twer, Martin. 2012. Why the Western Montana Corridor as a “Pilot NARA Community”. Misc MSU Extension Forestry publication.

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http://www.msuextension.org/forestry/nara.html
http://www.msuextension.org/forestry/nara_resources.html

Created a Montana NARA listserv

Trainings, Education and Outreach Materials

“An overview of the NARA project and expected outcomes” presented to:

- *Montana Forest Council*
- *Montana Tree Farm Board of Directors*
- *Montana Forest Owners Association*
- *Montana Logging Association*
- *Montana Association of County Agriculture (Extension) Agents*

Participation in work meetings, including two two-day comprehensive stakeholder meetings

- NARA Open House
- Western Montana NARA Fieldtrip
- NARA Annual Conference

Task O-3: University of Montana NARA Extension Initiative

Key Personnel	Affiliation
Todd Morgan	University of Montana

Task Description

NARA units, research, extension and industry members, will act as partners and facilitators with the ultimate goal of empowering the stakeholders to plan and implement the changes needed to build, develop, and sustain a biorefinery infrastructure. The goal of the outreach team is to promote stakeholder bioenergy literacy and build regional supply chain coalitions for development of a framework of biofuel and co-products production from woodybiomass. End outcomes of this goal are sustainable production of biojet fuel and co-products and rural economic development. Following are the objectives of the outreach team to reach this goal:

1. **Bioenergy Literacy,** where we: a) disseminate the research-based information (on technology and markets) to our industrial stakeholders and understand the technical challenges regarding implementation at industrial scale (industry-focus); b) relate the feedstock development and logistics information to our resource-based stakeholders (local communities, forest landowners, forest managers) and hear their concerns regarding the type of information that will assist them in keeping their costs low and marketable value high (resource-focus); and, engage the organizations and partnerships in connecting with public-interest groups and policymakers (public-focus). These activities will be carried out via a variety of communication mechanisms, including social media, newsletters, briefing papers, extension publications, workshops/seminars, conferences, field trips, and stakeholder meetings. Bioenergy literacy to professionals will be achieved through following tasks.
    a. Develop a bioenergy literacy platform for flow of information and knowledge between NARA research teams and the stakeholders.
    b. Implement targeted outreach activities for engaging stakeholders and advancing bioenergy literacy to professionals.
    c. Catalog activity outcomes and benchmark reports and studies.

2. **Build Supply Chain Coalitions** (logistical support and stakeholder development and engagement), where we will form working groups with stakeholders at community and bioregion levels to involve them through collaboration across the supply chain: forestland owners and managers, environmental NGOs, businesses, regulatory facilitators, and community infrastructure working groups to interact with and inform policymakers at regional, state, and federal levels. These stakeholders will be internal and external focused around the NARA communities (NCs) selected in the four-state region. This process will rely on support from other teams, such as Education and EPP, and consider physical and social assets along with practical aspects in narrowing down the list to a manageable number of communities with the four-state region. A long list will be shortened through surveying community-based stakeholders in the PNW and intermountain region to strategically choose several NCs for studying the viability of a biofuel-based infrastructure. Once communities are identified, focus group meetings involving a wide variety of stakeholders will be held at each community to discuss feedstock specifications and logistics, technology adoptions within the existing infrastructure, and viable strategies practical and beneficial for the communities. This process will involve industrial stakeholders and NARA industry partners as well. Establishing a meaningful dialogue on what local experts perceive to be

the barriers and opportunities for establishing a biorefinery infrastructure in their community is critical. Building supply chain logistics consists of four major tasks.

a. Define stakeholders and articulate stakeholder communication mechanism.
b. Define and establish NARA pilot supply chain (PSC) study regions to engage stakeholders in compiling supply chain assets, analyzing potential regional supply chain structure, and forming regional alliances.
c. Stakeholder development in the four-state region and pilot supply chain study regions.
d. Assist EPP with PSC selection process and support index study to develop a decision support tool.

Activities and Results

Over the past two years of the NARA project, BBER staff have worked with NARA Team Leaders and members and local Montana forestry and wood products associations, agencies, and individuals to help increase bioenergy literacy and build supply chain coalitions. Specifically, BBER staff have been active in Outreach activities to:

- identify appropriate selection criteria for NARA communities
- provide timber harvest, mill, and other information to MSU Extension
- select the Western Montana Corridor (WMC) as a NARA pilot community
- engage and inform local and regional stakeholders of the NARA project
- participate in the WMC planning events and annual NARA meeting held in Missoula
- communicate local (western Montana) concerns and issues to the NARA teams
- share information and progress from NARA with Montanans
- provide Montana-specific information and local contacts to members of other NARA Teams
- review drafts of the WMC Atlas produced by the NARA Education Team

BBER researchers have continued to inform individuals and groups throughout Montana and other states about NARA research since the start of the project. Todd Morgan, Steve Hayes and other BBER staff have attended the Montana Forest Restoration Committee's Forest Products Retention Roundtable monthly meetings to share information on NARA progress and hear comments from stakeholders in the WMC. The Roundtable was identified as the NARA "client" in Montana. Todd Morgan (of BBER) and Craig Rawlings (of Forest Business Network) regularly attend the Roundtable, report on NARA progress, and otherwise serve as liaisons between the Roundtable and NARA.

BBER personnel recently invested more than 100 staff hours reviewing the NARA Western Montana Corridor Atlas project. BBER personnel reviewed three separate Atlas products: posters at the January 2013 Missoula Open House, a rough draft Atlas document, and the revised Atlas draft. These oral and written reviews uncovered significant content problems, provided remedies for these shortcomings, and helped shape the final Atlas product.

Recommendations/Conclusions

The majority of the Extension/Outreach work that BBER is doing for the NARA project consists of sharing our research results from the Feedstock/Supply Chain side of the project and maintaining contact with the various Montana stakeholders, including the MFRC Forest Products Retention Roundtable, MWPA, MLA, and others. MSU is Montana's Forestry Extension program.

BBER's Forest Industry Research Program will continue to participate in the monthly Roundtable and other meetings, despite our formal withdrawal from the NARA Outreach Team (please see comments below). BBER staff have invested much time refining the Western Montana Atlas products. We will work with the Roundtable and NARA members to ensure the final Atlas meets stakeholder expectations.

Montana loggers, mill owners, forestry agency personnel, forest landowners and others worry that the NARA project may produce only paper plans with low probability of outcomes that would directly benefit their organizations financially. We must provide our stakeholders with succinct, unvarnished updates of project progress and high-quality, professionally-prepared information.

The Future:

In Year 3, the BBER team will cease formal Outreach activities under the NARA agreement, but will continue to share information with NARA Teams and stakeholders on an informal basis.

Given proposed budget changes (i.e., direct expenses reduced to accommodate increased indirect costs) BBER is losing approximately $9,400 in Year-3 direct funding. BBER's Year-3 Outreach efforts are estimated to have a direct cost of $8,700. The size of the direct budget cut requires a reduction in the quantity of activities and reporting that BBER is performing for NARA. Since the draft WMC Atlas was delivered to the Roundtable client in Year 2 and NARA Outreach and Education activities will be shifting to communities outside Montana in Year 3, BBER's level of Outreach activity would have otherwise decreased. In order to minimize the overall impact of the budget reduction on BBER's NARA research (System Metrics) activities and to reduce BBER's reporting burden, formal Outreach activities under NARA will cease.

We ask that the NARA Outreach Team re-organize its efforts in Montana to rely on Montana State University (MSU) Forestry Extension (under Peter Kolb) and Forest Business Network (under Craig Rawlings) for formal Outreach activities. While BBER staff will continue to participate in the MFRC Roundtable and fill information requests related to the NARA project, it will not be as a formal Outreach Team member.

We thank Outreach Team Leader Dr. Vikram Yadama for his enthusiastic leadership of NARA outreach efforts. We wish our fellow Outreach team members well and trust they will effectively engage many stakeholders in the NARA project.

Physical and Intellectual Outputs

Physical

- Todd Morgan, Steve Hayes, and/or other BBER staff participate in the monthly MFRC Forest Industry Retention Roundtable.
- BBER staff helped to coordinate and participated in the June 2012 WMC planning meeting, where researchers, students, and stakeholders met to discuss and plan other activities associated with the WMC Atlas project.
- BBER staff participated in the September 2012 NARA annual meeting held in Missoula, providing technical and logistic support, participating in the group capital "brainstorming" activities, and presenting information to those in attendance.

Research Presentations

Berg, E. 2012. Western Montana Corridor: Woody biomass from logging and mill residuals. Presentation at the NARA Annual Meeting, September 12-14, 2012. Missoula, MT.

Other Publications

The University of Montana produced a short press release (http://news.umt.edu/2011/10/100311nara.aspx) when the NARA project was announced at SeaTac. Todd Morgan had an interview on October 5, 2011 with a local TV news (KPAX) reporter, Russ Thomas, as follow-up to the press release.

Trainings, Education and Outreach Materials

Morgan, T. 2011. From stump to pump: wood-based biofuel research in the Northwest. Presentation/ web-cast is available online at: http://fresc.usgs.gov/spotlight/Presentations.html. The presentation introduced the NARA project in general, and provided details about the measurement of logging residues that BBER researchers are collecting. Portland State University, Portland, OR, December 15.

Morgan, T. 2012. Woody Biomass from Logging and Mill Residuals. Presentation described some of the work BBER is conducting as part of the NARA team and highlighted major trends and conditions in the Montana forest inventory, forest industry, and timber harvest. NARA meeting, Missoula, MT, June 13.

Task O-4: Oregon State University NARA Extension Initiative

Key Personnel	Affiliation
Scott Leavengood	Oregon State University

Task Description

NARA units, research, extension and industry members, will act as partners and facilitators with the ultimate goal of empowering the stakeholders to plan and implement the changes needed to build, develop, and sustain a biorefinery infrastructure. The goal of the outreach team is to promote stakeholder bioenergy literacy and build regional supply chain coalitions for development of a framework of biofuel and co-products production from woody biomass. End outcomes of this goal are sustainable production of biojet fuel and co-products and rural economic development. Following are the objectives of the outreach team to reach this goal:

1. **Bioenergy Literacy,** where we: a) disseminate the research-based information (on technology and markets) to our industrial stakeholders and understand the technical challenges regarding implementation at industrial scale (industry-focus); b) relate the feedstock development and logistics information to our resource-based stakeholders (local communities, forest landowners, forest managers) and hear their concerns regarding the type of information that will assist them in keeping their costs low and marketable value high (resource-focus); and, engage the organizations and partnerships in connecting with public-interest groups and policymakers (public-focus). These activities will be carried out via a variety of communication mechanisms, including social media, newsletters, briefing papers, extension publications, workshops/seminars, conferences, field trips, and stakeholder meetings. Bioenergy literacy to professionals will be achieved through following tasks.
    a. Develop a bioenergy literacy platform for flow of information and knowledge between NARA research teams and the stakeholders.
    b. Implement targeted outreach activities for engaging stakeholders and advancing bioenergy literacy to professionals.
    c. Catalog activity outcomes and benchmark reports and studies.

2. **Build Supply Chain Coalitions** (logistical support and stakeholder development and engagement), where we will form working groups with stakeholders at community and bioregion levels to involve them through collaboration across the supply chain: forestland owners and managers, environmental NGOs, businesses, regulatory facilitators, and community infrastructure working groups to interact with and inform policymakers at regional, state, and federal levels. These stakeholders will be internal and external focused around the NARA communities (NCs) selected in the four-state region. This process will rely on support from other teams, such as Education and EPP, and consider physical and social assets along with practical aspects in narrowing down the list to a manageable number of communities with the four-state region. A long list will be shortened through surveying community-based stakeholders in the PNW and intermountain region to strategically choose several NCs for studying the viability of a biofuel-based infrastructure. Once communities are identified, focus group meetings involving a wide variety of stakeholders will be held at each community to discuss feedstock specifications and logistics, technology adoptions within the existing infrastructure, and viable strategies practical and beneficial for the communities. This process will involve industrial stakeholders and NARA

industry partners as well. Establishing a meaningful dialogue on what local experts perceive to be the barriers and opportunities for establishing a biorefinery infrastructure in their community is critical. Building supply chain logistics consists of four major tasks.

a. Define stakeholders and articulate stakeholder communication mechanism.
b. Define and establish NARA pilot supply chain (PSC) study regions to engage stakeholders in compiling supply chain assets, analyzing potential regional supply chain structure, and forming regional alliances.
c. Stakeholder development in the four-state region and pilot supply chain study regions.
d. Assist EPP with PSC selection process and support index study to develop a decision support tool.

Activities and Results

Leavengood's primary role with respect to this project has been to serve as the key outreach liaison for Oregon. In that regard, Leavengood has focused efforts on identifying the key stakeholders in Oregon, keeping them and others informed of the activities of the project, and working to ensure stakeholders are able to engage and participate. These efforts have included giving presentations to the Oregon Forest Biomass Working Group, organizing meetings between members of the working group and NARA team members, developing newsletter articles and web pages, and serving as host for Michael Wolcott to give a lecture on the project as part of OSU's Starker Lecture Series.

