National Institute of Food and Agriculture
Bioeconomy-Bioenergy-Bioproducts
Portfolio Strategic Plan
2014 Progress and Implementation Report

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Table of Contents

Introduction

The National Institute of Food and Agriculture (NIFA) Bioeconomy-Bioenergy-Bioproduct (B3) Program Portfolio supports research, development, demonstration, extension, and education at the nexus of rural economic development, climate change, environmental services, food security, and National energy security. NIFA-supported projects build upon previous investments in basic and applied research, and leverage resources from other Federal agencies (e.g. Department of Energy [DOE], the Environmental Protection Agency [EPA], the Federal Aviation Administration [FAA]), other USDA agencies (Agricultural Research Service, Forest Service, Farm Services Agency, Rural Development, National Resources Conservation Service), and extensive private sector investment. The Bioeconomy-Bioenergy-Bioproduct Program Portfolio is a critical component of a cline of activities beginning with conceptual and foundational, research and development (R&D), applied R&D, sustainability analysis (economic, social, environmental), pre-commercialization R&D and demonstration, community and individual education, and workforce development, leading to DOE-supported pilot scale biorefineries, USDA Rural Development commercial biorefinery loan guarantees and Biomass Crop assistance programs, and ultimately private investment in the emerging bioeconomy sectors of biofuels, biopower, and biobased products.

Vision: Develop regional sustainable production systems for biofuels, biopower, and biobased products, through partnerships and collaboration, for increased rural economic vitality and national energy security.

Mission:

- Support transformational discovery, learning and outreach programs, and partnerships that advance the development of sustainable regional systems for the production of biofuels, biopower, and biobased products.
- Encourage integrated transdisciplinary research, education, extension collaboration;
- Reduce risk for diverse stakeholders (farmers, foresters, land owners, resource managers, consumers, industry, policymakers, investors)
- Ascertain regionally-appropriate feedstock available at requisite quantity, quality, and cost for emerging or extant fuel, power, or product conversion/production platforms;
- Enhance sound understanding of impacts on rural communities and economies, environmental services and natural resource management, and techno-economic feasibility.

History of the Program Portfolio

Prior to fiscal year (FY) 2010, the NIFA Bioenergy and Bioproduct Program Portfolio was made up of: a National Research Initiative (NRI) program researching biocatalysts for cellulosic ethanol (~ $5 M/annum); the Joint USDA-DOE Feedstock Genomics Program for Bioenergy (FGPB, $2 M); the Critical Agricultural Material Program (CAM, $1M); the Biodiesel Education Program (BEP, $1 M); the Small Business Innovation Research (SBIR) Program (~$2-4 M/annum); and the USDA/DOE Biomass Research and Development Initiative (BRDI, ~ $20 M). Fiscal year (FY) 2010 was the first year that the Agriculture and Food Research Initiative (AFRI) solicited competitive grant applications for sustainable bioenergy under the auspice of a grand societal challenge area. The new FY 2010 AFRI Program replaced the NRI program with the Sustainable Bioenergy Challenge comprised of: the Regional Sustainable Bioenergy System Coordinated Agricultural Project (CAP) Program ($136 M over five years on a continuation basis, 5 awards); a single Regional Bioenergy System CAP Planning Grant ($250 K); the Bioenergy Education Program ($10 M over 5 years, 2 awards); The Loblolly Pine Genome Program ($15 M over five years on a continuation basis, one award); and three Standard Research Programs, Carbon Sequestration, Co-products, and Feedstock Crop Protection. No AFRI solicitation for new awards was published in FY 2011, but BRDI increased to $28 M with FGPB, CAM, BEP, and SBIR remaining unchanged. In FY 2012, new AFRI awards were made in the Regional Feedstock Genomics CAP Program ($10 M over five years on a continuation basis, one award) and four AFRI Standard Research Grant Programs ($8 M, Policy Options, Environmental Implications of Land-use Change, Pollinator and Wildlife Impacts, and Socioeconomic Impacts). BRDI increased to $30 M with FGPB, CAM, BEP, and SBIR remaining unchanged. In FY 2013, new AFRI awards were made in the Regional Feedstock Genomics CAP Program ($10 M over five years on a continuation basis, one award) and one AFRI Standard Research Grant Programs ($3 M, Water Impacts). BRDI increased to $40 M with FGPB, CAM, BEP, and SBIR remaining unchanged. There were no new AFRI awards made in FY 2014 and the BRDI Program was not funded due to a Congressional Budget Continuing Resolution (CR), with FGPB, CAM, BEP, and SBIR remaining unchanged.

Currently, there are 171 AFRI projects summing to more than $126,720,503 million in the portfolio (see appendix A), and the REEport systems lists 291 projects (competitive and capacity).

Moving forward, NIFA's Bioeconomy-Bioenergy-Bioproduct (B3) Program Portfolio will contribute significantly to the mission of USDA to provide leadership on agriculture production, rural economic development, natural resources management, food security, and climate-related issues, based on sound public policy, the best available science, and efficient management. Its goal is to develop sustainable agriculture and forestry-based strategies for: rural economic development, energy security, ecosystem services and food production landscapes.

Knowledge Areas

Bioeconomy-Bioenergy-Bioproducts has the potential to affect almost all aspects of our life; from the environment to human health, to production agriculture, forestry and range. Hence, bioenergy/bioeconomy touches on almost all of the NIFA knowledge areas; however the ones listed below are most directly connected to the portfolio.

TOPIC I. NATURAL RESOURCES AND ENVIRONMENT

SOIL
101. Appraisal of Soil Resources
102. Soil, Plant, Water, Nutrient Relationships
103. Management of Saline and Sodic Soils and Salinity
104. Protect Soil from Harmful Effects of Natural Elements

WATER
111. Conservation and Efficient Use of Water
112. Watershed Protection and Management

FOREST AND RANGE RESOURCES
121. Management of Range Resources
122. Management and Control of Forest and Range Fires
123. Management and Sustainability of Forest Resources
125. Agroforestry

NATURAL RESOURCES, GENERAL
131. Alternative Uses of Land
132. Weather and Climate
133. Pollution Prevention and Mitigation
134. Outdoor Recreation
135. Aquatic and Terrestrial Wildlife
136. Conservation of Biological Diversity

AIR
141. Air Resource Protection and Management

TOPIC II. PLANTS AND THEIR SYSTEMS

PLANT PRODUCTION
201. Plant Genome, Genetics, and Genetic Mechanisms
202. Plant Genetic Resources
203. Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204. Plant Product Quality and Utility (Pre-harvest)
205. Plant Management Systems
206. Basic Plant Biology

PLANT PROTECTION
211. Insects, Mites, and Other Arthropods Affecting Plants
212. Pathogens and Nematodes Affecting Plants
213. Weeds Affecting Plants
214. Vertebrates, Mollusks, and Other Pests Affecting Plants
215. Biological Control of Pests Affecting Plants
216. Integrated Pest Management Systems

TOPIC III. ANIMALS AND THEIR SYSTEMS

ANIMAL PRODUCTION
302. Nutrient Utilization in Animals
307. Animal Management Systems

TOPIC IV. AGRICULTURAL, NATURAL RESOURCE, AND BIOLOGICAL ENGINEERING
401. Structures, Facilities, and General Purpose Farm Supplies
402. Engineering Systems and Equipment
403. Waste Disposal, Recycling, and Reuse
404. Instrumentation and Control Systems
405. Drainage and Irrigation Systems and Facilities

TOPIC V. FOOD AND NON-FOOD PRODUCTS: DEVELOPMENT, PROCESSING, QUALITY, AND DELIVERY

NON-FOOD
511. New and Improved Non-Food Products and Processes
512. Quality Maintenance in Storing and Marketing Non-Food Products

TOPIC VI. ECONOMICS, MARKETS, AND POLICY
601. Economics of Agricultural Production and Farm Management
602. Business Management, Finance, and Taxation
603. Market Economics
604. Marketing and Distribution Practices
605. Natural Resource and Environmental Economics
606. International Trade and Development
608. Community Resource Planning and Development
609. Economic Theory and Methods
610. Domestic Policy Analysis
611. Foreign Policy and Programs

TOPIC VII. HUMAN NUTRITION, FOOD SAFETY, AND HUMAN HEALTH AND WELL-BEING

FOOD SAFETY
711. Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

HUMAN HEALTH
723. Hazards to Human Health and Safety

TOPIC VIII. FAMILIES, YOUTH, AND COMMUNITIES
803. Sociological and Technological Change Affecting Individuals, Families, and Communities
804. Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures
805. Community Institutions, Health, and Social Services
806. Youth Development

Portfolio-level highlights for FY2014

The Bioeconomy-Biofuel-Bioproduct team (Team B3) focused on post-award management, including completing work on the proceedings 2013 Project Directors' Meeting held in conjunction with the Association for the Advancement of Industrial Crops (AAIC). The proceedings will be published in book form by AAIC and will include overviews of many of the current projects, including all of the Regional Bioenergy Coordinated Agricultural Projects (CAPs). Purdue University is managing the publication and it will be released in early 2015.

The five Regional Bioenergy System CAPs initiated in 2010 entered their fourth year of funding with four of the five CAPs reaching or exceeding significant milestones. Two other CAPs, initiated in 2012 and 2013, respectively, are also making progress. The CAPs led by Penn State, Washington State, and University of Washington sharpened their focus on working with industrial partners on producing alternative jet fuel (AJF). AJF has significant pull-through from both civilian and military aviation. In addition to liquid transportation fuel, all seven CAPs have broadened their work with regional partners on developing value-added co-products and additional biobased products that will incentivize landowners and producers to become early adopters in the planting of perennial feedstocks such as poplar, willow, energy cane and perennial grasses. The LSU-led CAP has completed commissioning of a valuable pilot plant at the Audubon Sugar Institute in Baton Rouge, LA, that will serve the region for decades to come by allowing new processes for the production of fuels and biobased products to be developed and tested and for training the next generation of process engineers.

Team B3 worked closely with other Federal agencies.

- Co-managed the Joint Feedstock Genomics Program for Bioenergy with the Department of Energy (DOE) Office of Science. 10 new awards, including two

important genomic studies on field pennycress (an oilseed feedstock) and cold tolerance in switchgrass funded by NIFA.
- Co-lead the Biomass Research and Development Initiative with DOE Bioenergy Technology Office (BETO).
- Co-lead the Federal Agency Feedstock Research Coordination Group with DOE BETO.
- Provided key contributions to the National Alternative Jet Fuel Strategic Plan led by the Federal Aviation Administration (FAA).

Bioenergy Bioeconomy Bioproducts (B3) Portfolio Programs

The Bioenergy Bioeconomy Bioproducts (B3) Portfolio is organized into programs under each. The following sample accomplishments are listed by program and goal (note: this is not a comprehensive list, but is illustrative of the types of projects supported).