The efforts have also included providing other NARA teams with information to assist in their efforts, e.g., coordinating completion of the 'stakeholder assessments' for the EPP team.

One sign of results is that Oregon agency personnel (e.g., Matt Krumenauer with the Oregon Department of Energy and Marcus Kauffman with the Oregon Department of Forestry) with responsibilities related to forest biomass utilization have organized conference calls and meetings about the NARA project independently of my efforts or of the efforts of other NARA team members. Sue Safford with Oregon BEST (Oregon built and environmentally sustainable technologies) also asked for information about technology commercialization opportunities from the project that might come about for the state. If nothing else, this shows that outreach efforts are having their desired effect of ensuring that key stakeholders in Oregon are engaged and committed to the project's success.

Recommendations/Conclusions

The results mentioned in the paragraph above and participation in meetings indicate that the outreach efforts are having some level of success, at least with regards to the task 2 - *Building Supply Chain Coalitions*. However, as mentioned in previous quarterly reports, stakeholders have asked for more of the details about the research efforts connected with this project, i.e., tasks related to task 1 - *Bioenergy Literacy*. Therefore, future efforts will focus on keeping stakeholders informed about progress with respect to efforts of the research teams – forest residues preparation, transportation, pretreatment, enzymatic hydrolysis, fermentation, and co-products as well as information related to life cycle assessment. Assisting with the organization of a NARA conference will be one task to achieve this goal as will working

with other outreach team members to develop educational materials that can be distributed via webinars, newsletter articles, and the website.

Physical and Intellectual Outputs

Physical

- 15 'Community Surveys' were created for specific Oregon communities related to key assets in these communities relevant for NARA; these surveys were developed to help define and establish NARA pilot supply chain (PSC) study regions
- 2 'Stakeholder assessments' spreadsheets were developed - 1 for southwest and 1 for northwest Oregon; these contained contact information for key personnel in Oregon to assist the EPP team with PSC selection process.

Other Publications

Oregon Wood Innovation Center (OWIC) Spring 2012 newsletter – article on NARA

OWIC website – page dedicated to disseminating information about the project - http://owic.oregonstate.edu/NARA

Videos and Webinars

Wolcott, M. 2013. Wood to Wing: Envisioning and Aviation Biofuels Industry Based on Forest Residuals in the Pacific Northwest (archived video of presentation). Starker Lecture Series, Oregon State University. April 11. (I served as organizer and host for the lecture)

Trainings, Education and Outreach Materials

Wolcott, M. 2013. Wood to Wing: Envisioning and Aviation Biofuels Industry Based on Forest Residuals in the Pacific Northwest. Starker Lecture Series, Oregon State University. April 11. (I served as organizer and host for the lecture)

Leavengood, S. 2013. Meeting of key Oregon agency personnel with interest in NARA Pilot Supply Chains. March 20. I served as organizer of an initial Pilot Supply Chain meeting of key personnel in the Oregon Forest Biomass Working Group.

Leavengood, S. 2012. Meeting of key Oregon agency personnel with interest in NARA project. October 22. I served as organizer and moderator of the meeting that included personnel from the Governor's office (Oregon Governor's Energy Policy Advisor), Business Oregon (economic development agency), Oregon Department of Forestry, Oregon Department of Energy, Oregon Department of Environmental Quality, Oregon BEST (Built Environment and Sustainable Technologies, a state-funded research center), Sustainable Northwest (eNGO), US Forest Service, Oregon Forest Resources Institute, US Bureau of Land Management, Oregon State University and Washington State University (Mike Wolcott in addition to Jim Funck with the Advanced Hardwoods Biofuel Network).

Leavengood, S. 2012. The Northwest Advanced Renewables Alliance (NARA): Recap of outreach team meeting in Missoula, MT. Informal presentation to the Oregon Forest Biomass Working Group. April 2.

Leavengood, S. 2011. The Northwest Advanced Renewables Alliance (NARA): An Introduction. Presentation to the Oregon Forest Biomass Working Group. October 25.

Task O-5: University of Idaho NARA Extension Initiative

Key Personnel	Affiliation
Randy Brooks	University of Idaho

Task Description

NARA units, research, extension and industry members, will act as partners and facilitators with the ultimate goal of empowering the stakeholders to plan and implement the changes needed to build, develop, and sustain a biorefinery infrastructure. The goal of the outreach team is to promote stakeholder bioenergy literacy and build regional supply chain coalitions for development of a framework of biofuel and co-products production from woodybiomass. End outcomes of this goal are sustainable production of biojet fuel and co-products and rural economic development. Following are the objectives of the outreach team to reach this goal:

1. **Bioenergy Literacy,** where we: a) disseminate the research-based information (on technology and markets) to our industrial stakeholders and understand the technical challenges regarding implementation at industrial scale (industry-focus); b) relate the feedstock development and logistics information to our resource-based stakeholders (local communities, forest landowners, forest managers) and hear their concerns regarding the type of information that will assist them in keeping their costs low and marketable value high (resource-focus); and, engage the organizations and partnerships in connecting with public-interest groups and policymakers (public-focus). These activities will be carried out via a variety of communication mechanisms, including social media, newsletters, briefing papers, extension publications, workshops/seminars, conferences, field trips, and stakeholder meetings. Bioenergy literacy to professionals will be achieved through following tasks.
    a. Develop a bioenergy literacy platform for flow of information and knowledge between NARA research teams and the stakeholders.
    b. Implement targeted outreach activities for engaging stakeholders and advancing bioenergy literacy to professionals.
    c. Catalog activity outcomes and benchmark reports and studies.

2. **Build Supply Chain Coalitions** (logistical support and stakeholder development and engagement), where we will form working groups with stakeholders at community and bioregion levels to involve them through collaboration across the supply chain: forestland owners and managers, environmental NGOs, businesses, regulatory facilitators, and community infrastructure working groups to interact with and inform policymakers at regional, state, and federal levels. These stakeholders will be internal and external focused around the NARA communities (NCs) selected in the four-state region. This process will rely on support from other teams, such as Education and EPP, and consider physical and social assets along with practical aspects in narrowing down the list to a manageable number of communities with the four-state region. A long list will be shortened through surveying community-based stakeholders in the PNW and intermountain region to strategically choose several NCs for studying the viability of a biofuel-based infrastructure. Once communities are identified, focus group meetings involving a wide variety of stakeholders will be held at each community to discuss feedstock specifications and logistics, technology adoptions within the existing infrastructure, and viable strategies practical

and beneficial for the communities. This process will involve industrial stakeholders and NARA industry partners as well. Establishing a meaningful dialogue on what local experts perceive to be the barriers and opportunities for establishing a biorefinery infrastructure in their community is critical. Building supply chain logistics consists of four major tasks.

a. Define stakeholders and articulate stakeholder communication mechanism.
b. Define and establish NARA pilot supply chain (PSC) study regions to engage stakeholders in compiling supply chain assets, analyzing potential regional supply chain structure, and forming regional alliances.
c. Stakeholder development in the four-state region and pilot supply chain study regions.
d. Assist EPP with PSC selection process and support index study to develop a decision support tool.

Activities and Results

Since project inception, UI Extension Forestry has delivered over 20 presentations about the NARA project and woody biomass utilization to over 1,000 stakeholders across the state of Idaho. Postcards and a one page fact sheet were developed and handed out at the above mentioned meetings and to various stakeholders. Surveys were developed to assess attitudes, and knowledge obstacles to woody biomass utilization. Many stakeholders are familiar with the basic processes (Figure 1) and a majority of stakeholders feel like utilizing woody biomass has the advantage of being sustainable (Figure 2). Overwhelmingly, stakeholders feel that lack of financial support (capital) is the major obstacle (Figure 3). Most think that their communities would benefit through jobs, economic development, healthier forests, and being associated with sustainable practices (Figure 4), while most did not see any drawbacks to utilizing woody biomass for energy production (Figure 5). As a result of a meeting held in Orofino in the spring of 2012, Brooks has been part of a smaller group that was awarded funding to build a biomass boiler system built in Orofino. Town hall meetings are being planned in the Orofino community to inform stakeholders about the potential use of biomass for bioenergy associated with the grant.

Working with graduate student Jilian Moroney, we organized and held the Clearwater County 6th Grade Forestry Tour. The 3-day, 2-night tour focused on natural resources. We introduced the NARA Project, and Jillian then made 5 presentations to the youth about thinning and utilizing biomass for biofuels. As part of Moroney's thesis research project, the youth were given a pre-test in May, and then given a post-test (consisting of the same pre-test questions) at the end of the tour. The same post-test was given two months after the tour to assess long-term knowledge retention. A survey was also given to the youth to assess their knowledge of biomass and its utilization. Findings were presented at the national eXtension annual conference held in Oklahoma City, OK. These results have been summarized and will be submitted to the Journal of Extension. We attended the NARA Annual meeting in Missoula, MT and presented four posters about our work with the NARA grant over the past year. Moroney also attended the American Planning Association Idaho Chapter annual conference in Boise, Idaho and presented three posters on her work with NARA. Overall, we have made 8 poster presentations about the project.

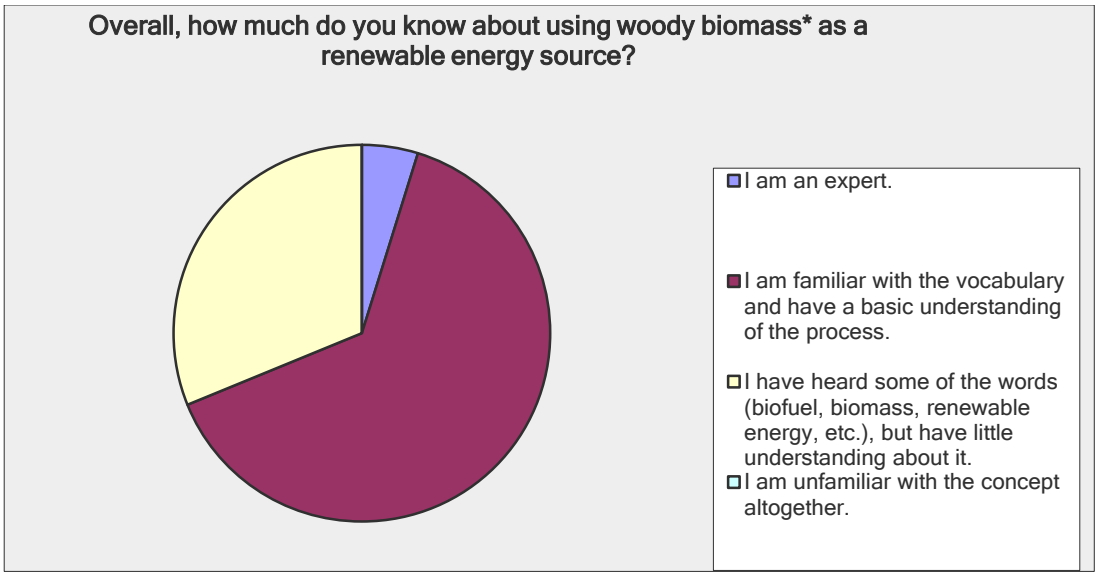

Figure 1. How much do stakeholders know about using woody biomass as a renewable energy source?

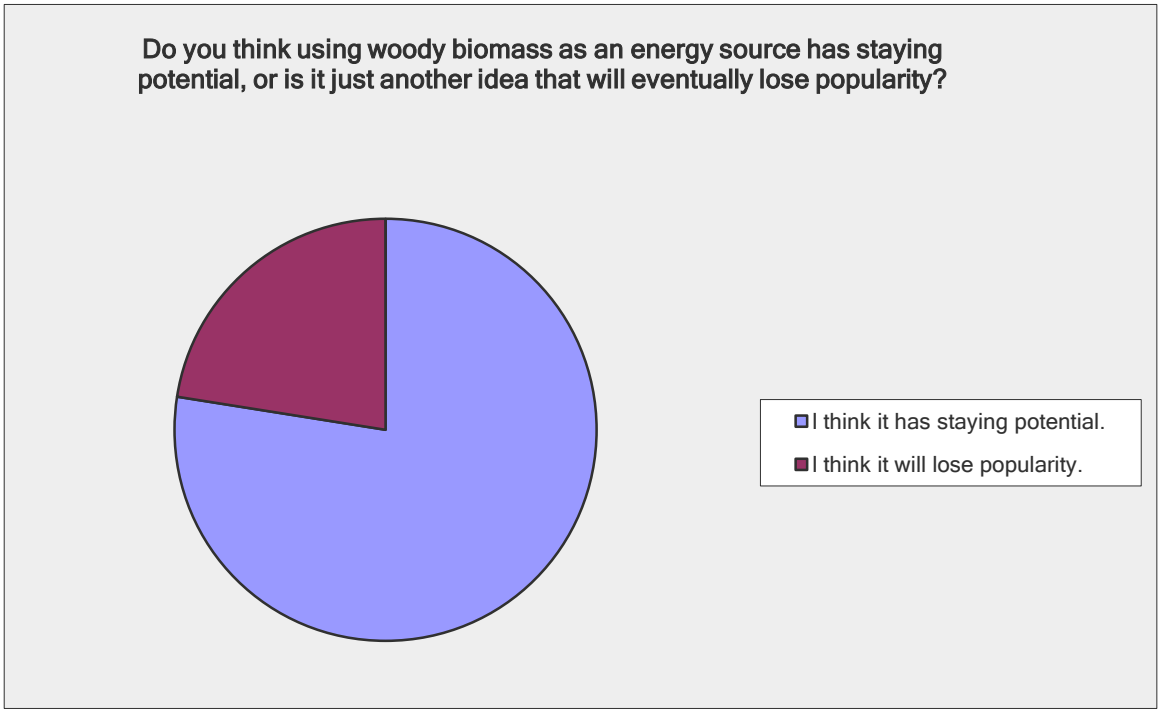

Figure 2. Does woody biomass have staying potential or will it lose popularity?

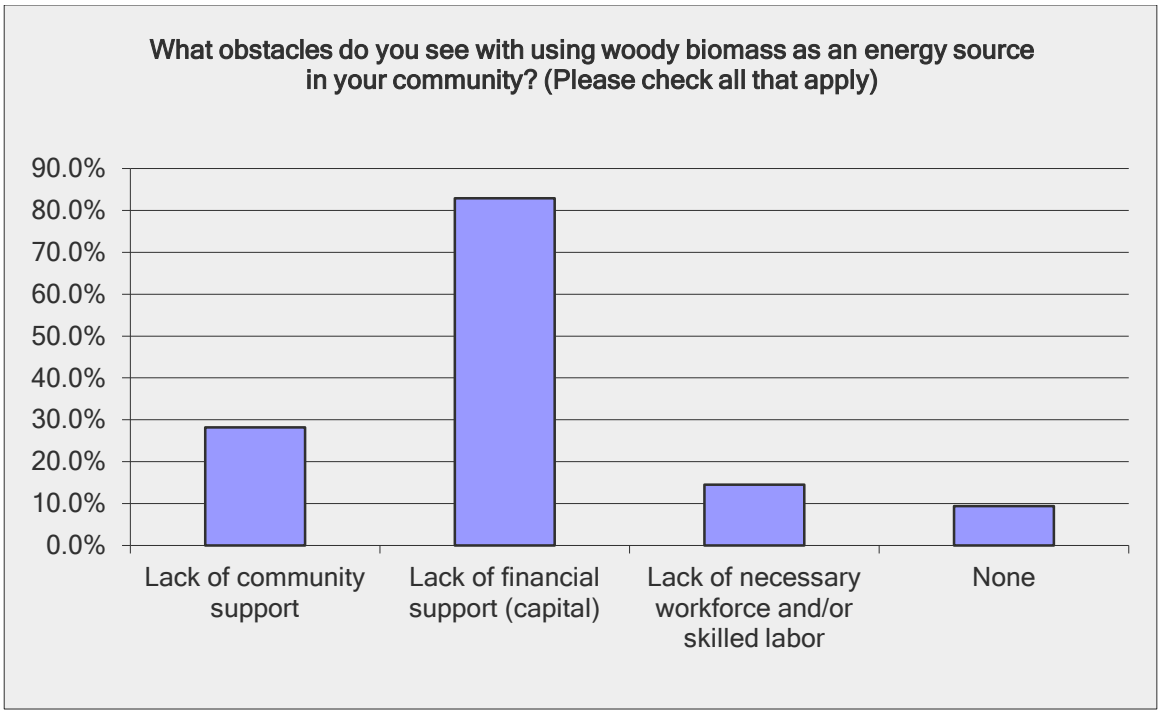

Figure 3. What are the obstacles to using woody biomass?

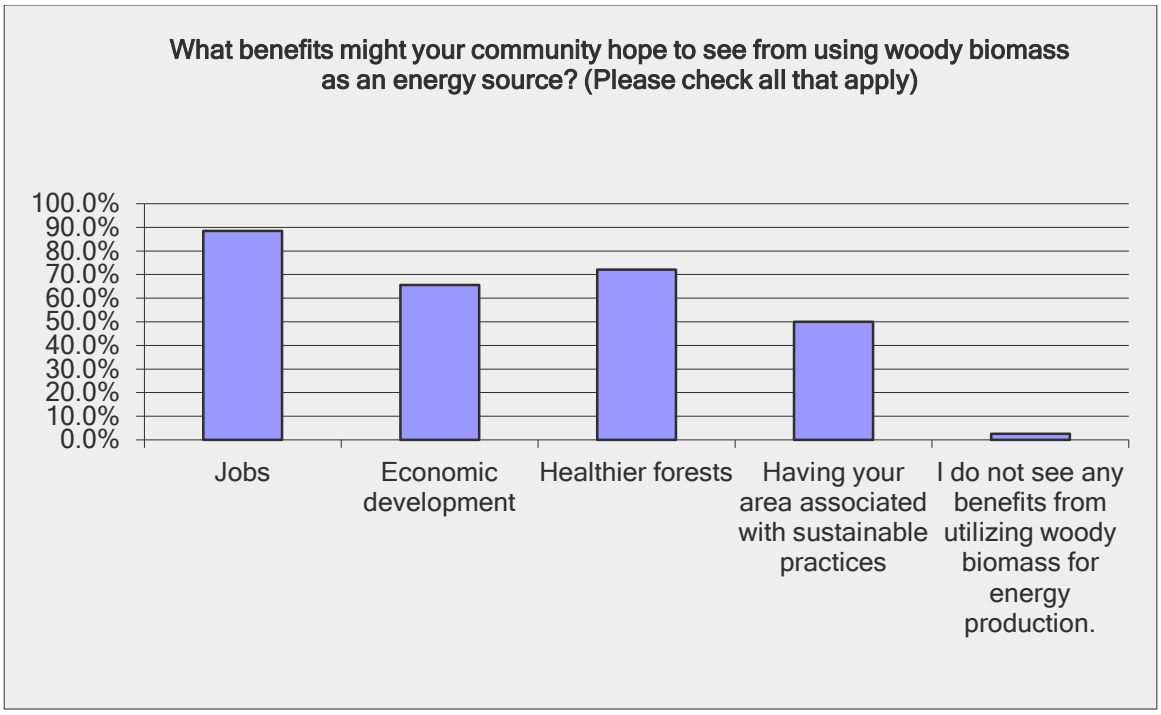

Figure 4. How would communities benefit from using woody biomass?

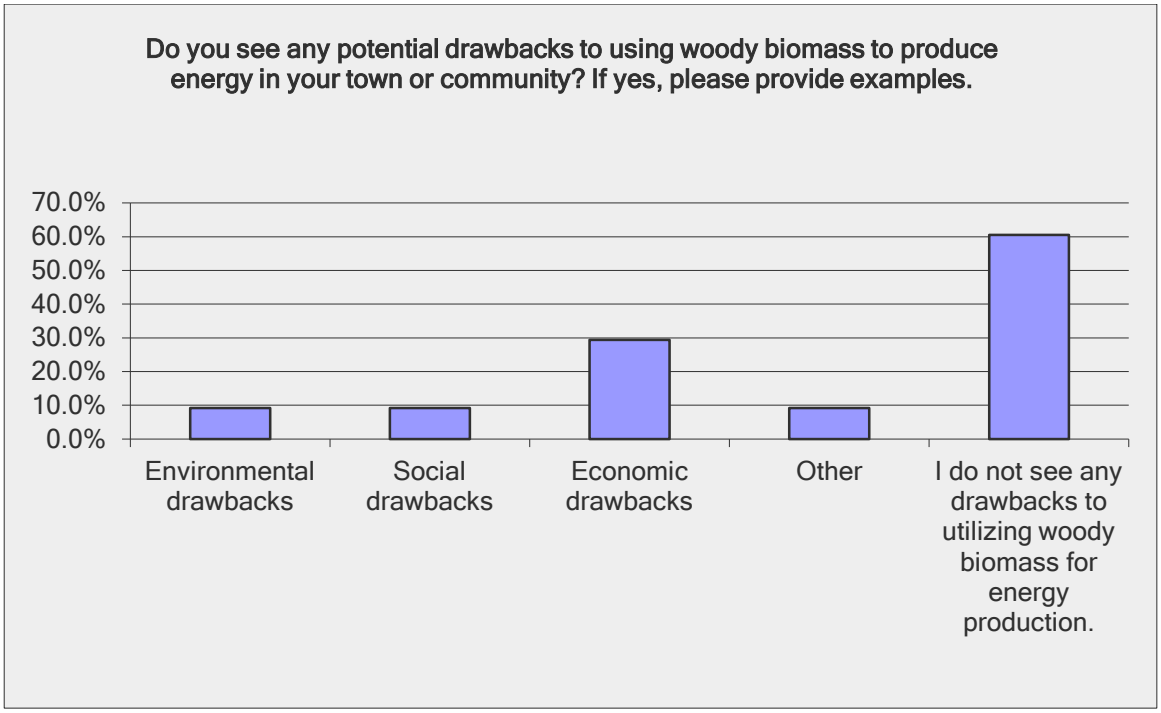

Figure 5. What are potential drawbacks to using woody biomass to produce energy?

Recommendations/Conclusions

Over 400 loggers have been introduced to the NARA Project and introduced to options for biomass utilization. Logger Education post-workshop exit evaluations showed 62% of those surveyed indicated they could identify opportunities and challenges associated with forest biomass and residues, while 21% were not sure, and 17% indicated probably not. Suggestions for future training topics included biomass updates, energy & oil, what new products can be found in woody biomass, and expanding the markets.

Over 120 youth have been introduced the woody biomass and the concept of making biofuel from woody biomass. A portion of these youth were given pre-test, post-test, and a 2nd post-test two months after the workshops (to assess long-term knowledge retention).

Survey results are still being evaluated, but early indicators show that relatively few stakeholders in Idaho are using electronic means to receive communications. Therefore, efforts to educate stakeholders in Idaho need to utilize every opportunity to attend face-to-face meeting to inform them about the project.

Physical and Intellectual Outputs

Physical

- Survey Monkey Stakeholder Survey was developed in March, 2012 and given to community leaders.
- Survey Monkey Stakeholder Survey was developed in February, 2013 and given to 6 groups (loggers, students, teachers, mill/industry foresters, landowners, extension stakeholders)

Refereed Publications (accepted or completed)

Brooks, R. and J. Moroney. 2013. Forestry Tour Educates Youth in North Central Idaho. Journal of Extension. Accepted, in review.

Conference Proceedings and Abstracts from Professional Meetings

Brooks, R., and J. Moroney. 2012. Clearwater Basin Bioenergy Survey. Poster presented to Northwest Bioenergy Research Symposium. Seattle, WA. Nov. 12-14, 2012.

Research Presentations

Brooks, R., J. Moroney, R. Keefe, and T. Laninga. 2013. Biomass Survey Assessment of Idaho Forestry Extension Stakeholders. Poster presented at The International Wood Composite Symposium. Seattle, WA. April 2-4, 2013.

Brooks, R., J. Moroney, and T. Laninga. 2012. Clearwater Basin Bioenergy Survey. Poster presented at Northwest Bioenergy Research Symposium and Future Energy Conference, Seattle, WA. Nov. 13-14, 2012

Moroney, J. 2012. Clearwater County Idaho Sixth Grade Forestry Tour Assessment: Tracking the Change in Students' Knowledge and Attitudes. Research presented at the National eXtension Conference, Oklahoma City, OK. Oct. 3, 2012.

Moroney, J, T. Laninga, and R. Brooks. 2012. Clearwater Basin Bioenergy Survey. Poster presented at Idaho Chapter of the American Planning Association Annual Conference, Boise, ID. Oct. 10-12, 2012

Brooks, R. 2012. Forestry Tour Educates Youth and Teachers. Poster presentation at NARA 2012 Annual Meeting, Missoula, MT, Sept 13-14, 2012.

Moroney, J.M., R. Brooks, and T. Laninga. 2012. Clearwater County Forestry Tour: A Knowledge Assessment. Poster presentation at NARA 2012 Annual Meeting, Missoula, MT, Sept 13-14, 2012.

Brooks, R. and J. Moroney. 2012. Clearwater Basin Bioenergy Survey: A brief assessment of regional norms and values that could have an impact on community responses to the development of woody biomass as an energy source in the Clearwater Basin. Poster presented at The International Wood Composite Symposium. Seattle, WA, April 11-13, 2012.

Other Publications

Maroney, J.M. and R.H. Brooks. Biomass 101 for Idaho Forest Landowners. 2012. University of Idaho. In preparation.

Brooks, R. 2012. From Wood to Wing: Biofuels and the NARA Opportunity. Idaho Gem State Producer. Vol. 15:8. Pg. 25-27. Dec. 2012.