Program 1. Agriculture and Food Research Initiative Sustainable Bioenergy Challenge: Regional Bioenergy System Coordinated Agricultural Projects

Agriculture and Food Research Initiative Sustainable Bioenergy Regional System Coordinated Agricultural Project Description

The USDA National Institute of Food and Agriculture (NIFA) Agriculture and Food Research Initiative (AFRI) is funding seven regional integrated Coordinated Agricultural Projects (CAPs) targeting enhanced rural prosperity and National energy security through the development of regional systems for the sustainable production of advanced biofuels and biobased products. The regional systems focus on non-food dedicated biomass feedstocks such as perennial grasses, sorghum, energy cane, oilseed crops, and woody biomass. The CAPs are intended to enhance existing agricultural systems, create new job opportunities in rural areas, and support the existing and expanding North American fossil–based energy systems by contributing to the potential for these finite resources to be used at more moderate rates over a longer period of time thus potentially improving economic sustainability and slowing the rate of climate change.

Seven academic, industry, government, and non-governmental institution consortia in the Pacific Northwest (2), Southeast (2), Rocky Mountains, Northeast, and the Central United States have been awarded a total of $156 million over five years. Each project will facilitate the development of a sustainable regional supply chain by integrating research, education (workforce development) and Extension/outreach/technology transfer to support bioenergy feedstock genetic development, sustainable feedstock production, post-harvest logistics (densification, transportation, storage, preprocessing), conversion to biofuels and biobased products, and marketing and distribution. Through a transdisciplinary approach, the projects will be working with the communities that will be impacted by these emerging supply chains and will be collecting data that will be

used to analyze the impacts of these systems on environmental, social and economic sustainability. These projects involve: 27 States; 31 Land-Grant Universities (including 6 minority-serving institutions); 6 Non Land-Grant Public Universities; 1 Community College Regional Consortium; 2 Private Non-Profit institutions; 9 USDA Federal Partners; 2 DOE Federal Partners; and 23 Industrial Partners. The projects are intended to test the feasibility of developing regional bioenergy systems which operate at a scale and level of integration to make them cost effective.

In addition to the seven regional bioenergy CAPs, NIFA is funding two bioenergy education grants ($5 M each over five years). The education projects target increased energy literacy, especially in communities impacted by emerging regional bioenergy systems, and include rural, minority serving, and tribal schools, colleges (e.g. the College of the Menominee Nation, a tribal Land Grant institution), and universities. The education projects also provide workforce training to support regional energy efforts across the supply chain from crop production through biorefinery operation.

The seven AFRI Regional Bioenergy CAPs include:

- *System for Advanced Hardwood Biofuels in the Pacific Northwest (AHB-PNW)* is led by the University of Washington which is using purpose-grown hardwoods as the feedstock for the production of gasoline and aviation fuel.
- *Northwest Advanced Renewables Alliance (NARA): A New Vista for Green Fuels, Chemicals, and Environmentally Preferred Products* is led by Washington State University and is working with the region's forest products industry to convert waste from logging and thinning operations into butanol (compatible with gasoline, aviation fuel) and other industrial chemicals.
- *Central USA (CenUSA) Agro-ecosystem Approach to Sustainable Biofuels Production Via the Pyrolysis-Biochar Platform* is led by Iowa State University and will create region-enhancing ecosystem services growing switchgrass and other perennial grasses on marginal lands and buffers bordering traditional row crop production for the production of biobased products.
- *Sustainable Bioproduct Initiative (SUBI): A Regional Program for Production of Multiple Agricultural Feedstocks and Processing to Biofuels and Biobased Chemicals* led by Louisiana State University is using energy cane and sweet sorghum to produce butanol, aviation fuel, and other industrial chemicals.
- *Southeast Partnership for Integrated Biomass Supply Systems (IBSS)* led by the University of Tennessee is using switchgrass and woody biomass to produce gasoline, butanol and aviation fuel.
- *NEWBio: Northeast Woody / Warm-season Biomass Consortium* led by the Pennsylvania State University is using switchgrass, winter ryegrass, Miscanthus and purpose-grown willow to produce advanced biofuels and industrial chemicals.

- *BANR: Bioenergy Network Alliance of the Rockies* led by Colorado State University is determining the economic, environmental, and social feasibility of harvesting insect-damaged trees and converting them to Advanced liquid transportation fuels and carbon-sequestering biochar soil amendments using a mobile thermochemical (pyrolysis) conversion platform.

CAP Project Example One:

Northwest Advanced Renewables Alliance: Wood to Wing

Civil and military jet aviation is central to the economic well-being and national security of the United States. Both commercial aviation (http://www.caafi.org/, http://www.masbi.org/solutions-in-action/aviation-biofuels-development-initiatives) and the military (Navy, Air Force) have significant interest in alternative jet fuel (AJF). Currently only jet fuels derived from petroleum are available on a cost-competitive basis. As a result, U.S. aviation faces challenges lined to petroleum-based fuel consumption, such as price instability, harmful environmental impacts, and supply uncertainty. The use of AJFs can expand domestic energy sources, facilitate a diverse, secure, and reliable fuel supply, contribute to price and supply stability, reduce emissions that impact air quality and global climate, and generate economic development.

Almost half of the Pacific Northwest is covered by forests, which are currently used for a host of different products. There are many points along the supply chain where waste wood exist and can provide a significant source of potential biomass. The Northwest Advanced Renewables Alliance (NARA, https://www.nararenewables.org/) led by Washington State University NARA works to harness woody biomass for alternative biofuel. These steps begin with logging residues currently burned in the forest and extend to significant amounts of wood that end up in landfills as construction and demolition waste. NARA researchers are taking a multi-pronged approach for the development and sustainable production of feedstocks derived from wood materials. In particular, they will be studying the use of forest residues from timber harvest and wood waste from municipal solid waste sites. They aim to optimize the harvesting, transportation and processing systems that are already in place for woody biomass for use in biofuel/bioproduct industries. NARA's industrial partners include Weyerhaeuser (the largest land owner in the Pacific Northwest, http://www.weyerhaeuser.com/), Catchlight Energy (a joint venture between Weyerhaeuser and Chevron, http://www.catchlightenergy.com/), Cosmo Specialty Fibers (http://www.cosmospecialtyfibers.com/), and the fuel producer Gevo (http://www.gevo.com/).

The NARA alliance is tasked with increasing efficiency for each supply chain step from forestry operations to conversion processes; creating new biobased products; providing economic, environmental and social sustainability analyses; engaging stakeholder groups; and improving bioenergy literacy for students, educators, professionals and the general public.

ACCESSION NO: 0225437 **SUBFILE:** CRIS
PROJ NO: WNP00784 **AGENCY:** NIFA WN.P
PROJ TYPE: AFRI COMPETITIVE GRANT **PROJ STATUS:** EXTENDED
CONTRACT/GRANT/AGREEMENT NO: 2011-68005-30416 **PROPOSAL NO:** 2010-05066
START: 01 AUG 2011 **TERM:** 31 JUL 2015
GRANT AMT: $8,000,000 **GRANT YR:** 2014
AWARD TOTAL: $31,600,000

INVESTIGATOR: Cavalieri, R. P.; Wolcott, M. P.; Ahring, B.; Bahr, D. F.; Barber, M. E.; Cook, R.; Englund, K. R.; Kern, M. A.; Kirchhoff, H.; Lamb, B. K.; Lewis, N. R.; Yadama, V.

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NORTHWEST ADVANCED RENEWABLES ALLIANCE (NARA): A NEW VISTA FOR GREEN FUELS, CHEMICALS, AND ENVIRONMENTALLY PREFERRED PRODUCTS (EPPS)

NON-TECHNICAL SUMMARY: The US faces the urgent grand challenge of rapidly developing and attaining a secure domestic supply of both carbon-based transportation fuels and related chemicals for polymers/materials/intermediate chemicals at the scale and cost needed to compete favorably with the petrochemical industry. With established oil refining and distribution assets, a high need for military and commercial aviation fuels, and abundant woody biomass currently at scale, the Northwest is well positioned to deliver such bio- based aviation fuels and chemicals within 5-years. Thus, the **Northwest Advanced Renewables Alliance** (NARA): A New Vista for Green Fuels, Chemicals, and Environmentally Preferred Products (EPPs) has been created to both address and develop regional sustainable solutions for aviation fuel and key petrochemical replacements from sustainable woody-based resources in the Pacific Northwest. It is envisaged that NARA will serve as a national model in this regard with its game-changing approaches. In addressing this regional and national grand challenge, NARA seamlessly links all of the major research institutions in the Pacific Northwest (Washington State University, University of Washington, Oregon State University, University of Idaho, University of Montana, Montana State University) and tribal colleges, with our industrial partners (Weyerhaeuser and Gevo) as well as various

federal laboratories (USDA Forest Service). The approach taken herein involves feedstock development, sustainable forest/ plantation production, new methodologies to identify the most promising plant lines/forest residuals and their subsequent conversions into aviation fuel/petrochemicals at scale and cost needed. A significant effort is also directed towards training the next generation of both leaders and workers needed for this emerging green economy, particularly in rural areas, as well as in helping educate our regional population at all levels (K-12, college and university students/faculty, the general population, legislators, industry, land and forest owners, etc.) in sustainable bioenergy.

highlighted in Year-3 reporting will continue.

IMPACT: 2013/08 TO 2014/07
What was accomplished under these goals? Objectives have been restated and are to: 1. Develop a sustainable biojet fuel industry in the Pacific Northwest that uses residual woody biomass as feedstock. 2. Create valuable co-products made from lignin, which is an industrial byproduct of the woody biomass to biojet process. 3. Enhance and sustain rural economic development 4. Establish supply chain coalitions within the NARA region 5. Improve bioenergy literacy to develop a future energy workforce and enhance citizen understanding. Sustainable Biojet: Feedstock: Methods to improve costs associated with processing and transporting forest residuals were evaluated. The range of net feedstock cost variation when considering grinding, bulk density and sizing options together is $30 per oven-dried short ton. This amount of change to feedstock costs in the NARA base case economic analysis changes total costs by more than $25 million dollars per year. A forest residue decision support system (RENO) was completed and is designed to improve processing and transportation costs. To improve models for biomass availability, fieldwork to provide data for recovery coefficients at various costs for forest residual collection has been completed and slash pile measuring techniques were evaluated. To better predict moisture content in slash piles and live wood, four plots of a total of 36 trees were established in four geographical regions to monitor live branch moisture quarterly. Two plots of forest residue piles were instrumented for measuring pile temperature, relative humidity, and climatic variables. Conversion: The mild bisulfite pretreatment process was selected by NARA as the preferred pretreatment to be incorporated in subsequent environmental and techno-economic analyses. This action is a significant NARA milestone. A wood milling process has been initially characterized and may present a significant opportunity in areas with low electric rates to reduce pretreatment costs. Valuable co-products made from lignin: A structural analysis of activated carbon (AC) derived from the pretreated (mild bisulfite and wet oxidation) forest residuals was completed. Initial tests indicate that activated carbons derived from the pretreated forest residuals demonstrate moderate capacitance. Work is progressing to enhance the capacitance of this material for creating supercapacitor electrodes. Experimental results indicate that a greater than 70% yield of partially depolymerized lignin can be obtained from lignin sources derived from pretreated forest residual samples. A new pathway was discovered to selectively convert biorefinery lignin to dicarboxylic acids (DCA), including muconic, maleic, and succinic acids. These DCAs are highly valuable industrial chemicals and platform intermediates used in many

areas including biopolymer, pharmaceutical, and food additives industries. Rural Economic Development: Social Sustainability: A biogeophysical and social asset assessment for the western Montana corridor region has been published. This work establishes a method used to quantify a region's social capability to embrace a wood to biofuel industry. Economic Sustainability: Work has been completed identifying co-products and intermediate products that are produced during the wood-isobutanol-biojet life cycle and potential applications for these products. A preliminary community impact assessment (CIA) was applied to the western Washington region. This initial assessment suggests that a biorefinery could generate as many as 1,200 jobs within forestry, transportation and refinery operations. Indirect and direct economic impact of this refinery could total $510 million. A preliminary TEA analysis for a multi-product integrated conversion facility using the mild bisulfite pretreatment process was completed and suggests an internal rate of return at 12.5%. Environmental Sustainability: Initial treatments (logging operations with varied residual removal) have been conducted, conifer seedlings have been planted, an array of measuring instruments have been assembled at the NARA Long-Term Soil Productivity Site (LTSP) located in Springfield, Oregon. Soil data have been recorded at the LTSP site on pre- and post-harvest conditions, which will serve as baseline data for soil, water and wildlife studies during the first growing cycle. In order to better quantify the amount of standing residual biomass available, two seasons of biomass sampling has been completed. This data is used to develop allometric equations to predict biomass quantities and nutrient content in a standing forest. The biomass equations have been incorporated into ORGANON and CIPSANON growth models, enabling users to estimate biomass components of trees and stands. A survey of local and regional USFS silviculturists and NEPA planners was completed in order to understand the range of potential silvicultural options that are currently being implemented on agency lands. These prescriptions were incorporated into a model framework to test the impact that both prescription form and harvest intensity have on potential wood supply and fire hazard mitigation. This work satisfies a NARA milestone and will tie directly into the biomass availability model completed by NARA and allow for the more accurate model simulation reflecting USFS decision options and the accounting of stand-level impacts of silvicultural treatments on future structural conditions and potential fire hazards. The BBER staff completed data sets for mill residue production in ID, MT and OR and are nearly complete with the WA data. This activity represents a NARA milestone and will be used for biomass availability modeling. Supply Chain Coalitions: A supply chain analysis was initiated for western Oregon and Washington (MC2P), and regional assets were compiled. NARA facilitated stakeholder involvement by conducting multiple meetings, seven webinars and two informational documents including a community profile document. These efforts have resulted in activating a large group of stakeholders that include the Washington State Department of Commerce as well as interest from numerous corporations around the supply chain. A highlight of these efforts is the decision by Cosmo Specialty Fibers, an affiliate member and a pulp company based in Grays Harbor, WA, to pursue a biorefinery business model to augment their traditional pulp offerings. A 10-year biomass projection study was completed and provided to the Confederated Salish and Kootenai Tribes (Task E-1). This deliverable provides leverage for future tribal partnerships and undergraduate and graduate educational work

experience. Due to the successful completion of this report, funding for follow-up work was secured and a new study for CSKT was established to test the fire resiliency of siliviculture treatments. Bioenergy Literacy: Nine undergraduate students participated in NARA project research under the Summer Undergraduate Research Experience (SURE). A nine-lesson energy curriculum titled “Fueling Our Future: Exploring Sustainable Energy Use” was published and 120 copies have been purchased by middle and high school teachers. 2013 Imagine Tomorrow program was completed with 140 high school team participating from the OR, WA, ID and MT region. Imagine Tomorrow students were surveyed after the 2013 competition with 67% of the students responding that they were extremely or very interested in pursuing a career in science. Summer workshops that focused on bioenergy and climate change were provided to K-12 teachers. Seventy-five teachers participated in the workshops. A follow up survey connected with this workshop indicates that teacher literacy was increased and that 48% incorporated biofuels into their lessons. Over 200 K-12 students were assessed after being introduced to NARA generated curricula and showed significant increases in bioenergy knowledge, positive attitude towards biofuels, and science processing skills.

PUBLICATIONS (not previously reported): 2013/08 TO 2014/07

1. Type: Journal Articles Status: Submitted Year Published: 2014 Citation: Garrett, B.G., Srinivas, K., Ahring, B.K., ?Performance and Stability of Amberlite? IRA-67 Ion Exchange Resin to Extract Acids via pH Control during Corn Stover Fermentation?. Submitted to Bioresource Technology
2. Type: Theses/Dissertations Status: Other Year Published: 2013 Citation: Gerald Schneider, M.S., Construction and Demolition Recycled Wood Waste Assessment within the Northwest United States. August 2013. Masters Thesis. Washington State University, Pullman, WA
3. Type: Journal Articles Status: Published Year Published: 2014 Citation: Langfitt, Q., Haselbach, L., Hougham, J. 2014. Artifact-Based Energy Literacy Assessment Utilizing Rubric Scoring. J. Prof. Issues Eng. Educ. Pract.DOI: 10.1061/(ASCE)EI.1943-5541.0000210
4. Type: Journal Articles Status: Accepted Year Published: 2014 Citation: Schon, J., Eitel, K.B., Bingaman, D., Miller, B.G., Rittenburg, R. (accepted for publication, 2014). Little leaders in conservation. Science & Children.
5. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Hougham, R. J., Bradley Eitel, K., & Miller, B. G. (in review). ?Technology-enriched STEM Investigations of Place: Using Technology to Extend the Senses and Build Connections to and between Places in Science Education.? Manuscript in review at the Journal of Geoscience Education.
6. Type: Theses/Dissertations Status: Other Year Published: 2013 Citation: Ike Nwaneshiudu,Ph.D., Tailoring Polymer Micro-extraction Phases to Enhance the Sensitivity and Selectivity of Raman Spectroscopy, Chemical Engineering, University of Washington, Sept 2013.
7. Type: Journal Articles Status: Published Year Published: 2014 Citation: Alex D. Paulsen, Blake R. Hough, C. Luke Williams, Andrew R. Teixeira, Daniel T. Schwartz2, Jim Pfaendtner, Paul J. Dauenhauer, Fast Pyrolysis of Wood for Biofuels: Spatiotemporally Resolved Diffuse Reflectance In situ Spectroscopy of Particles,

ChemSusChem 7(3), 765-776 (2014).
8. Type: Journal Articles Status: Published Year Published: 2014 Citation: Scott Geleynse, Carlos Alvarez-Vasco, Karissa Garcia, Keith Jayawickrama, Matt Trappe, Xiao Zhang. 2014. A Multi-Level Analysis Approach to Measuring Variations in Biomass Recalcitrance of Douglas Fir Tree Samples. Bioenerg. Res. 10.1007/s12155-014-9483-z
9. Type: Journal Articles Status: Submitted Year Published: 2014 Citation: Srinivas, K., Garrett, B., and Ahring, B. K. Design and Optimization of a semi-continuous high pressure carbon dioxide extraction of acetic acid from cow rumen fluid. Submitted to Bioresource Technology.
10. Type: Journal Articles Status: Published Year Published: 2014 Citation: Schon, J., Hougham, R.J., & Eitel, K.B., Hollenhorst, S. (2014). The value of a tree. Science Scope. 37(7), pp. 27 ? 35.
11. Type: Journal Articles Status: Published Year Published: 2014 Citation: Kirchhoff, H. Diffusion of molecules and macromolecules in thylakoid membranes. Biochim. Biophys. Acta Volume 1837 (4). Pp 495-502. DOI: 10.1016/j.bbabio.2013.11.003
12. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Zamora, R. and J. Sessions, Effect of Vertical Acceleration on the Bulk Density of Ground Residues. In review. Forest Products J.
13. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Zamora, R., J. Sessions and D. Smith. Effect of Grinder Parameters on Particle Size and Fuel Consumption. In review. Biomass and Bioenergy.
14. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Zamora, R., J. Sessions and K. Boston. Economic Optimization of Forest Biomass Processing and Transport. In review. Forest Science.
15. Type: Journal Articles Status: Published Year Published: 2013 Citation: Zamora, R., J. Sessions, G. Murphy and K. Boston. 2013. Economic impact of truck-machine interference in forest biomass recovery operations on steep terrain. Forest Products Journal. Vol. 63(5-6). http://dx.doi.org/10.13073/FPJ-D-13-00031
16. Type: Journal Articles Status: Published Year Published: 2014 Citation: Zamora, R., K. Boston, J. Sessions, and G. Murphy. 2013. Stochastic simulation and optimization of mobile chipping economics in processing and transport of forest biomass from residues. Silva Fennica.Vol. 47(5). http://dx.doi.org/10.14214/sf.937
17. Type: Journal Articles Status: Published Year Published: 2014 Citation: Zamora, R., P. Adams, and J. Sessions. Ground-based thinning on steep slopes in Western Oregon: Soil compaction and disturbance effects. Forest Science. Vol 60(2). http://dx.doi.org/10.5849/forsci.12-525
18. Type: Journal Articles Status: Published Year Published: 2013 Citation: Beck, S. and J. Sessions. Ant Colony Optimization for Forest Road Access Decisions for non-conventional products. Croation J. of Forest Engineering.Vol.34(2):201-215
19. Type: Journal Articles Status: Published Year Published: 2013 Citation: Smith, D., J. Sessions, K. Tuers, D. Way and J. Traver. 2013. Characteristics of forest derived woody biomass collected and processed in Oregon. Forest Products J. Vol. 62(7/8):520-527.
20. Type: Journal Articles Status: Published Year Published: 2013 Citation: D.-W. Kim and G. Murphy. 2013. Forecasting air drying rates of Douglas-fir and hybrid poplar biomass in Oregon, USA. International Journal of Forest Engineering 24(2):137-147

21. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Zamora, R. and J. Sessions. 2013. RENO: A Computerized Solution Procedure and Decision Support System for Forest Biomass Recovery Operations. In Proceedings of the 2013 Annual Council on Forest Engineering Meeting, July 7-10, Missoula, MT.
22. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Sessions, J. and R. Zamora. 2013. Cost?effective logistics for forest harvest residuals: the upstream part of the sugar stream. Prepared for the 2013 AAIC-AFRI conference on New Crops: Bioenergy, Biomaterials and Sustainability, Oct 12-16, Washington, D.C.
23. Type: Theses/Dissertations Status: Other Year Published: 2013 Citation: Zamora, Rene. 2013. Economic Optimization of Forest Biomass Processing and Transport. PhD thesis. Completed May 23, 2013. John Sessions, Advisor.
24. Type: Journal Articles Status: Published Year Published: 2014 Citation: 1. Martinkus, N., W. Shi, N. Lovrich, J. Pierce, P. Smith, and M. Wolcott. 2014. Integrating Biogeophysical and Social Assets Into Biomass-to-Biofuels Supply Chain Siting Decisions. Biomass & Bioenergy. Vol. 66:410-418. DOI: 10.1016/j.biombioe.2014.04.014
25. Type: Journal Articles Status: Accepted Year Published: 2013 Citation: Pelton, R.E.O, Smith, T.M. , Lahd, H. 2013. Assessing Hotspot Assessment: A Procurement Perspective. Journal of Industrial Ecology.
26. Type: Book Chapters Status: Published Year Published: 2014 Citation: 2. Smith, T.M., Mollina Murillo, S.A., and Anderson, B. M. 2014. Implementing sustainability in the global forest sector: Toward the convergence of public and private forest policy. In The Global Forest Sector: Changes, Practices, and Prospects. E. Hansen, R. Panwar, and R. Vlosky (eds.). Taylor & Francis, CRC press, Boca Raton, 237-260.
27. Type: Journal Articles Status: Accepted Year Published: 2014 Citation: Francesca Pierobon, Indroneil Ganguly, Ivan L. Eastin, Tait Bowers, and Tommaso Anfodillo. 0000-00-00 Accepted. ?Evaluation of Environmental Impacts of Woody Biomass Based Bio-energy: a Life Cycle Assessment (LCA) Approach. Future Forestry Leaders Symposium.? Forestry Chronicle
28. Type: Journal Articles Status: Published Year Published: 2014 Citation: Austin J. Himes, Rob Harrison, Darlene Zabowski, Eric Turnblom, David Briggs, Warren Devine, Kimberly Hanft. Predicting risk of long-term N depletion due to whole-tree harvesting in the coastal Pacific Northwest. Forest Science. Vol 60(2): 382. http://dx.doi.org/10.5849/forsci.13-009
29. Type: Journal Articles Status: Published Year Published: 2014 Citation: Long, J. and K. Boston. An evaluation of measurement techniques for estimating the volume of piled logging residue. Forest Science. Vol 60(1):200-204.http://dx.doi.org/10.5849/forsci.13-501
30. Type: Journal Articles Status: Published Year Published: 2014 Citation: Vance, ED, WM Aust, RE Froese, RB Harrison, LA Morris, and BD Strahm. 2013. Biomass Harvesting and Soil Productivity: Is Science Meeting our Policy Needs? Soil Sci. Soc. Am. J. doi:10.2136/sssaj2013.08.0323nafsc
31. Type: Journal Articles Status: Published Year Published: 2014 Citation: Knight, E, , P. Footen, R.B. Harrison, T. Terry, S. Holub. 2013. Competing vegetation effects on soil

carbon and nitrogen 12 years post-harvest in a Douglas-fir plantation on a highly productive site. Soil Sci. Soc. Am. J. doi:10.2136/sssaj2013.07.0320nafsc
32. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Francesca Pierobon, Indroneil Ganguly, Ivan L. Eastin, Tait Bowers, and Tommaso Anfodillo. 2014. ?Evaluation of Environmental Impacts of Woody Biomass Based Bio-energy: a Life Cycle Assessment (LCA) Approach.? In Vancouver, Canada: University of British Colombia.
33. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Indroneil Ganguly. 2013. Environmental Implications of Advanced Biofuels in the Pacific Northwest: An LCA Approach? presented at the AAIC 25th Anniversary Meeting, Washington, October 13?16, Washington, DC
34. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Ganguly, I, I Eastin, F Pierobon, and T Bowers. 2014. ?Environmental Assessment for Woody Biomass Feedstock for Bio-jet Fuel Production.? In Proceedings of the Seventh National New Crops Symposium New Crops: Bioenergy, Biomaterials, and Sustainability. Washington D.C.: AAIC.
35. Type: Journal Articles Status: Submitted Year Published: 2014 Citation: Vogler, K.C., and J.D. Bailey. 2014. Sustainable Biomass Supply from Fuel Reduction Treatments: A Biomass Assessment of Federally Owned Land in Eastern Oregon? for submission to Forest Ecology and Management
36. Type: Journal Articles Status: Accepted Year Published: 2014 Citation: Brooks, R., and J. Moroney. Forestry Tour Educates Youth. 2014. Accepted. Journal of Extension
37. Type: Journal Articles Status: Published Year Published: 2013 Citation: Lowell, E.C. and S. Leavengood. 2013. From Wood to Wing: NARA Works to Harness Woody Biomass for Aviation Biofuel. Western Forester 58(3):12-13.
38. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Francesca Pierobon, Indroneil Ganguly, Tait Bowers, Tommaso Anfodillo and Ivan L. Eastin. Feedstock LCA for Bio-Jet Fuel in Temperate Mountain Systems: Incorporating Carbon Sequestration. 2014 IUFRO conference, Salt Lake City, Utah
39. Type: Theses/Dissertations Status: Other Year Published: 2013 Citation: Knight, Erika. 2013. Harvest intensity and competing vegetation control have little effect on soil carbon and nitrogen pools in a Pacific Northwest Douglas-fir plantation. MS thesis, University of Washington
40. Type: Journal Articles Status: Published Year Published: 2013 Citation: Zhang, C., C.J. Houtman, J.Y. Zhu, 2013. Maximize Enzymatic Saccharification and Minimize Sugar Degradation in SPORL Pretreatment of Douglas-fir at a Low Temperature: A Kinetic Approach. Bioresource Technology
41. Type: Journal Articles Status: Published Year Published: 2013 Citation: Leu, S.-Y., Gleisner, R., J.Y. Zhu, Sessions, J., Marrs, G., 2013. Robust Enzymatic Saccharification of a Douglas-fir Forest Harvest Residue by SPORL, Biomass and Bioenergy. Vol. 59 393-401.http://dx.doi.org/10.1016/j.biombioe.2013.08.014
42. Type: Journal Articles Status: Published Year Published: 2014 Citation: Zhang, C., Houtman, C.J., Zhu, J.Y. (2014), ?Using Low Temperature to Balance Enzymatic Saccharification and Furan Formation during SPORLPretreatment of Douglas-fir?, Process Biochemistry 49:466-473 DOI: 10.1016/j.procbio.2013.12.017
43. Type: Conference Papers and Presentations Status: Other Year Published: 2013

Citation: Jinwen Zhang. Improving the performance of biobased polymers via manipulating the structures of building blocks, the 13th International Symposium on Bioplastics, Biocomposites and Biorefining, May 19 ? 24, 2014, Guelph, Ontario, Canada.
44. Type: Journal Articles Status: Published Year Published: 2014 Citation: Zhang, C., Lei, X., Scott, C.T., Zhu, J.Y., K. Li, (2014), ?Comparison of Dilute Acid and Sulfite Pretreatment for Enzymatic Saccharification of Earlywood and Latewood of Douglas-fir?, BioEnergy Research 7:362-370 DOI:10.1007/s12155-013-9376-6
45. Type: Journal Articles Status: Published Year Published: 2013 Citation: Zhou, H.F., Lou, H., Yang, D., Zhu, J.Y., Qiu, X., (2013) ?Lignosulfonate to Enhance Enzymatic Saccharification of Lignocelluloses: The Role of Molecular Weight and Substrate Lignin?, Ind. Eng. Chem Res. 52(25):8464-8470 DOI: 10.1021/ie401085k
46. Type: Journal Articles Status: Published Year Published: 2013 Citation: Zhou, H.F., Zhu, J.Y., Luo, X., Leu, S.-Y., Wu, X., Gleisner, R., Dien, B.S., Hector, R.E., Yang, D., Qiu, X., Horn, E., Negron, J. (2013), ?Bioconversion of Beetle-Killed Lodgepole Pine Using SPORL: Process Scale-up Design, Lignin Co-product, and High Solids Fermentation without Detoxification?, Ind Eng Chem Res 52:16057-16065 DOI: 10.1021/ie402873y
47. Type: Journal Articles Status: Published Year Published: 2014 Citation: Ma, R.S., Guo, M., Zhang, X. 2014. Selective conversion of biorefinery lignin to dicarboxylic acids, ChemSusChem, 7(2) 412-415. DOI: 10.1002/cssc.201300964
48. Type: Journal Articles Status: Published Year Published: 2013 Citation: Alvarez Vasco, C., Zhang, X. 2013. Alkaline hydrogen peroxide pretreatment of softwood: Hemicellulose degradation pathways, Bioresource Technology, 150C: 321-327. DOI: 10.1016/j.biortech.2013.10.020
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50. Type: Journal Articles Status: Published Year Published: 2013 Citation: Qin, J., H. Liu, P. Zhang, M.P. Wolcott and J. Zhang. 2013. Use of eugenol and rosin as feedstock for biobased epoxy resins and study of curing and performance properties, Polymer International, DOI: 10.1002/pi.4588
51. Type: Journal Articles Status: Published Year Published: 2014 Citation: Qin, J., M. Wolcott and J. Zhang. 2014. Use of polycarboxylic acid derived from partially depolymerized lignin as curing agent for epoxy application, ACS Sustainable Chemistry & Engineering, DOI: dx.doi.org/10.1021/sc400227v. 2(2):188-193.
52. Type: Journal Articles Status: Published Year Published: 2014 Citation: Xin, J., P. Zhang, M.P. Wolcott, X. Zhang, and J. Zhang. 2014. Partial depolymerization of enzymolysis lignin via mild hydrogenolysis over Raney Nickel. Bioresource Technology. DOI: http://dx.doi.org/10.1016/j.biortech.2013.12.092.
53. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Jinwen Zhang. Diversifying Biobased Polymers and Expanding the Window of Properties via Manipulating the Structures of Building Blocks, 2013 First International Biobased Macromolecule Material Forum, Nov 13 ? 14, 2013, NingBo, China
54. Type: Conference Papers and Presentations Status: Other Year Published: 2014

Citation: Grant Baltzar. Fermentative Conversion of Hydrolyzed Douglas fir Biomass into Isobutanol and Biojet. Harvesting Clean Energy. Feb. 4-6, 2014, Helena MT 55. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Grant Baltzar. Conversion of Douglas fir Biomass into Isobutanol and Biojet. Northwest Wood-Based Biofuels and Co-Products Conference. April 28-30, 2014, Seattle, WA**CAP Project Example Two:**

Sustainable Bioenergy Alliance Network of the Rockies

Today's headlines are ablaze with reports of potentially catastrophic wild fires. In 2013, one Colorado fire alone accounted for over $500 million in economic damages (http://www.usatoday.com/story/weather/2013/11/23/wildfire-season/3674707/). More than half of the US Forest Service's annual budget is consumed fighting wildfires nationwide. Wildfires are fueled to a large extent by to widespread tree death in coniferous forests across the Rocky Mountains caused by infestations of pine and spruce bark beetles over the past decade, with ~42 million acres of U.S. forests impacted since 1996. This trend is only likely to intensify with future global climate change. The resulting beetle-killed wood represents not only a catastrophic wildfire fuel source, but also a vast **bioenergy resource** that requires no cultivation, circumvents food-versus-fuel concerns, and may have a highly favorable carbon balance compared other forestry feedstocks. However, beetle-killed biomass is typically located far from urban industrial centers in relatively inaccessible areas with challenging topography, and transportation costs have been a key barrier to more widespread productive utilization of this vast resource.