Trainings, Education and Outreach Materials

Brooks, R. 2013. A NARA Project Update and Review. Presented at LEAP Update sessions in 5 locations across north Idaho. 290 participants. Dates: March 3 through March 29, 2013.

Brooks, R. 2013. How Tree Biology can fit in the NARA Project. Presented to Asotin County, Washington, Advanced Master Gardeners. 43 participants. March 12, 2013.

Brooks, R. 2013. Forestry and Biofuels. Presented to UI Extension “Keeping the Legacy Alive”. 15 participants. Lewiston, ID. March 13, 2013.

Brooks, R. The NARA Project: An Overview. Talk given to UI CNR Dean’s Annual Stakeholder Mtg., Moscow, ID. 9/22/12

Brooks, R. Utilizing forest biomass to make biofuels. 3 Presentations to UI Ag Resource Policy class. Camp Wittman, ID. 9/19/12

Brooks, R. Biomass opportunities associated with thinning for forest insects and diseases. UI Extension Forest Insects & Disease Field Day, Moscow, ID. 7/27/12

Brooks, R. How biomass and biofuels fits in with a thinning regime. UI Extension Forestry Thinning & Pruning Field Day, Cottonwood, ID.7/20/12

Moroney. J. From Biomass to Biofuels: Clearwater County (ID) 6th Grade Forestry Tour. Headquarters, ID. 7/12/12

Brooks, R. and J. Moroney. Woody Biomass and the NARA Project Overview: Presented Natural Resources Youth Camp north of Sun Valley, ID at the Central Idaho 4-H Camp. **2 lectures** and **5 labs** where presented on biomass, biomass utilizations, and biofuels. Over 70 youth and 14 adults were present. June 25-29, 2012.

Moroney, J. Bioregional Planning and Community Design studio project presentations (2). These projects consisted of looking at the community attitudes towards woody biomass and the feasibility of this industry taking root in North Central Idaho. Approximately 15 stake holder and community participants. (Jillian Moroney) Mar/May, 2012.

Brooks, R. A woody biomass overview: presented at LEAP Update sessions in Council, Idaho, and at LEAP sessions in Moscow and Coeur d'Alene, Idaho. 90 participants. May, 2012.

Brooks, R. The NARA Project in Idaho: A project overview presented to the Idaho Association of Logging Contractors. 43 participants. April, 2012.

Brooks, R. 2012. A woody biomass overview: presented at LEAP Update sessions in 5 locations across northern Idaho. 300 participants. March, 2012.

Brooks, R. 2012. Keeping the Forest Legacy Alive. Presented to family forest owners Craigmont, ID and Moscow, ID. 40 participants. Feb. 24, 2012.

Brooks, R. 2012. Biomass: Options & Opportunities: Presented to the Selkirk Chapter Society of American Forests quarterly meeting. 34 participants. Feb. 16, 2012.

Brooks, R. 2012. NARA Project Overview: Presented to north central Idaho Pesticide Applicators training meeting, Nezperce, ID. 21 participants. Jan. 24, 2012.

Thesis and Dissertations

Moroney, J. 2012. Clearwater County Sixth Grade Forestry Tour Program Evaluation: Determining Participants' Knowledge Gain and Behavioral Change. University of Idaho, Master's Thesis. 2012.

Task O-6: Forest Service-Pacific NW Research Station

Key Personnel	Affiliation
Eini Lowell	USDA FS PNWRS

Task Description

NARA units, research, extension and industry members, will act as partners and facilitators with the ultimate goal of empowering the stakeholders to plan and implement the changes needed to build, develop, and sustain a biorefinery infrastructure. The goal of the outreach team is to promote stakeholder bioenergy literacy and build regional supply chain coalitions for development of a framework of biofuel and co-products production from woody biomass. End outcomes of this goal are sustainable production of biojet fuel and co-products and rural economic development. Following are the objectives of the outreach team to reach this goal:

1. **Bioenergy Literacy,** where we: a) disseminate the research-based information (on technology and markets) to our industrial stakeholders and understand the technical challenges regarding implementation at industrial scale (industry-focus); b) relate the feedstock development and logistics information to our resource-based stakeholders (local communities, forest landowners, forest managers) and hear their concerns regarding the type of information that will assist them in keeping their costs low and marketable value high (resource-focus); and, engage the organizations and partnerships in connecting with public-interest groups and policymakers (public-focus). These activities will be carried out via a variety of communication mechanisms, including social media, newsletters, briefing papers, extension publications, workshops/seminars, conferences, field trips, and stakeholder meetings. Bioenergy literacy to professionals will be achieved through following tasks.
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the barriers and opportunities for establishing a biorefinery infrastructure in their community is critical. Building supply chain logistics consists of four major tasks.

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b. Define and establish NARA pilot supply chain (PSC) study regions to engage stakeholders in compiling supply chain assets, analyzing potential regional supply chain structure, and forming regional alliances.
c. Stakeholder development in the four-state region and pilot supply chain study regions.
d. Assist EPP with PSC selection process and support index study to develop a decision support tool.

Activities and Results

Lowell has worked within the PNW Research Station to prepare materials that inform key stakeholders, leadership, and the public about NARA. These include press releases as appropriate and congressional briefing papers for the Research Station's annual visit to Washington, DC. He continues to work with other NARA Outreach members to prepare one page updates on NARA progress that are posted on the website and distributed through other channels such as printed materials at meetings. Lowell has also advised students of the opportunities associated with Summer Undergraduate Research Experience (NARA-SURE).

The first Pilot Supply Chain (PSC) coalition has been identified in the Northern Rocky Mountain Ecoregion. Lowell actively participated in the stakeholder meetings, conference calls, and site visits. The Outreach team is now working to identify the second PSC. It was decided that western Oregon/Washington would be a likely candidate. So he has worked to identify key stakeholders from this area to invite to preliminary meetings. A concerted effort was made to engage the US Forest Service in these discussions. The initial meetings were held in March 2013; one in OR and the other in WA. A joint meeting with additional stakeholders was held in Vancouver, WA in April 2013. Identification of a different set of NARA stakeholders and clients is of relevance to several other NARA teams. Lowell have provided input to activities of other NARA teams such as The Environmentally Preferred Product group which is conducting informed Stakeholder (SH) Assessment interviews.

Lowell has also been actively leveraging NARA efforts through involvement with his research at the PNW Station. The Collaborative Forest Landscape Restoration Program (CFLRP) within the USDA Forest Service provides an opportunity to address both biomass availability issues and rural economic development. There are several projects in the Northwest that would be possible foundations for, or additions to, pilot supply chain coalitions. These projects also provide an existing partnership framework of stakeholders and clients. Another project overlaps some of NARA's goals and includes development of a Community Biomass Handbook. This is a multimedia electronic library to help community partners rapidly explore and initially evaluate a variety of bioenergy and other product options without having to invest significant time, resources, or pursue costly feasibility studies. It may enable communities to determine where they could potentially find a fit in the NARA PSC. A Research Joint Venture Agreement was entered into with David Smith (Oregon State University Wood Innovation Center) to conduct case studies describing pro forma business plans for Coos Bay, OR. The research team engages students, industry experts, OSU Extension, and community business leaders fostering bioenergy literacy. An interactive model will be developed that will allow potential investors to examine various facility capacities and product mixes to determine the optimum configuration and capabilities for a particular biomass processing center.

Recommendations/Conclusions

Work in identifying Pilot Supply Chain coalitions is progressing and generating interest among stakeholders and clients. Forest Service personnel working in rural communities and at the wildland-urban interface are especially following NARA progress. I will continue to engage these personnel and work to integrate existing partnerships into NARA's stakeholder and client groups. I have an active role in planning and conducting workshops and work will begin on organizing the first NARA conference. The PNW Research Station will publish a proceedings from this conference. Preparation of other materials, including one page information sheets documenting progress of other NARA teams, will continue.

Physical and Intellectual Outputs

Physical

Preparation of one page information sheets on:

- NARA and Advance Hardwood Biofuels Northwest – a one page document was developed to illustrate the differences between the 2 projects and alleviate confusion among the public
- NARA Supply Chain
- NARA Feedstocks

Pilot Supply Chain Coalition Meetings:

- Missoula, MT (2012: March 20-22, June 12-14, Sept. 9-14)
- Salem, OR (March 20, 2013)
- Chehalis, WA (March 26, 2013)
- Vancouver, WA (April 12, 2013)

Research Presentations

Lowell, Eini C. 2012. Video conference presentation to the Chief of the U.S. Forest Service that included describing the overall objectives and providing information on the NARA project as well as my role on the Outreach Team. "Conversation with the Chief" - June 28, 2012

Lowell, Eini C. 2012. "Bioeconomy Opportunity Zones or how do we get there from here?" An oral presentation made to the PNW Research Station Management Team, July 16, 2012.

Lowell, E.C. 2013. "The Northwest Advanced Renewables Alliance A Supply Chain to Aviation Biofuels and Environmentally Preferred Products." An oral presentation to Willamette National Forest Leadership and community leaders. Springfield, OR (1/25/2013) (will be available on-line shortly)

Other Publications

Sands, Yasmeen. 2011. Woody biomass research grant to launch biofuel industry in the Pacific Northwest. Press release issued from Pacific Northwest Research Station/USDA Forest Service. September 28, 2011.

Petersen, L. RENEWABLE ENERGY: USDA looks to jump-start wood-to-fuel conversion in Pacific Northwest. Land Letter. E&E Publishing, LLC. Wash., D.C. October 6, 2011 (Quoted in)

PNW Research Station, Communications and Applications. A briefing paper was prepared for the PNW Research Station Director visit to Capitol Hill. April 8-12, 2013.

Trainings, Education and Outreach Materials

Attendence at the International Wood Composites Symposium to network with other NARA members learning the of potential new technologies that could be incorporated into the pilot supply chain coalitions.

Task O-7: William D. Ruckelshaus Center

Key Personnel	Affiliation
Michael Kern	Ruckelshaus Center
Michael Gaffney	Ruckelshaus Center /DGSS

Task Description

The Ruckelshaus Center senior staff members will: 1). work with the Leadership Team to assist in the creation of a "Stakeholder Advisory Board,"; 2). facilitate monthly Leadership Team meetings, quarterly Advisory Board meetings, and an annual stakeholder meeting. Additionally the Center will assist in development of process protocol agreements and help engage policy makers through distribution of quarterly web-based newsletters and briefing papers from information provided by the Project Directors and Leadership Team and 3). participate in an assessment of public perceptions to "connect social and technical aspects" of the project through quantitative surveys and focus groups.

Supplemental Research Proposal

The Division of Governmental Studies and Services (DGSS) has been engaged on the NARA project since its inception – as a subcontractor to the William D. Ruckelshaus Center. The original set of deliverables for DGSS consisted solely of an assessment process to inform the development of the project Advisory Committee. In addition to completing that deliverable, DGSS has also over time participated in stakeholder (SH) Assessment and engagement efforts as a part of the Outreach team, and has begun active participation with the EPP team on physical-social asset assessment efforts. In order to secure additional effort from DGSS on the development and administration of SH Assessment interviews, and to facilitate the ground-truthing of large national database application to potential NARA communities through the use of existing DGSS community-level survey databases, DGSS requests additional funding through year four of the project. Specific deliverables from an additional $40,000 (annual basis) include:

1. Support access to DGSS's web-survey capacity ("Remark" software) to facilitate data entry from SH Assessment telephone interviews to be conducted by EPP team.
2. Substantial data aggregation, manipulation and analyses to render data from existing DGSS community surveys into a format useful for analysis to be used in conjunction with national data and SH Assessment interview results in a triangulated approach ("Ground-truthing") for NARA Region social asset assessment
3. Continued and expanded participation by elements of DGSS on the EPP team in support of team community stakeholder Assessment efforts
4. Support and participation in preparation and submission of reports, presentations, and publications

These efforts would be in addition to, and would complement, DGSS and Ruckelshaus participation in the Outreach team and contracted project management support activities.

Activities and Results

Task O-7.1. All of the Ruckelshaus Center responsibilities under this task have been completed. Ruckelshaus/DGSS worked extensively with the Outreach Team, Team Leaders and the executive team to develop a structure for categorizing and engaging diverse stakeholders. The Ruckelshaus Center/DGSS completed an interview-based assessment of informed observers and senior stakeholders, to obtain input on the formation and management of an Advisory Board for the NARA project. A summary report of that effort was presented to the project's executive committee, with recommendations regarding the interests that should be considered when selecting potential board members, along with a list of individuals who had been suggested as potential members. This report was used to inform the executive committee's selection of Advisory Board members and in the management of interactions with that board. The inquiry also addressed the more general topic of stakeholder engagement, and recommendations on that topic were passed on to the executive committee and the Outreach team.

Task O-7.*2.* The Ruckelshaus Center has been actively engaged in facilitation and project management support – specifically supporting the project leadership with team facilitation, agenda development and establishment of ground rules and meeting protocols. Ruckelshaus senior staff facilitated the monthly leadership team meetings since the project kick-off in 2011. The monthly leadership team meetings have focused on a number of relevant topics, including the Phase & Gate process and various discussions related to the management of NARA teams and units.

The Center assisted in the development, planning, and facilitation of the September 2011 and 2012 NARA annual meetings in Spokane, Washington and Missoula, Montana. The Center facilitated a lunch discussion at the 2012 annual meeting between NARA stakeholders and Outreach team leaders.

The Center invited interested SAFN members to attend the presentation on NARA at the 2012 International Wood Composites Symposium followed by an informal discussion with Dr. Wolcott and Ruckelshaus Center over lunch. The Ruckelshaus Center focused its spring 2012 Ruckelshaus Center Advisory Board meeting in Spokane on aviation biofuels and featured the PIs of NARA and the UW-led project on hybrid poplars.

The Center, with the NARA leadership committee, communications team and outreach team, worked closely with the Advanced Hardwood Biofuels Northwest (AHB) project to prepare a series of quarterly briefing papers aimed at jointly informing policy-makers in Washington, Oregon, Idaho, Montana and Northern California about the projects' progress. The first briefing was sent in September 2012, the second in February 2013, and the third will be sent in April 2013.

Task O-7.3. The Ruckelshaus Center/DGSS has been working with the NARA Environmental Preferred Products team on the assessment of potential NARA communities and targeted engagement of stakeholders in those communities, using a variety of research and outreach methods. This effort is focused on the identification and refinement of several social asset tools to better focus on these NARA communities. Included in the process of NARA community assessment will be the use of numerous existing DGSS survey data sets to validate the use of national-level data sets in the selection process.

Recommendations/Conclusions

- Continue to facilitate the monthly Leadership Team meetings, plan and facilitate the NARA annual meetings, and potentially help facilitate team or unit discussions if mutually agreeable
- Continue to produce joint quarterly policy-maker briefings with the UW AHB project.
- Continue to work with the EPP team on NARA community assessment protocols
- Continue participation on the Outreach Team regarding stakeholder engagement

Physical and Intellectual Outputs

- The Center invited SAFN members to attend the presentation on NARA at the 2012 International Wood Composites Symposium followed by an informal lunch discussion with Dr. Wolcott and Ruckelshaus Center.
- The Ruckelshaus Center focused its spring 2012 Ruckelshaus Center Advisory Board meeting in Spokane on aviation biofuels and featured the PIs of NARA and the UW-led project on hybrid poplars.
- The Center, with the NARA leadership committee, communications team and outreach team, worked closely with the Advanced Hardwood Biofuels Northwest (AHBN) project to prepare a series of quarterly briefing papers aimed at jointly informing 1,500+ policy-makers in Washington, Oregon, Idaho, Montana and Northern California about the projects' progress.

Research Presentations

Kern, M. and M. Gaffney. 2012. *Engaging Policy Makers & Advisory Board Assessment.* Presentation at 2012 NARA Annual Meeting, Missoula, MT, September 13-14.

Wolcott, M. 2012. *Northwest Advanced Renewables Alliance: A New Vista for Green Fuels, Chemicals and Environmentally Preferred Products.* Presentation at The William D. Ruckelshaus Center Advisory Board Meeting, Spokane, WA, April.

Kern, M. 2011. *The William D. Ruckelshaus Center: Fostering Collaborative Public Policy.* Presentation at WSU Extension and CAHNRS all Faculty Conference, Pullman, WA, October.

Other Publications

Kern, Michael. "Creating a 'Flight Path' for Aviation Biofuels. Ruckelshaus Center eNews Fall 2011 Nov. 2011 http://ruckelshauscenter.wsu.edu/eNewsFall2011Edition.html

Task O-8: GreenWood Long-Term Strategic Feedstock Production Analysis and Outreach Initiative

Key Personnel	Affiliation
Brian Stanton	GreenWood Resources, Inc.
Jake Eaton**	GreenWood Resources, Inc.

Task Description

GreenWood Resources was originally tasked with developing a strategic business plan using poplar feedstock from dedicated plantation and agro-forestry systems throughout the Pacific Northwest to supplement the broader NARA supply of logging residues. GreenWood was directed to develop a new project and statement of work in September, 2012 focused on softwood resource management. The objective was an integrated plan of blending the supply of forest residuals and purpose-grown, the latter serving as a strategic biomass reserve for bioenergy facilities.

The biomass reserve incorporated three components:

1. Energy feedstock intercropping with higher-value poplar stands managed for veneer and saw logs
2. Intercropping poplar energy feedstock with conventional agricultural crops;
3. Dedicated energy tree farm systems on marginal agricultural land

GreenWood's NARA project was designed to complement its AFRI subcontract to the University of Washington's, "*Advanced Hardwoods Biofuels Northwest"* in that its poplar focus was as a supplemental feedstock source that would be integrated with the primary feedstock supply from logging and thinning operations conducted in softwood stands (The sole focus of the *Advanced Hardwoods Biofuels Northwest* project is poplar as a standalone dedicated feedstock operation). The premise is that cyclicality in the construction market and its effect on saw log demand will introduce long-term volatility in the volume and pricing of forest residuals and thinnings. Accordingly, sole reliance on logging residuals and thinnings for NARA refineries will be attended by too much risk. Thus, GreenWood's approach was to assess the potential value of a second approach that combines residuals with a strategic component of plantations grown specifically for energy markets (i.e. purpose-grown trees or the reserve). GreenWood's premise is that feedstock supply portfolios that include purpose-grown energy plantations as an indispensable addition to forest residuals will better position NARA bio-refineries to secure their requisite financing.

Key project goals and deliverables were as follows:

1. **Strategic Planning** – We prepared a report identifying regional opportunities where poplar biomass makes economic sense as an adjunct to forest and agricultural residues either as dedicated energy tree farms or integrated agroforestry systems. We developed a business and

execution plan that considers multiple revenue sources including environmental credits. GreenWood was to have formulated a financing and investment plan to acquire investment from capital markets to build out Phase II full commercialization.

2. **Landowner and Community Development** – We worked with extension teams to develop an outreach program for farming and forestry communities that present poplar production opportunities. GreenWood is to work with the NARA extension initiative to identify key stakeholders and assist them in implementation of the plan.

Activities and Results

GreenWood initiated its project during the reporting period for the NARA Western Montana Corridor. An assessment was begun for dedicated poplar plantations as a biomass resource that could be converted into simple sugars for Rivertop Renewables. Rivertop Renewables is a chemistry company based in Missoula, MT that manufactures biodegradable and non-toxic chemicals and bio-products derived from renewable plant sugars. GreenWood met with Rivertop Renewables and learned about a Midwestern facility and its willingness to consider a similar one for Missoula, if a sugar source were readily available. GreenWood proposed a concept to Rivertop Renewables with annual demand at 60 million pounds of sugar. GreenWood's project design was to supply one-third of this demand – 20 million pounds – on an annual basis. Yield projections, plantation design features, growing costs, and varietal selections required by the project were based upon GreenWood's 2009 poplar field trial conducted in collaboration with Flathead Valley Community College in Kalispell, Montana. Parameters are listed below under B.2. The project plan was also to include partnering with Hybrid Energy Group on poplar feedstock production. GreenWood met with Hybrid Energy Group. They have been working with the City of Missoula to acquire and develop potential wastewater land application sites adjacent to the City's municipal treatment facility utilizing poplar plantations. Approximately 5% of Missoula's wastewater effluent could be used to grow poplar plantations during an initial demonstration phase after which GreenWood would expand the program through the NARA Outreach program.

Recommendations/Conclusions

GreenWood recommended a dedicated plantation to supply biomass to provide one-third of Rivertop Renewables' sugar demand. The essential parameters for management of a network of poplar plantations are detailed in the following table.

Model Parameter	Definition and Units
3	Biomass growth rate in bone dry tons-per-acre-per-year
5	Coppice rotation length in years
15	Per acre yield of biomass in bone dry tons at rotation
6	Per acre yield of sugar in bone dry tons
12,000	Per acre yield of sugar in dry pounds at rotation
60,000,000	Annual demand of sugar in pounds
33	Percentage of annual sugar demand to be supplied from poplar plantation managed in a combined strategy of refinery reserves and farmer based partnerships.
19,800,000	Annual demand of sugar to be met with poplar in pounds
1,650	Annual cut of poplar in acres
8,250	Total project size in acres

Physical and Intellectual Outputs

Conference Proceedings and Abstracts from Professional Meetings

Summers, B. 2012. Managing Woody-Biomass Supply-chain. Abstract for International Wood Composite Symposium, Seattle, WA, April 11-13, 2012.