The Sustainable Bioenergy Alliance Network of the Rockies (BANR, http://banr.colostate.edu/Home/About?Length=4) led by Colorado State University will bring together scientists, educators, and extension specialists from universities and government agencies across the region to work with industry partners to develop a comprehensive program addressing the major challenges limiting feedstock development, production, logistics and utilization of insect-killed trees for the production of biofuels and biochar. Cool Planet Energy Systems' (http://www.coolplanet.com/) recent advances in modular thermochemical conversion technologies enable the production of advanced liquid biofuel feedstocks and biochar co-products on-site deep within stands of beetle-killed timber, bypassing these fundamental logistical constraints. There are still significant technical and knowledge barriers that must be explored before such systems can be widely deployed in an environmentally, economically, and socially sustainable manner.

ACCESSION NO: 1001665 **SUBFILE:** CRIS
PROJ NO: COL0-2013-03867 **AGENCY:** NIFA COL
PROJ TYPE: AFRI COMPETITIVE GRANT **PROJ STATUS:** NEW
CONTRACT/GRANT/AGREEMENT NO: 2013-68005-21298 **PROPOSAL NO:** 2013-03867
START: 01 SEP 2013 **TERM:** 31 AUG 2014
GRANT AMT: $1,820,000 **GRANT YR:** 2013
AWARD TOTAL: $1,820,000

INVESTIGATOR: Paustian, K.; Rhoades, CH.; Tinker, DA, B..; Wilson, RI.; Anderson, NA.; O'Laughlin, JA.; Lawrence, RI.; Chung, WO.; Strauss, SA.; Reardon, KE.; Moore, JO.; Mackes, KU.; Evangelista, PA.; Cotrufo, MA.

PERFORMING INSTITUTION:
Soil and Crop Sciences
COLORADO STATE UNIVERSITY
FORT COLLINS, COLORADO 80523

SUSTAINABLE BIOFUEL FEEDSTOCKS FROM BEETLE-KILLED WOOD: BIOENERGY ALLIANCE NETWORK OF THE ROCKIES (BANR)

NON-TECHNICAL SUMMARY: Infestations of pine and spruce bark beetles have caused widespread mortality in coniferous forests in the Rocky Mountains over the past decade, with ~42 million acres of U.S. forests impacted since 1996, a trend is only likely to intensify with future global climate change. The resulting beetle-killed wood represents a vast, high-density bioenergy resource that requires no cultivation, circumvents food-versus-fuel concerns, and likely has a highly favorable carbon balance compared to most other forestry systems due to the underlying disturbance to ecosystem carbon stocks and net productivity. Beetle-killed biomass is typically located far from urban industrial centers, in relatively inaccessible areas with challenging topography; thus harvest and transportation costs have been a key barrier to more widespread utilization of the resource. However, recent advances in mobile thermochemical conversion technologies are enabling the production of advanced liquid biofuel feedstocks and co-products on-site, thus bypassing this fundamental constraint. Cool Planet Energy Systems has been a driving force in this field, and their prototype pyrolysis system can be deployed in close proximity to beetle-killed timber and other sources of non-commercial woody feedstocks. However, significant technical and knowledge barriers to the widespread deployment of such systems in beetle-disturbed forests still exist, and environmental footprints, social issues, and local policy constraints remain largely unexplored. Our proposed project, Sustainable biofuel feedstocks from beetle-killed wood: Bioenergy **Alliance** Network of the **Rockies** (BANR), will develop a comprehensive program to address the major challenges limiting feedstock development, production, logistics and utilization of insect-killed trees in the Rockies. Research tasks will be undertaken to create a spatial atlas of wood availability, advance the logistics of harvest and preprocessing, explore issues of quality with respect to thermochemical conversion, undertake comprehensive economic, environmental, and

social/policy assessment, and to integrate research results into a web-based user-friendly decision support system. Educational efforts will include development of middle and high school science units on bioenergy-related topics, professional development and research experiences for K-12 teachers and undergraduates and new courses for undergraduates, graduate students, and K-12 teachers. Extension work will deliver results and tools developed through research and education on ecological, technical, economic and social aspects of bioenergy production from beetle-killed wood, fire hazard reduction and other forest feedstocks.

OBJECTIVES: The project objective is to provide the science-based underpinnings - through targeted research, education, training and extension - to support the development of sustainable biofuel production from beetle-killed wood and other non-commercial woody feedstocks in the Rocky Mountain Region. Expected outcomes will provide new knowledge and solutions for development of sustainable biofuel production systems using beetle-killed and waste wood feedstocks.

IMPACT: 2013/09 TO 2014/08
What was accomplished under these goals? IMPACT The Bioenergy Alliance Network of the Rockies (BANR) will assess the potential for an environmentally sustainable, economically viable and socially acceptable biofuel industry in the Rocky Mountain region based on beetle-killed trees and other forest biomass, and provide the research, education, training and outreach to support the development of such systems. Over 42 million acres of western forests have been significantly impacted by bark beetles, resulting in 100s of millions of tons of potential feedstock material. In many beetle-impacted forest stands, wood removed for forest restoration management and fire hazard reduction is not usable for traditional forest products and is instead burned in piles, resulting in the waste of a potentially valuable feedstock and often incurring significant additional environmental damages in the process. The BANR project will comprehensively study this unique biomass resource with a focus on conversion to ‘drop-in’ liquid transportation fuels and valuable co-products via a novel, scalable, locally sited thermochemical biomass conversion technology that minimizes feedstock transport distances and system environmental impacts. While the BANR project is only in its initial stages, potential impacts are large. A detailed spatially-explicit assessment of the amount of wood potentially available from beetle-kill forest restoration and fuel reduction operations is a major objective of the project, and we anticipate the potential for millions of gallons of renewable fuel production across the region. Project research will enable accurate determination of the ‘carbon footprint’ and other environmental and economic performance metrics of such production, to determine where and how much biomass can be sustainably utilized, and to estimate the associated reduction in fossil fuel dependency and greenhouse gas emissions. Planned socio-economic and policy research will assess impacts on jobs and economic development in small rural communities in the region, many of which have suffered losses from the decline in traditional forest industries. Finally, the project will determine the potential of active management of forests in the region, driven by economically-viable biomass harvest and utilization, to yield healthier forests and improve ecosystem services. GOALS AND ACCOMPLISHMENTS 1. Quantify and locate existing Feedstock Supply (Task 1) and

develop tools for rapid detection and quantification of newly-occurring infestations The Feedstock Supply team has focused on planning and developing infrastructure, such as repositories of GIS resources, field measurement data, and literature. Task members have established active collaborations with other task groups, including field research site coordination, allometric equation testing using terrestrial LiDAR scans and field data collection. The team is producing a preliminary coarse-resolution feedstock atlas for the BANR area, giving other BANR researchers a tool for experimental design or modeling purposes. It is expected that BANR members will provide feedback on the utility of the preliminary feedstock atlas, allowing them to refine the design of subsequent iterations. 2. Evaluate Feedstock Logistics and Processing (Task 2) to improve financial viability of harvest, collection, processing, transport and storage of woody biomass feedstock materials A challenge for this research is to identify existing active harvest operations at sites and with treatments that are relevant to the BANR plan of study on which to piggyback shift-level operations studies. Significant progress has been made towards identifying such sites across the BANR study area, including sites in Colorado and Montana. Extensive coordination with the Feedstock Supply and Environmental Impacts teams ensures that the sites being identified are consistent with the stand types and treatments most relevant to the BANR project as a whole, and makes optimal use of project personnel resources. 3. Assess System Performance and Sustainability (Task 3) with regard to: - Environmental Impacts (Task 3.1) of different beetle-killed tree harvesting techniques in dominant forest types throughout the study region - The effectiveness of Biochar (Task 3.2) as a soil amendment and its potential to improve the greenhouse gas balance of the biofuel system - The economic and social practicality of harvest and biofuel production through Conversion Modeling (Task 3.3), Financial Analysis (Task 3.5), and Socioeconomic & Policy Analysis (Task 3.6) - The greenhouse gas mitigation potential and other environmental impacts of the full wood-based biofuel supply chain using Lifecycle Assessment (Task 3.4) - The intersection of supply availability, harvest logistical capability, and any other economic, environmental, or social constraints on harvest and conversion within a spatially-explicit web-based Decision Support System (Task 3.7) The Environmental Impacts team has focused on laying the groundwork for a successful summer field campaign. Successful establishment of an intensive network of field sites will allow team members to make inferences about the rate of biomass recovery, stand succession, and soil biogeochemistry post-infestation in the presence or absence of salvage logging. Careful experimental design is key for the Biochar team, especially for the advanced GHG measurement capabilities being developed. While reduction of GHG emissions from intensive agriculture is a proposed benefit of biochar use, few field-based measurements are currently available, in particular continuous measurements as are being designed for the dryland corn biochar field trials. Continuous N2O measurements in multiple amended and control plots planned here will represent a significant contribution to the literature. Outcomes for subtasks 3.3-3.7 are more limited in Year 1. Proper scoping of these tasks at the project outset is essential for a) ensuring that the full range of economic, environmental, and social sustainability criteria necessary to predict system viability are represented, b) providing guidance to the teams doing fieldwork to ensure that data produced is appropriate for the broader project analytical framework, and c) maintaining consistency in scope and scenario assumptions across

all of the modeling-based and integrative research objectives. 4. Increasing understanding of forest health and management issues and bioenergy literacy for students at all levels through a targeted Education (Task 4) program Teachers selected to participate in the Lead Teacher program in Year 1 will gain scientific and pedagogical knowledge related to bioenergy that can be transferred to their classrooms. Middle and high school students targeted through this program will learn about a locally relevant topic that builds interdisciplinary knowledge and possibly interest and motivation for science careers. 5. Providing useful practical and timely information to communities and stakeholder groups on all aspects of a potential beetle-kill bioenergy industry through Extension and Outreach (Task 5) The Extension team has presented an introduction to the BANR project to several interested community groups (see Presentations). Additionally, the team is developing informational fact sheets to be made available to stakeholders in Year 1 addressing topics such as potential forest biomass sources, biomass conversion technology, and the existing science regarding the role of woody debris in ecosystems and impacts of harvesting this material. 6. Understanding and incorporating the concerns of communities regarding the Health & Safety (Task 6) of biofuel and biochar production and distribution The Health & Safety team did not have any formal deliverables planned for Year 1. However, the preliminary literature review work will facilitate scoping and planning activities for work to be undertaken in subsequent years of the project.

PUBLICATIONS (not previously reported): 2013/09 TO 2014/08
1. Type: Other Status: Other Year Published: 2014 Citation: Kolb, P. 2014. An overview of the Bioenergy Alliance Network of the Rockies. Presented to three organizations: Montana Tree Farm Program, Montana Forest Owners Association, and Montana Forest Council.
2. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Paustian, K. 2014. Beetlejuice ? Researching Sustainable Biofuels from Beetle-Kill Wood in the Rockies. Northwest Wood-Based Biofuels + Co-Products Conference. Apr. 28-30, 2014, Seattle, WA.
3. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Vorster, A., A. Sidder. 2014. Applying Geospatial Modeling Strategies for Detection of Mountain Pine Beetle Mortality in the Central Rocky Mountains using NASA Earth Observing System. Front Range Student Ecology Symposium. February 19, 2014, Fort Collins, Colorado.
4. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Vorster, A. 2014. Applying Geospatial Modeling Strategies for Detection of Mountain Pine Beetle Mortality in the Central Rocky Mountains using NASA Earth Observing System. Colorado Bark Beetle Cooperative Quarterly Meeting. January 17, 2014, Breckenridge, Colorado.

Program 2: Agriculture and Food Research Initiative Sustainable Bioenergy Challenge: Bioenergy Education

The field of bioenergy and biobased products holds potential for new technologies and entrepreneurial opportunities that may substantially change regional rural economies. This emerging bio-economy will demand a new workforce and challenge institutions to

produce graduates who have the multidisciplinary and problem solving framework to meet this demand. This new economy will require a trained and competent skill set that meets workforce needs all along the bio-energy value chain encompassing a wide range of technical, educational, socio-economic, and scientific competencies. Additionally, there exists a gap between the diverse workforce projected for 2050 and the educational investment in minority serving students and institutions. Relevant K-12, undergraduate and master's level academic engagement and teaching expertise to prepare a new generation of scientists is lacking, especially at underserved schools. The outcome for this program is to stimulate the K-12 and baccalaureate and master's level education system to produce students who are science and math based independent thinkers and investigators, steeped in interdisciplinary coursework who can identify solutions to problems and opportunities, work creatively in teams and present solutions in a clear and concise manner, and who have an interest in America's bio-energy and bio-based products future.

Northeast Bioenergy and Bioproducts Educational Program
Cornell University

The Northeast Bioenergy and BioProducts Educational Program (NBBEP) is being offered through the expertise and collaborative efforts of eight institutions in the Northeast region of the US, each offering unique expertise to provide the multi-disciplinary content of the biofuels and bioproducts industry in a coordinated teacher training program. In the first three years of the program, more than 1900 kits, videos and engagement activities have been distributed to classrooms through 218 program participants (42%reported they were from high-needs school districts). The program has trained 15 interns, 29 Certified Master Teacher Trainers (34% from an 1890 institution) and 112 Master Teachers in Bioenergy and Bioproducts Education. The program has provided 13,960 hours of professional development experience to 218 educators in the first three years of operation. The multiplier effect into classrooms is significant with 85% of the 2013 teachers reporting reaching more than 75 students each year. In year 3 NBBEP (2013) programs alone, over 1200 middle and high school students have been reached through their teachers' participation and an estimated total of over 3600 middle and high school students were reached through teacher participation in years 1-3 combined.

During year 3, a teacher that was inspired by what she learned about Anaerobic Digestion at a 2011 NBBEP workshop was awarded $1.5 million to install an anaerobic digestor in her community near Lake Placid, New York.

Place Based Opportunities for Sustainable Outcomes and High Hopes (POSOH)
University of Wisconsin

The overarching goal for POSOH is to develop a model for supporting teachers' and students' learning of both sustainability and bioenergy concepts and their understanding that these concepts can be explored, explained and applied during decision-making using multiple perspectives. POSOH builds cross-cultural collaborations and honors both tribal ways of knowing and learning together and scientific ways of knowing to construct integrated perspectives on sustainability that can advance agricultural practices and promote energy solutions for the future. New STEM education curriculum

has been developed for the regional K-16 education system; strengthening underserved schools. It has been adopted by teachers from the Menominee Tribal School, the Menominee Indian School District, Oneida Indian Turtle School District, and three public school districts adjacent to the reservations along with the Sustainable Development Institute and Teacher Education Program staff from the College of Menominee Nation, community members and faculty/researchers/graduate students from the University of Wisconsin, Michigan State University, and the Great Lakes Bioenergy Research Center.

Program 3: Agriculture and Food Research Initiative Sustainable Bioenergy Challenge: Standard Research

Overview – AFRI Sustainable Bioenergy Research: Policy Options for and Impacts on Regional Biofuels Production Systems

Concerns over global climate variability and change, the need to reduce the price volatility and vulnerability of petroleum imports, and the desire to strengthen rural economies have increased interest in the U.S. government and industries to augment the supply of renewable energy as an alternative to petroleum. Since 1970s, there have been arrays of state and federal policies (e.g., the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007), supporting the development and deployment of alternative fuels, including agricultural-based biofuels. In order to better understand the efficiency, effectiveness, or impact of the policy measures, in FY2012, NIFA offered a research program: Policy Options for and Impacts on Regional Biofuels Production Systems.

This program focuses on evaluating the compatibility or challenges between federal and state policies, understanding policy alternatives for achieving sustainable regional biofuels production systems and commercialization, or any potential unintended consequences of biofuels production on domestic and global markets. A project funded by the Policy Options for and Impacts on Regional Biofuels Production Systems Program in FY2012 is highlighted below.

PD: Amy Landis

Institution: Arizona State University
Title: Developing A Life Cycle Assessment Model for Evaluating Policy Implications of Biofuels
Duration: 36 months
Award Amount: $ 350,000
Proposal Number: 2012-00893
Award Number: 2012-67009-19717
CRIS Accession Number: 0229795

The goal of this project is to quantify the policy implications of increased biofuel production by evaluating the environmental impacts associated with second and third generation biofuels, specifically using perennial grasses as feedstocks. One of the

main research objectives is to develop life-cycle inventory (LCI) and life-cycle assessment (LCA) modules for converting biomass to drop-in biofuel pathways. LCA-based tool will allow users to evaluate different combinations of feedstocks, processing, and conversion pathways to determine the effects that different policies may have on biofuel production and environmental impacts. The project team has since developed a detailed LCI, capable of capturing uncertainty, for miscanthus and switchgrass. LCA has shown that biofuels derived via the fast pyrolysis of these two feedstocks have lower overall life-cycle GHG emissions compared to that of first generation biofuels, and meeting RFS2 GHG reduction requirement of 60%. Additionally, LCA shows that biofuels derived from this process have a favorable energy balance and are competitive with other leading 2nd generation biofuels derived from corn-stover. In addition, the team has reviewed a huge amount (~1,370) of federal and statewide policies. Analysis result shows that only 31.5% of the examined state biofuel-related policies contain environmental sustainability themes, highlighting the need for further integration between policy and life-cycle thinking. The team has one peer-reviewed journal articles under review, "The Role of Sustainability and Life-Cycle Thinking in U.S. Biofuels Policies" (to be published in *Energy Policy*, 2014) and other papers presented at national and international conferences. The project provides opportunities for graduate students to learn modeling software packages (e.g., ArcGIS, SimaPro, ASPEN Plus, MARKet ALlocation (MARKAL) model, Global Trade Analysis Project (GTAP), etc.); and to develop other technical and presentation skills. The project also supported one female African American graduate student who completed her MS program in Civil Engineering at Arizona State University based on research related to this project.

Overview – AFRI Sustainable Bioenergy Research: Socioeconomic Impacts of Biofuels on Rural Communities

In FY 2010, the Agriculture and Food Research Initiative (AFRI) Sustainable Bioenergy Challenge Area Program offered grants to fund the development of a network of Regional Bioenergy consortia (Coordinated Agricultural Projects, CAPs), a variety of research programs, as well as educational projects to train the next generation of bioenergy scientists and professionals, in supportive of establishing these regional sustainable bioenergy systems.

In order to establish a new and sustainable industry of biofuels and biobased products, besides assessing the environmental impact, social and economic aspects are the other two key elements of the sustainability issues. For example, it is imperative to understand what may be potential direct, indirect, or cumulative effects or impacts on producers, consumers, or communities at local, regional, or national levels; to develop decision support tools for feedstock producers, biorefinery investors, entrepreneurs, and policy makers; to identify barriers or risk mitigation strategies in feedstock and technology adoption; or to determine the level of acceptability of products or processes in general.

Below highlights a project funded in FY 2012 by the AFRI Sustainable Bioenergy research priority area: Socioeconomic Impacts of Biofuels on Rural Communities. This

program focuses on enhancing scientific knowledge of socioeconomic aspects of adopting feedstocks or potential direct, indirect, or cumulative effects and impacts of sustainable regional production of biofuels and biobased products.