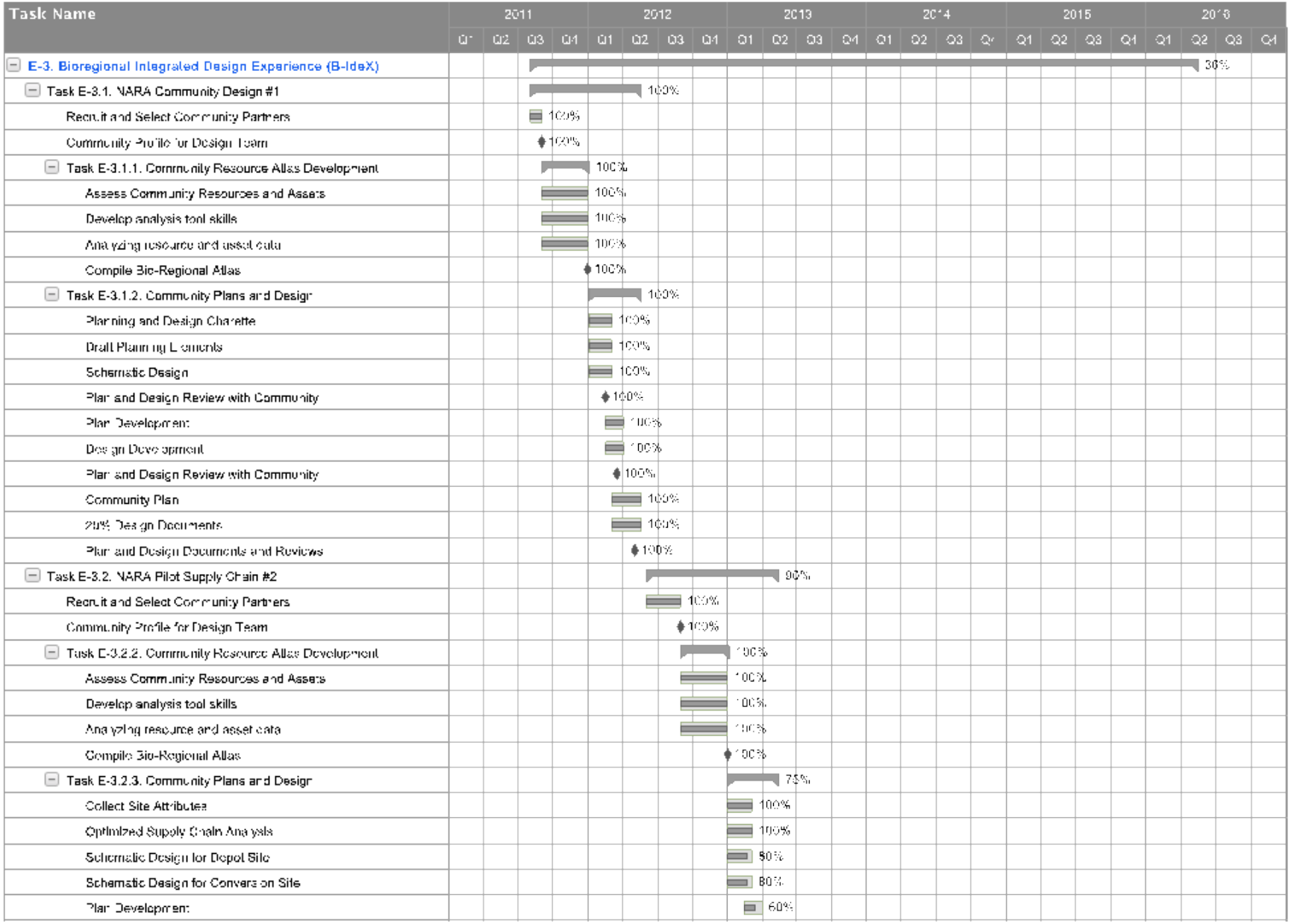
Research Presentations

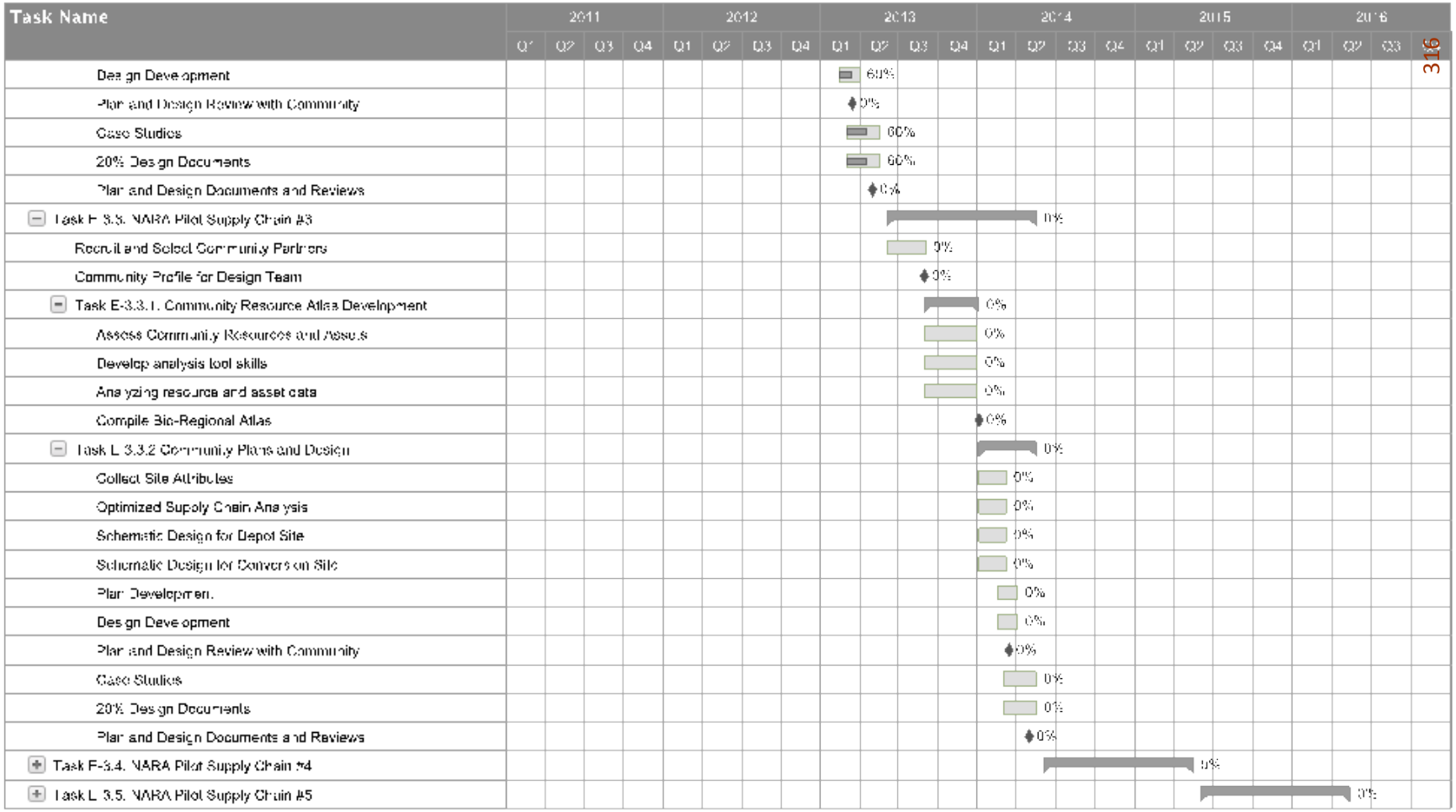
Summers, B. 2012. Managing Woody-Biomass Supply-chain. Presentation at International Wood Composite Symposium, Seattle, WA, April 11-13, 2012.

Smithhart, X., B. Stanton, and H. Brown. 2012. Strategic positioning of softwood plantations as a secondary feedstock resource for NARA bio-refineries. Poster presentation at NARA 2012 Annual Meeting, Missoula, MT, Sept 13-14, 2012.

Education_Wolcott_Laninga

NARA




Task Name
2011
2012
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Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
316
35 Design Development 60%
36 Plan and Design Review with Community 0%
37 Case Studies 60%
38 20% Design Documents 60%
39 Plan and Design Documents and Reviews 0%
40 Task E-3.3. NARA Pilot Supply Chain #3 0%
41 Recruit and Select Community Partners 0%
42 Community Profile for Design Team 0%
43 Task E-3.3.1. Community Resource Atlas Development 0%
44 Assess Community Resources and Assets 0%
45 Develop analysis tool skills 0%
46 Analyzing resource and asset data 0%
47 Compile Bio-Regional Atlas 0%
48 Task L 3.3.2 Community Plans and Design 0%
49 Collect Site Attributes 0%
50 Optimized Supply Chain Analysis 0%
51 Schematic Design for Depot Site 0%
52 Schematic Design for Conversion Site 0%
53 Plan Development 0%
54 Design Development 0%
55 Plan and Design Review with Community 0%
56 Case Studies 0%
57 20% Design Documents 0%
58 Plan and Design Documents and Reviews 0%
59 Task E-3.4. NARA Pilot Supply Chain #4 0%
78 Task L 3.5. NARA Pilot Supply Chain #5 0%

Education_Englund

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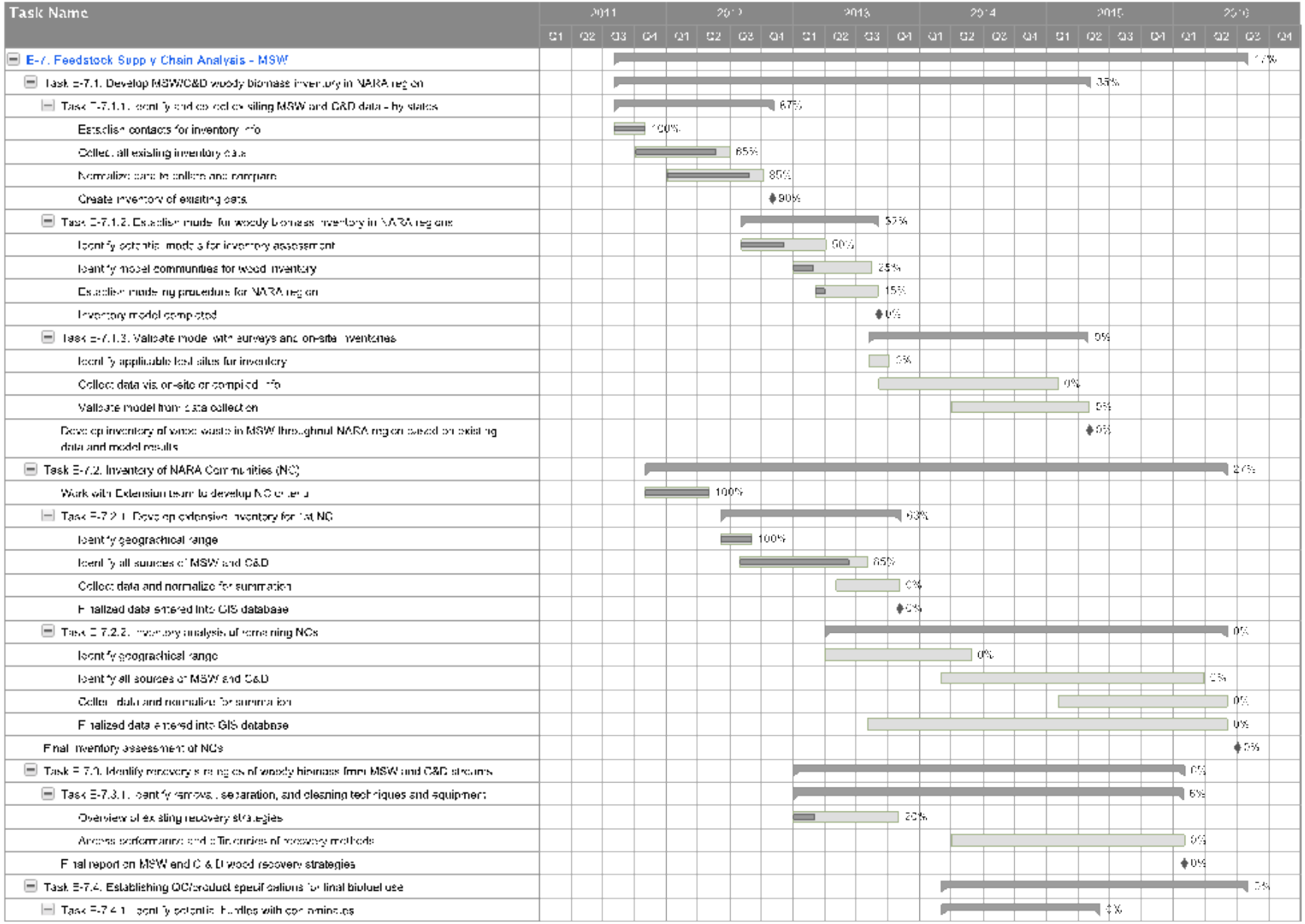


Task Name
2011
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Q1 Q2 Q3 Q4
38 Identify and categorize major contaminants for fuel production 0%
39 Determine contaminant levels in wood wastes 0%
40 Task 3-7.4.2. Develop specifications for "allowable materials" for biofuel usage 0%
41 Task 3-7.4.3. Develop supply chain logistics model to efficiently utilize recovered material for ideal end use 0%
42 Task 3-7.5. Develop wood composition model 0%
43 Collect initial data/info on wood materials in MSW 0%
44 Address historical data on wood materials in building construction 0%
45 Model wood material types in the C&D stream 0%
46 Final report on quality control and specifications for using MSW and C&D wood as biofuel 0%
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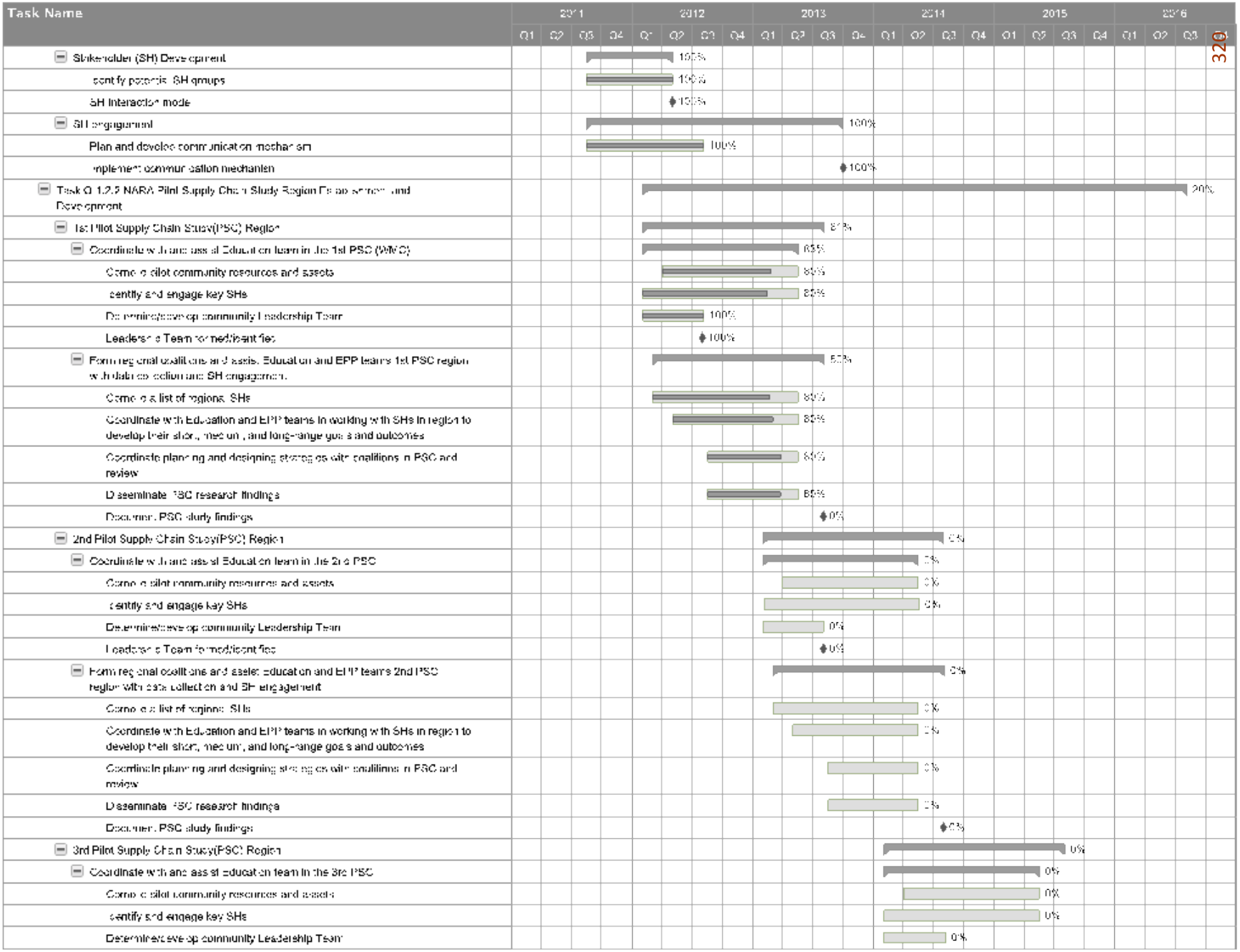
Outreach_Yadama_Englund