PD: Satish Joshi
Institution: Michigan State University
Title: Decision Support Systems for Regional Planning and Impact Assessment of Biorefineries
Duration: 36 months
Award Amount: $ 349,695
Proposal Number: 2012-00841
Award Number: 2012-67009-19693
CRIS Accession Number: 0229682

This project aims at developing decision support tools to help investors, regional planners, and potential biorefinery entrepreneurs in promoting and sustaining the bioenergy sector. Research objectives include: (1) assessing the acceptability of biorefineries to local communities; (2) identifying socio-economic factors associated with the level of such acceptability, including implications for small-scale and minority (tribal) producers; (3) designing a biomass harvest-shed tool that determines the optimal mix of woody biomass, biomass from annual crops, and perennial grasses for regional biorefinery; (4) developing a logistics decision support tool to evaluate alternative feedstock supply chain configurations, including contract design; and (5) building a temporal dynamic agent-based simulation modeling tool that predicts the evolution of the harvest-shed over time under alternative market development scenarios. The project is novel and innovative, especially in evaluating willingness to plant energy crops and the acceptability of biorefineries by tribal producers in three counties around Bay Mills Community College, Michigan. In less than two years since receiving the award, the project is making excellent progress, including having published one article entitled, “Spatially and Temporally Optimal Biomass Procurement Contracting for Biorefineries,” in a peer-reviewed journal, *BioResources* (May 2014) and several conference presentations with papers that will be submitted to referred journals for publication. Some key research findings include: (a) identified several important attributes of the desired supply contract terms to potential producers: price, compensation mechanism, contract length, harvesting/shipping responsibilities, quality and quantity checking, and delivery frequency; (b) while these characteristics are similar to that of University of Tennessee’s research findings, Michigan farmers seem to prefer compensation mechanism based on quantity and quality, versus annual fixed payments. The project supports two Ph.D. and one Masters students; enhancing their research skills, especially in survey techniques, GIS, agent-based modeling, as well as developing their oral presentation skills. Bay Mills Community College is also employing and training an undergraduate student.

Overview-AFRI Sustainable Bioenergy Research: Environmental Implications of Direct and Indirect Land Use Change, AFRI

Another concern with expanded biofuel feedstock production is the Environmental Implications of Direct and Indirect Land Use Change. In FY 2012 the AFRI Sustainable Bioenergy Program included a priority to study this issue with the overall goal to maximize the benefits of biofuel and feedstock production while minimizing potential negative environmental consequences of biofuels-induced land use change. This includes potential risks to ecosystem services; issues of water availability; issues of soil, water and air quality; and indirect land use change with potential cascading environmental effects. Projects funded range from the Pacific Northwest, the Southwest, the South, and the MidWest. Below is a highlight description from Florida:

PD: J.E. Erickson
Institution: University of Florida
Title: Direct effects of converting conventional cropping systems to biofuel cropping systems on ecosystem services for the Southeastern U.S.A.
Duration: 48 months
Award Amount: $ 497851
Proposal Number: 2012-00953
Award Number: 2012-67009-19596
CRIS Accession Number: 0229454

The overall goal of this project is to enhance understanding of the implications of direct land use change to biofuel cropping systems on ecosystem services including quantification and comparison of the effects on 1) aboveground primary production, 2) water use and water quality, and 3) greenhouse gas regulation for four years following conversion of current conventional cropping systems in the Southeast to emerging biofuel cropping systems, with and without land application of bio-char and vinasse generated from the conversion of the crop to biofuel. Preliminary data indicate important differences in water use efficiency between the different perennial grasses and soil amendments. In general, the highest yielding grasses use more water than is delivered in precipitation annually such that this could be an important issue for sustainability and for the environmental and climate-related impacts of this land-use change. Expected outputs include data collection and analysis, development of a project website page, mentoring of graduate students and post-doctoral scholars, class presentations of the experiment and results to undergraduate and graduate students, and scientific and outreach publications and presentations will be used to disseminate research findings.

Overview-AFRI Sustainable Bioenergy Research Impacts of Regional Bioenergy Systems on Water Availability and Quality

Results from the first two rounds of research grants in the AFRI Sustainable Bioenergy Program as well as observations related to biofuel ethanol production suggest that water quantity and quality are likely to be major environmental and socio-economic concerns of increasing biofuel feedstock production. Therefore, in FY 2013, the program included a priority on *Impacts of Regional Bioenergy Systems on Water Availability and Quality. Concerns about water range from the potential for increased depletion of stored*

soil water or groundwater, to water quality effects of fertilizers, amendments and waste products from biofuel production. Funded projects are examining both woody and non-woody biofuel feedstocks, and interactions with climate change, policy, and economics. One of these projects from Oklahoma dealing with both woody and herbaceous feedstocks is described below:

PD: R. E. Will
Institution: Oklahoma State University
Title: Increasing water yield and quality through an integrated woody and herbaceous biofuel feedstock production system
Duration: 60 months
Award Amount: $ 500,000
Proposal Number: 2013-03912
Award Number: 2014-67010-21653
CRIS Accession Number: 1001708

Regionally appropriate cellulosic biofuel feedstocks for the southern Great Plains include perennial grasses (e.g., switchgrass or other native prairie grasses) and several woody species. Developing an integrated feedstock mix for this region should consider alternate land-use concerns (e.g., food production) and other ecosystem services (e.g., wildlife habitat), while maintaining or increasing water yield and quality. Determining the most appropriate feedstock mix (woody, prairie grasses, and dedicated crops) requires balancing competing concerns of biomass production with water yield and quality, as well as other ecosystem services. Integrating Juniperus spp. into a regional feedstock for cellulosic-based biofuels could help restore grasslands and likely increase water yields. The goal of this research project is to determine the change in water yield and the effects on water quality, specifically non-point transport of sediment with these different options for biofuel feedstock production, and to determine the effects on water from planting marginal lands with a dedicated biofuel/bioenergy feedstock, such as switchgrass, as compared to restoring native grassland. This knowledge is necessary for managing regional water yield and understanding the tradeoffs of utilizing various types of feedstock in an integrated, regional approach to feedstock supply. Objectives include a) comparison of water balance at the watershed scale of harvesting invasive Juniper species for biofuels followed by a return to native tall-grass prairie, compared to juniper harvest followed by switchgrass; and b) scale results to a regional level and project effects of and influence on climate and extreme weather events. Projects from this solicitation have only preliminary results.

Overview-AFRI Sustainable Bioenergy Research – Carbon Sequestration

One of the concerns of increasing the extent of dedicated bioenergy crops is the secondary effect on net carbon flows and greenhouse gas emissions. Thus in FY 2010, the AFRI Sustainable Bioenergy Program included a priority to study the effects of different bioenergy crop production systems on carbon sequestration and/or greenhouse gas emissions. Funded projects included analyses to determine strategies of fertilization, irrigation, harvest (frequency and percent residue left), land/soil and

climate suitability, and rotations for optimal biofuel potential yield with minimal loss of soil organic matter and GHG emissions. Below is an example of outcomes from a study project funded by the AFRI Sustainable Bioenergy Research: Carbon Sequestration and Sustainable Bioenergy Production:

PD: Frank Hons
Institution: Texas A&M University
Title: A Novel Foundry Fuel Source Utilizing Biomass Co-Products as Binders and Fuel
Duration: 60 months
Award Amount: $ 995,013
Proposal Number: 2010-03853
Award Number: 2011-67009-30050
CRIS Accession Number: 0224230

This project addresses the system of conversion of high biomass sorghum into biofuels but considering potential for negative outcomes of this proposed short term solution to over reliance on imported fossil fuels such as a reduction in the productive capacity of soils. Field experiments, studies under laboratory conditions, and computer modeling are being used to accomplish our overall goal of developing advanced crop production systems utilizing improved nutrient management, crop rotation, and decreased soil tillage, among other practices, to increase carbon sequestration, mitigate greenhouse gas (GHG) emissions, and improve the sustainability of biomass sorghum feedstock production in the south central region. The integration of field and laboratory experiments and modeling creates the opportunity to identify the relative importance of the different factors that influence biomass sorghum yield and quality, nutrient cycling, carbon sequestration, GHG emissions, and economic viability. An important research output will be the carbon footprint of biomass sorghum production in this region (Texas high plains) through a life cycle (cradle to grave) analysis. Results have shown a greater than expected soil carbon accumulation to a meter depth that is not very sensitive to above-ground harvesting, making biomass sorghum a good candidate for carbon sequestration, and reducing the life-cycle GHG emissions from sorghum-derived biofuel to less than half the federally mandated 60% reduction in life-cycle GHGs for biofuels. The research further indicates that bioenergy sorghum is particularly promising in drought-prone areas.

In addition to this project, another grant to the University of California Riverside (David Grantz, Life Cycle Assessment of Sequestration and Exchange of Water, Carbon and Nitrogen in the Dedicated Bioenergy Feedstock, Energy Cane, 60 months, $967,671; 2010-03860, 2011-67009-30045, 0224406) developed a model that works to evaluate the carbon footprint and sustainability of both sorghum and energy cane production for cellulosic biofuel in arid environments.

Overview – AFRI Sustainable Bioenergy Research: Enhanced-value Co-product Development

The U.S. Dept. of Agriculture's National Institute of Food and Agriculture (NIFA) has made significant investments in funding research to support the development of advanced drop-in fuel from dedicated bioenergy crops such as sorghum, perennial grasses, energy cane, woody biomass, and oil crops (oilseeds and algae). In FY 2010, the Agriculture and Food Research Initiative (AFRI) Sustainable Bioenergy Program developed grants to fund the development of a network of Regional Bioenergy consortiums (Coordinated Agricultural Projects, CAPs), research in basic sustainable bioenergy, and educational projects to train the next generation of bioenergy scientists and professionals.

In order to successfully compete as a sustainable energy resource, the value of biomass feedstock for advanced drop-in fuel production must be maximized through the production of valuable co-products during the biorefining process. If additional specialty chemicals and other biobased products can be extracted from biomass prior to or after the conversion process, they can increase the overall value of the biomass feedstock. In addition, the economic viability and sustainability of regional bioenergy systems will be greatly enhanced by the production of high-value co-products from regionally-appropriate biomass feedstocks.

Below is a hi-lighted project funded by the AFRI Sustainable Bioenergy Research: Enhanced-value Co-product Development program. The priority of this program area focuses on biological, chemical, and thermochemical processes to produce valuable, bio-based chemicals, adhesives, materials, and industrial polymers.

PD: Nicole Brown
Institution: Pennsylvania State University
Title: A Novel Foundry Fuel Source Utilizing Biomass Co-Products as Binders and Fuel
Duration: 48 months
Award Amount: $ 894,507.00
Proposal Number: 2010-04033
Award Number: 2011-67009-20049
CRIS Accession Number: 0224089

This fundamental research will create enhanced-value for biofuel co-products and residues. Our goal is to create a binder that holds together waste anthracite fines so as to replace coke in iron foundries. This will save money, energy, and greenhouse gas emissions while increasing the competitiveness of both foundries and biofuel production facilities. In coke production, bituminous coals are pyrolyzed at 900 degrees (C) for a day. This allows the coke to burn rapidly. However, coking consumes 25% of the raw coal's energy. In contrast, our co-product-bindered bricks can be made at near-ambient temperature and thus can diminish carbon dioxide release by 1-3 million tons / year. By bindering waste anthracite fines with a composite binder of biomass co-products, our preliminary results show that the project director (PD) can make a brick with the same

toughness, thermal resiliency, high surface area, fast burning rate, and high energy content as coke. Currently, PD will expand the fundamental thermo-chemistry of these hybrid binders, so as to enhance the co-products' value to foundries. The project team has investigated the thermal production of biomass byproducts at temperatures from ambient to 1600C; they have studied the conversion of products into silicon carbide nanowires which impart strength; and have investigated the fuel potential, chemistry, and strengths of the fuel bricks. The bricks have already been demonstrated at partnering foundries, using 8 Tons of bricks. The demonstrations were highly successful. The project team is trying to optimize the bricks to support further development. Since the inception of this project, the PD has published 8 peer-reviewed journal articles or abstracts and presented her research as a speaker at 4 national/international conferences.