NARA

	Task Name	2011				2012				2013				2014				2015				2016			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	O-1. Washington State University NARA Extension Initiative																								43%
2	Task O-1.1. Bioenergy Literacy																								35%
3	Task O-1.1.1. Develop an energy literacy platform for ease of communication																								40%
4	Establish technology transfer mechanisms												90%												
5	Coordinate and compile information from each of the NARA Research Teams																								25%
6	Network with Outreach Team Partners																								32%
7	Forest Business Network (FBN)																								38%
8	Link NARA on FBN																								
9	Integrate NARA into FBN newsletters																								25%
10	Assist NARA with WT Pilot Community												92%												
11	Assist NARA with other PSC study regions																								0%
12	Coordinate NARA's Role in Small Log Conf												100%												
13	USDA FS PNW																								30%
14	State Extension Personnel (OR, ID, MT)																								30%
15	Rockefellow Center																								25%
16	GreenWood Resources																								30%
17	Task O-1.1.2. Outreach Activities for Disseminating Knowledge and Receiving Feedback																								39%
18	Assess and determine dissemination mechanism												55%												
19	Design and draft agenda for the outreach activity in coordination with corresponding team																								30%
20	Disseminate NARA findings (Conferences, Fact Sheets, Knowledge Base, etc.)																								30%
21	Managing Woody Biomass Supply Chain Symposium																								
22	Compile and catalog activity outcomes																								
23	Program development and coordinate NARA related sessions for NW Bioenergy Research Symposium																								
24	Small Log Conference with FBN																								
25	Compile and catalog activity outcomes																								
26	Develop program, coordinate and organize NARA Conference 1																								
27	Compile and catalog conference proceedings																								
28	Develop program, coordinate and organize NARA Conference 2																								
29	Compile and catalog conference proceedings																								
30	Task O-1.1.3. Catalog Activity Outcomes and Benchmark Reports and Studies																								23%
31	Catalog benchmark reports and studies related to biofuels, bioenergy, and co products																								30%
32	Develop and conduct applied research on pre-conversion of woody biomass and alternative value-added options																								23%
33	Task O-1.2. Build Pilot Supply Chain Coalitions																								51%
34	Task O-1.2.1. Define Stakeholders and Articulate Communication Mechanisms												100%												


Task Name
2011
2012
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Q1 Q2 Q3 Q4
35 Stakeholder (SH) Development
36 Identify potential SH groups
37 SH Interaction mode
38 SH engagement
39 Plan and develop communication mechanism
40 Implement communication mechanism
41 Task O 1.2.5 NARA Pilot Supply Chain Study Region Establishment and Development
42 1st Pilot Supply Chain Study(PSC) Region
43 Coordinate with and assist Education team in the 1st PSC (WWC)
44 Compile pilot community resources and assets
45 Identify and engage key SHs
46 Determine/develop community Leadership Team
47 Leadership Team formed/identified
48 Form regional coalitions and assets: Education and EPP teams 1st PSC region with data collection and SH engagement
49 Compile a list of regional SHs
50 Coordinate with Education and EPP teams in working with SHs in region to develop their short-, mid-, and long-range goals and outcomes
51 Coordinate planning and designing strategies with coalitions in PSC and review
52 Disseminate PSC research findings
53 Document PSC study findings
54 2nd Pilot Supply Chain Study(PSC) Region
55 Coordinate with and assist Education team in the 2nd PSC
56 Compile pilot community resources and assets
57 Identify and engage key SHs
58 Determine/develop community Leadership Team
59 Leadership Team formed/identified
60 Form regional coalitions and assets: education and EPP teams 2nd PSC region with data collection and SH engagement
61 Compile a list of regional SHs
62 Coordinate with Education and EPP teams in working with SHs in region to develop their short-, mid-, and long-range goals and outcomes
63 Coordinate planning and designing strategies with coalitions in PSC and review
64 Disseminate PSC research findings
65 Document PSC study findings
66 3rd Pilot Supply Chain Study(PSC) Region
67 Coordinate with and assist education team in the 3rd PSC
68 Compile pilot community resources and assets
69 Identify and engage key SHs
70 Determine/develop community Leadership Team
100%
100%
100%
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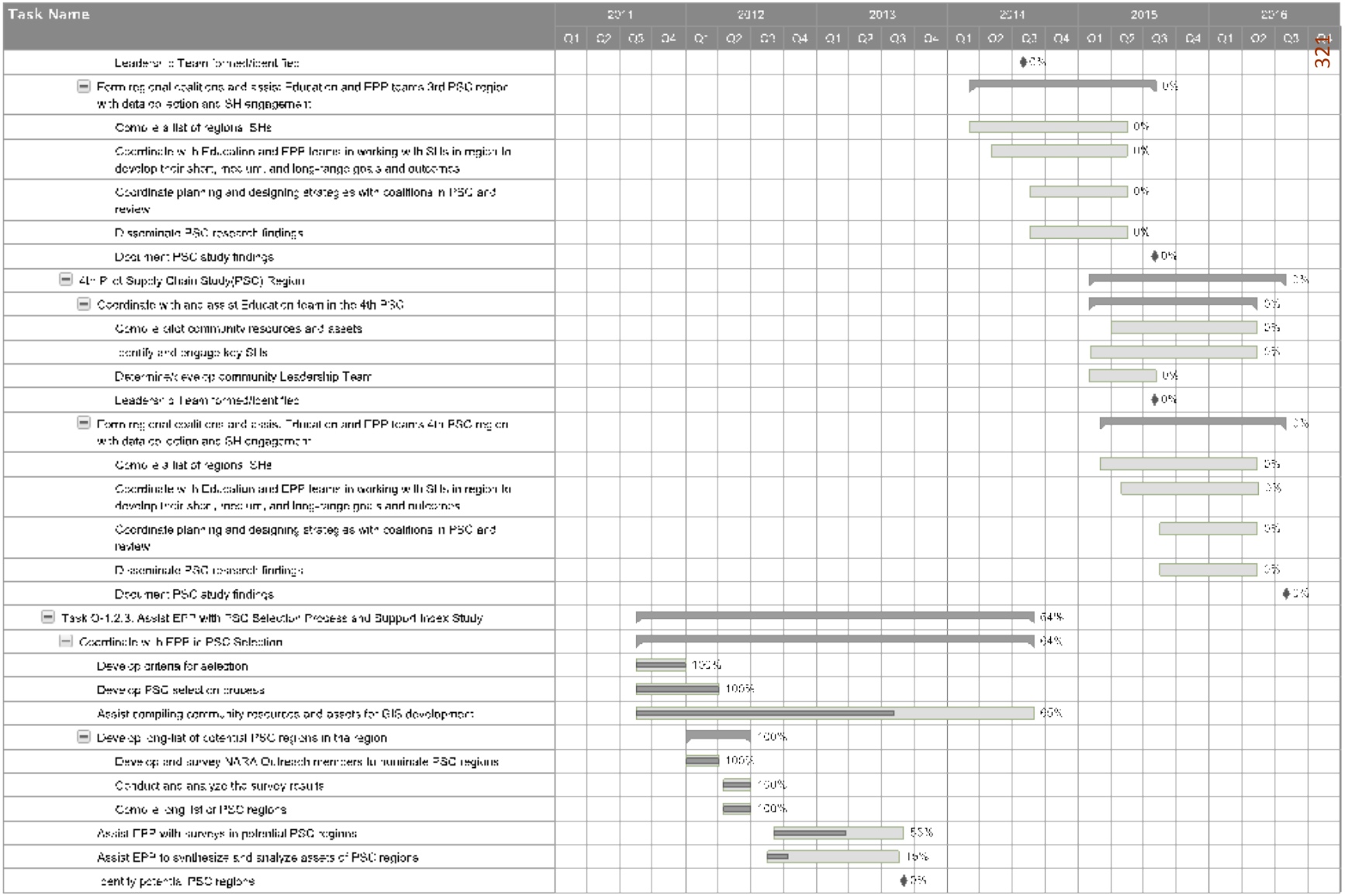
Task Name
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2016
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
71 Leadership Team formed/identified 0%
72 Form regional coalitions and assist Education and EPP teams 3rd PSC region with data collection and SH engagement 0%
73 Compile a list of regional SHs 0%
74 Coordinate with Education and EPP teams in working with SHs in region to develop their short, medium, and long-range goals and outcomes 0%
75 Coordinate planning and designing strategies with coalitions in PSC and review 0%
76 Disseminate PSC research findings 0%
77 Document PSC study findings 0%
78 4th Postal Supply Chain Study(PSC) Region 0%
79 Coordinate with and assist Education team in the 4th PSC 0%
80 Compile a list community resources and assets 0%
81 Identify and engage key SHs 0%
82 Determine/develop community Leadership Team 0%
83 Leadership Team formed/identified 0%
84 Form regional coalitions and assist Education and EPP teams 4th PSC region with data collection and SH engagement 0%
85 Compile a list of regional SHs 0%
86 Coordinate with Education and EPP teams in working with SHs in region to develop their short, medium, and long-range goals and outcomes 0%
87 Coordinate planning and designing strategies with coalitions in PSC and review 0%
88 Disseminate PSC research findings 0%
89 Document PSC study findings 0%
90 Task O-1.2.3. Assist EPP with PSC Selection Process and Support Index Study 64%
91 Coordinate with EPP in PSC Selection 64%
92 Develop criteria for selection 100%
93 Develop PSC selection process 100%
94 Assist compiling community resources and assets for GIS development 65%
95 Develop long-list of potential PSC regions in the region 100%
96 Develop and survey NASA Outreach members to nominate PSC regions 100%
97 Conduct and analyze the survey results 100%
98 Compile long list of PSC regions 100%
99 Assist EPP with surveys in potential PSC regions 55%
100 Assist EPP to synthesize and analyze assets of PSC regions 15%
101 Identify potential PSC regions 0%

Outreach_Kolb

NARA

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	Task Name	2011				2012				2013				2014				2015				2016			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Q 2. Montana State University NARA Extension Initiative																								33%
2	Attend kick-off meeting																								
3	Introduce NARA to Montana Biomass Working Group and use to develop Montana NARA advisory group																								
4	Introduce NARA to Montana Forest Council																								
5	Introduce NARA to Montana Logging Association																								
6	Develop article about NARA and publish on Montana Tree Farm and forest landowner newsletter, as well as send out to all Montana State county Extension Agents																								
7	Develop NARA web site on MSU Extension web page																								
8	Develop database and periodically update of potential feedstock suppliers																								
9	Work with entire NARA program and MT Biomass working group to develop test bed site criteria and rubric																								
10	Work with Montana Biomass working group to collect and collect data and applications from landowners, industry and extension stakeholders with regard to potential test bed sites for Montana																								
11	Review data and rank sites for potential NARA Communities																								
12	Organize and conduct meetings and field trip with Montana Nara working group and potential NARA Communities																								
13	Summarize results from MT NARA working group and present findings to NARA regional alliance																								
14	Communicate updates on biomass specifications to stakeholders via web page, newsletter updates and working group updates																								
15	Organize meetings with selected NARA community and stakeholders to update on feedstock developments																								
16	Organize and conduct field trips to potential feedstock sites and harvesting practices within selected NARA community (s)																								
17	Write final NARA program summary and impacts for Montana Stakeholders and publish in landowner newsletter and web page																								

Outreach_Morgan

NARA 323

	Task Name	2011				2012				2013			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	O-3. University of Montana NARA Extension Initiative												88%
2	Attend kick-off meeting and subsequent NARA region-wide events												85%
3	Participate with NARA, MSU Extension, and Montana Biomass Working Group (MBWG) as member of both NARA and MBWG												85%
4	Introduce NARA to Montana Wood Products Association (MWPA), provide updates to MWPA at periodic meetings												85%
5	Cooperate with NARA, MSU Extension, and MBWG in developing test bed site criteria in Montana								100%				
6	Assist with updating of Montana NARA database developed & maintained by MSU Extension												80%
7	Advance the western Montana corridor as a NARA Pilot Community								100%				
8	Participate in NARA field trip planning & execution with MSU Extension												100%
9	Participate in NARA community meetings and stakeholder groups in Montana with MSU Extension												85%

Outreach_Leavengood

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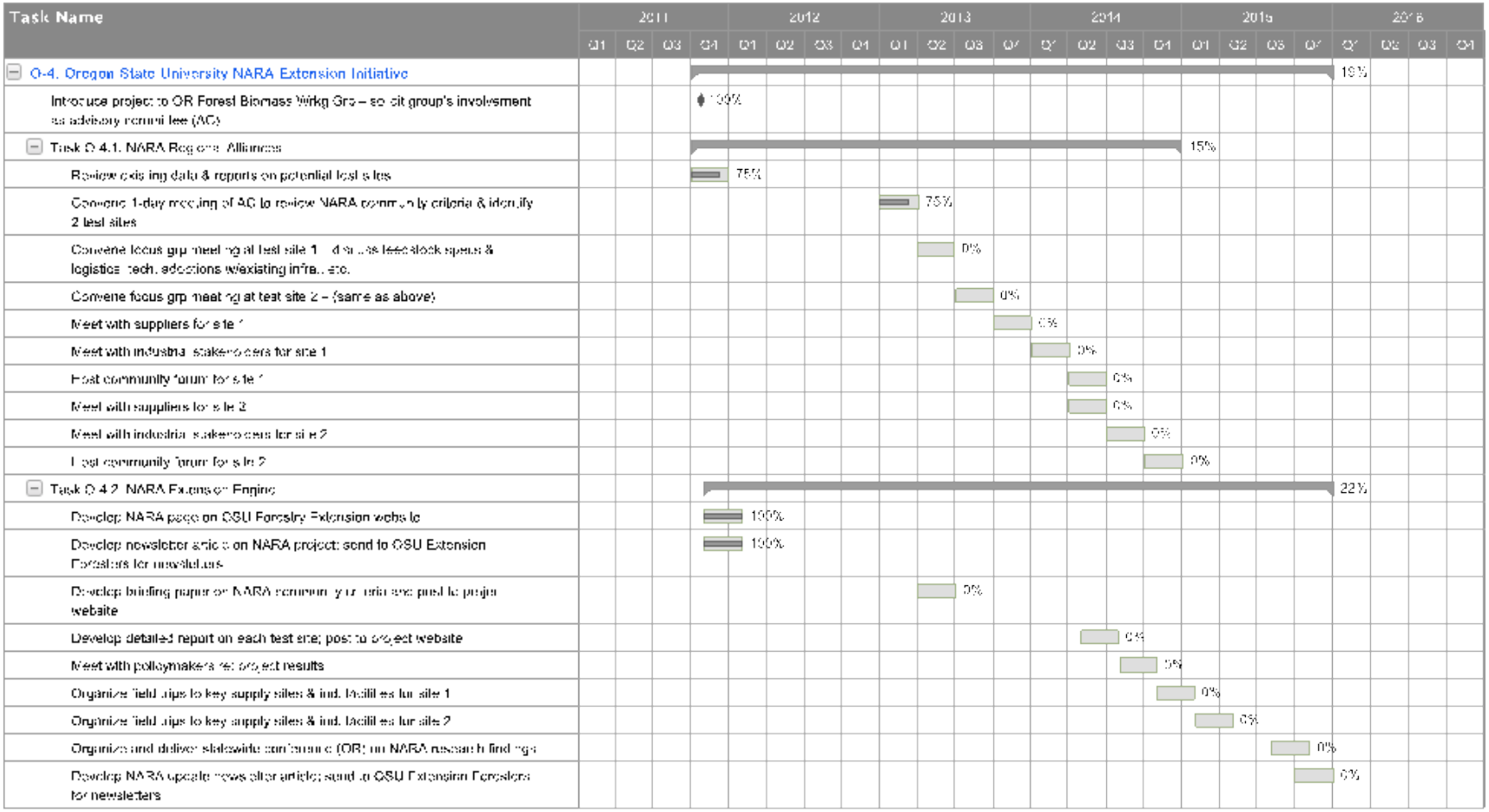
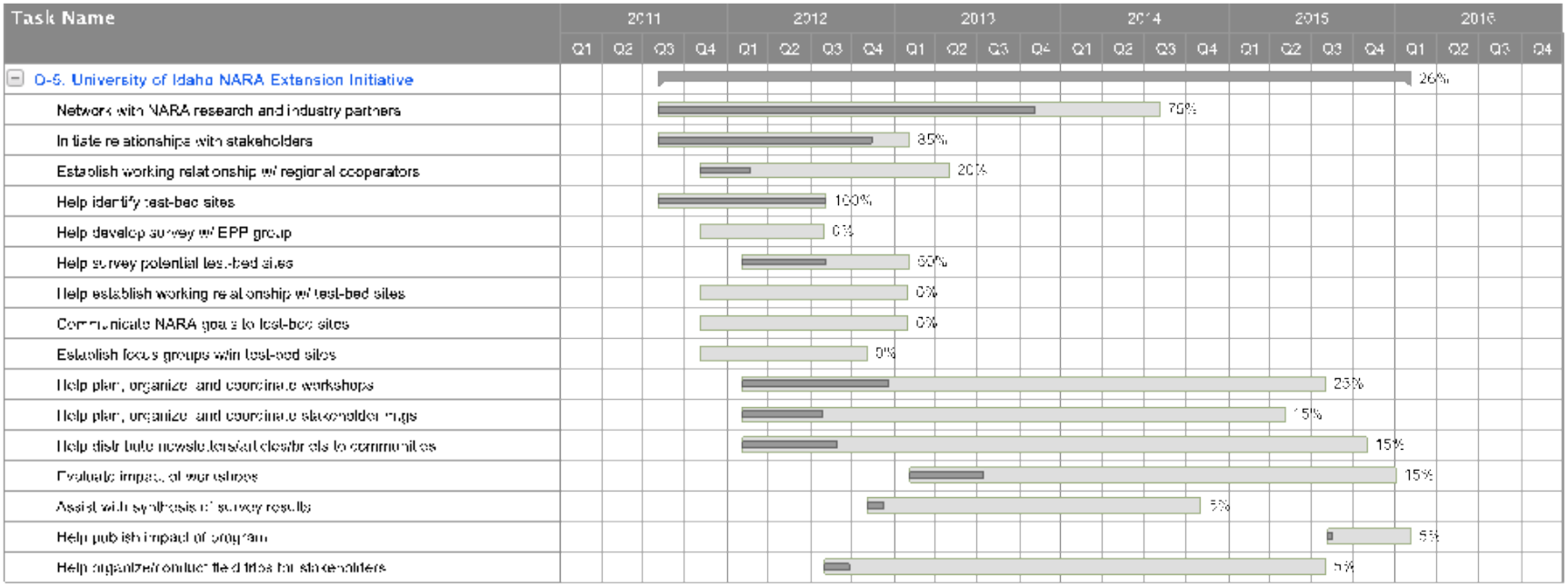


Outreach_Brooks

NARA

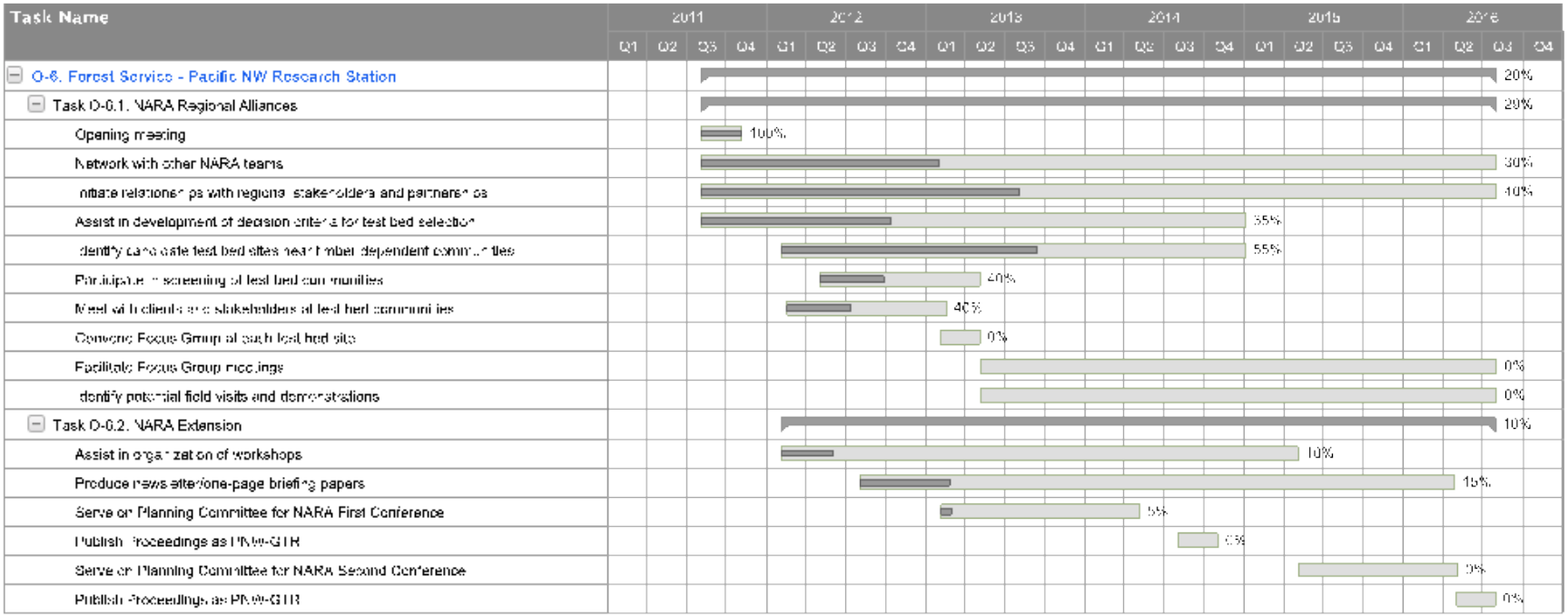
325



Outreach_Lowell

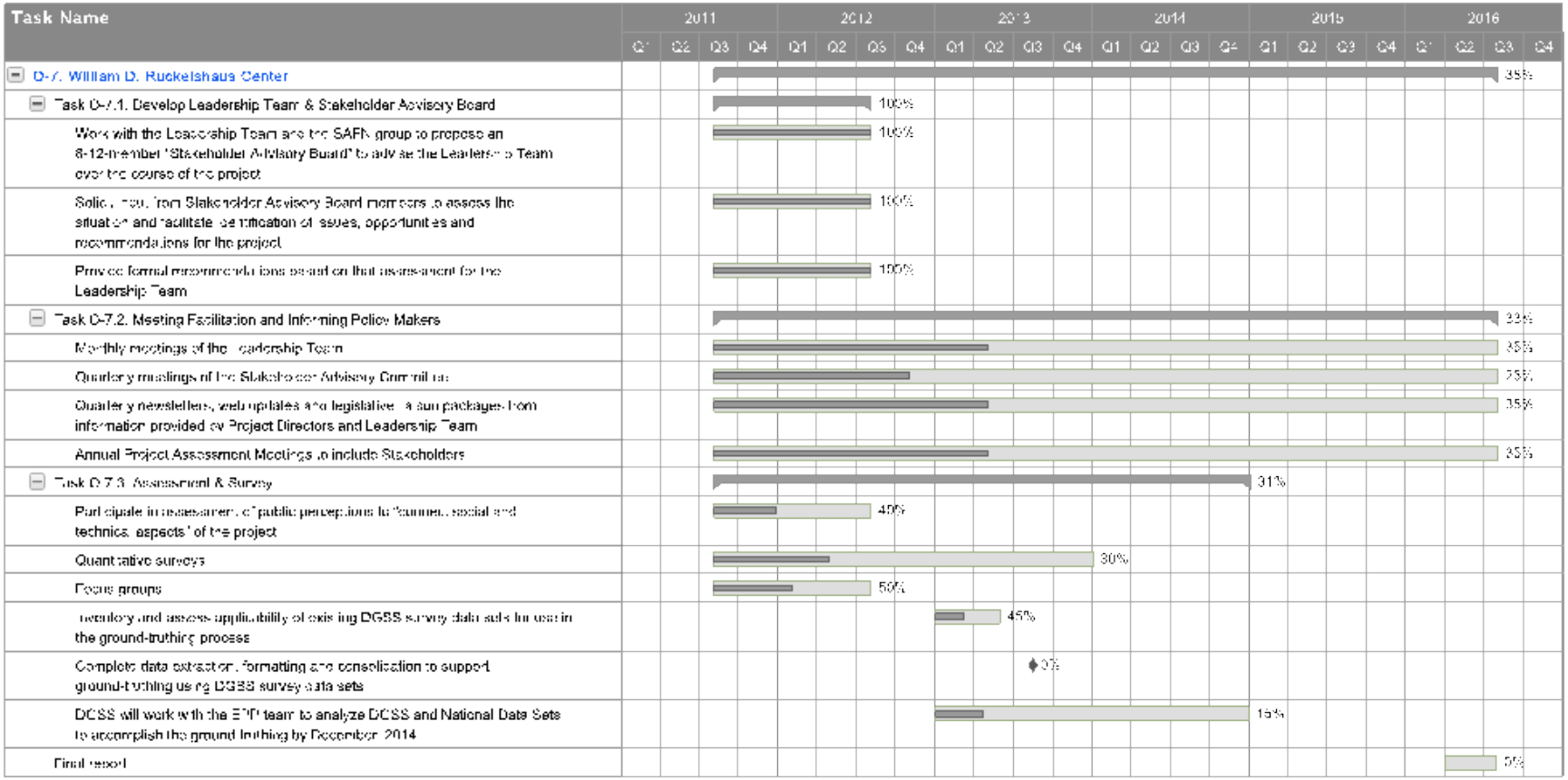
NARA

326



Outreach_RuckelshausCtr

NARA 327



Outreach_Greenwood

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