Overview – AFRI Sustainable Bioenergy Research: Pollinators and Wildlife

This priority area was established in FY 2012. The potential for land-use change with respect to the production of feedstocks for biofuels and bioenergy will have an unknown effect on sustainable wildlife habitat and pollinator species. Funded projects are examining issues such as fragmentation of habitat, edge-effects, migratory and breeding patterns, predator-prey interactions, and other wildlife issues impacted by biomass development. Additionally, projects are encouraged to develop best-management practices to minimize adverse effects on wildlife and pollinators.

Selected accomplishments:

- Farmer-friendly alternative crops such as the oilseed plant *Echium* (aka Bluebell) are providing added value to the biofuel industry and as co-products to consumers (e.g., heart-healthy dietary supplements and personal care products). Research is showing that oilseed crops such as *Echium*, when planted across broad landscapes, successfully support pollinators because they provide diverse and nutritious floral resources. In addition, they can flower up to 6 months in a year, which sustains pollinators for longer periods.
- Studies are underway to examine the potential for switchgrass to enhance the suitability of agricultural landscapes for grassland birds. Agent-based models are being developed to test the efficacy of corridors of favorable habitat, bird-sensitive harvesting regimes and landscape heterogeneity, which are attributes of effective management strategies to ensure the persistence of grassland birds in the biofuel era.

Overview – AFRI Sustainable Bioenergy Research: Feedstock Crop Protection

The Feedstock Crop Protection Program was initiated in 2010 to address the evaluation and mitigation of pests and diseases that threaten economic production of bioenergy crops as well as to examine the potential adverse impacts on arthropod biological control agents and pollinators of agronomic crops.
Selected accomplishments:

- Successfully transformed three disease resistance genes in switchgrass and sorghum; field testing transformed switchgrass and sorghum plants against natural field inoculum.
- Developed empirical models in soybean to quantify relationships between pest population dynamics, natural enemy abundance, crop yield, local habitat attributes and landscape characteristics.
- A draft genome sequence was generated and gene assembly has been initiated for the western corn rootworm, *Diabrotica virgifera*. It is anticipated that whole genome sequencing of this major pest will lead to the discovery of genes that may be exploited for development of novel control methods.

Program 4: Biomass Research and Development Initiative

Biomass Research and Development Initiative (BRDI) fills a significant gap in the continuum of technology development and commercialization supported by USDA and other Federal programs. While meeting the requirements of section 9008 (research focused on Feedstock Development, Biofuels and Biobased Product Development, Biofuels Development Analysis) of the Agricultural Act of 2014, USDA has shaped the program to be a source of bridge funding for developing and emerging technologies to cross the "economic valley of death." The intent of the Program is to help develop and demonstrate technologies to the point that they might attract additional private or public financing to scale-up and/or produce commercial quantities of biomass based energy and/or materials.

Thermoplastics Composites Reinforced with Natural Fibers and Inorganic Nano-Particles
Louisiana State University

A novel formulation of plastic and natural fiber composite was developed through BRDI and commercialized by the oil industry as a "lost circulation control" material with the trade name ***TigerBullets***®. ***TigerBullet*s**® product is currently manufactured by Wallace Molding and Millwork Inc., Columbia, LA – a traditional wood products company - and marketed by MI-Swaco Inc., Houston, TX (a Schlumberger Company) and HolePluggers LLC, New Iberia, LA. So far, over 5,000,000 pounds ($8,000,000) of material have been manufactured and sold to major oil companies, including BP, Exxon, Chevron, XTO, Pioneer, and OXY for use in over 300 oil wells in the U. S. and abroad. The BRDI funding indirectly helped Wallace Molding and Millwork Company maintain its workforce by rehiring 30-45 workers during an economic downturn through manufacturing the ***TigerBullets***® product. The Louisiana-based start-up company HolePluggers LLC was set-up to market the ***TigerBullets***® products.

Adding Cellulosic Ethanol- ACE
Quad County Corn Processors

ACE has improved the utilization of the stream of corn kernel fiber in existing ethanol plants to add three important revenue streams to the facility; cellulosic ethanol, corn oil, and increased value feed. The ACE process has been installed and is operating at the Quad County Corn Processors site. The facility was built for an investment of $4.63 per

gallon of cellulosic capacity, under the estimate of $5.00 per gallon. It is currently being operated at 70% capacity. Based on current production data the estimate is that 0.15 gallons of cellulosic ethanol per bushel are easily achievable.

Program 5: Critical Agricultural Materials

The Critical Agricultural Materials Program supports product development, demonstration and validation of product performance under operational field conditions, specifically for paints, coatings, and adhesives for composites which are manufactured from domestically produced agricultural materials and are of strategic and industrial importance to benefit the economy, defense and general well-being of the Nation. Many such products replace petroleum-based products, and offer opportunities to create new businesses and new markets for agricultural materials.

Biobased Acrylic Polymers for Waterborne Coatings
PPG Coatings and Resins
A series of pigmented dispersions based on the biobased acrylics developed under this program was prepared by PPG and formulated into automotive basecoat paints and tested at North Dakota State University. In general, test results confirmed that the experimental biobased basecoat formulations performed equal to the commercial control basecoats. Physical property testing and accelerated weathering testing did not identify any weaknesses with the biobased systems. However, neither did the biobased systems offer any measurable property advantages over the currently-used dispersions. The opportunities for this technology in the automotive marketplace therefore appear to be limited at this time.

Program 6: Biodiesel Education

The goals of the Biodiesel Fuel Education Program are to stimulate biodiesel consumption and the development of a biodiesel infrastructure. The information and outreach activities to raise awareness of the benefits of biodiesel fuel use complemented the incentives provided by the Energy Policy Act of 2005 (EPAct) (Pub. L. 109-58), and the Energy Independence and Security Act of 2007 (Pub. L. 110-140). As a result of increased awareness and consumption of biodiesel over the past decade, the Biodiesel Education program supports educational programs which will advance infrastructure, technology transfer, fuel quality, fuel safety and increasing feedstock production.

Biodiesel Fuel Education
National Biodiesel Board and University of Idaho
The program supports and promotes the BQ-9000 Quality certification program. Today there are 23 certified marketers, 46 certified producers and 11 certified labs representing more than 85 percent of the market. The University of Idaho offers workshops, short courses, and individual phone/email assistance to producers to inform them about technical innovations and the need for continuous improvement in production quality. Forty eight states have officially adopted ASTM D-6751, up from just

27 when the Biodiesel Education program began, and NBB has worked with each state on fuel quality enforcement. This fuel quality program has been dramatically successful at increasing the adopting of standards and monitoring of fuel quality nationwide

Program 7: Small Business Innovation Research

The USDA Small Business Innovation Research (SBIR) Program is part of a > two billion dollar Federal Program supporting pre-commercialization research and development for US owned and operated small businesses (less than 500 employees). USDA SBIR has 10 topic areas. Five of the topic areas provide between $2-4 million dollars annually in aggregate to fund projects addressing the development of feedstock systems and production of biofuels and biobased products:

- 8.1 Forests and Related Resources: woody biomass crop development, cultivation, crop protection and biomass utilization (fuels, bioproducts)
- 8.2 Plant Production and Protection – Biology: genetic crop development and crop protection
- 8.7 Aquaculture: cultivation of algae
- 8.8 Biofuels and Biobased Products: biobased processes and products including advanced biofuels, adhesives, bioplastics, industrial chemical intermediates, biopolymers, coatings, anaerobic digesters
- 8.13 Plant Production and Protection – Engineering: Biomass feedstock crop production, harvesting, and logistic system components

SBIR Example one:

ACCESSION NO: 1002740 **SUBFILE:** CRIS
PROJ NO: WN.K-2014-00341 **AGENCY:** NIFA WN.K
PROJ TYPE: SMALL BUSINESS GRANT **PROJ STATUS:** NEW
CONTRACT/GRANT/AGREEMENT NO: 2014-33610-21920 **PROPOSAL NO:** 2014-00341
START: 01 JUN 2014 **TERM:** 31 JAN 2015
GRANT AMT: $100,000 **GRANT YR:** 2014
AWARD TOTAL: $100,000

INVESTIGATOR: Dooley, J. H.

PERFORMING INSTITUTION:
FOREST CONCEPTS, LLC
3320 WEST VALLEY HIGHWAY N., D 110
AUBURN, WASHINGTON 98001

MODEL BASED CONTROL FOR DRYER ENERGY CONSERVATION

NON-TECHNICAL SUMMARY: Producers of solid and liquid biofuels need to reduce both capital and operating costs to achieve unsubsidized cost parity with fossil fuels. Many biomass feedstocks destined for conversion platforms must be dried, however, the capital cost for dryers is high due to long residence times and the operating cost is high due to system inefficiencies. Consistent and reliable operation of biomass dryers is problematic across emerging and rapidly expanding biofuel firms due to inexperience of operators and lack of knowledge about drying characteristics of their feedstocks. This project will develop advanced, retrofit-able dryer control systems utilizing modern sensor equipment as well as high pressure low temperature down draft drying methods that optimize final moisture content, energy input, and capital costs that can be applied to both new and existing dryers. During this project we will develop a table of drying properties for bioenergy feedstocks of switchgrass, Miscanthus, sorghum, high-moisture baled corn stover, and poplar chips. We will also formulate a physics-based drying model for moving bed dryers relevant to a model based control system in order to minimize drying time and energy consumption. Products of this research will include a table of important drying parameters for select crops as well as a model based control system for dryers. The technologies resulting from this project can immediately be implemented in current biopower and solid biofuel gasification facilities as well as future second generation thermochemical facilities. These technologies will likely reduce the capital by 30% and operating costs by 25% resulting in dramatic biofuels production cost reduction.

OBJECTIVES: The overarching goal of the proposed project is to simplify the complexity of operation of a dryer and improve energy efficiency. Current dryers heavily rely on intuitive solving of multiple coupled equations, a skill which can only be developed with years of experience. In the emerging bioenergy field where new facilities are proliferating, experienced operators are often unavailable. Further, even experienced operators must adjust to changing feedstocks and other environmental factors. A model based control that is informed by incoming biomass particle data as well as an appropriate model solver, will allow less experience operators to consistently meet drying goals and achieve optimal dryer efficiency. The overarching goal can be broken into three primary objectives. Objective 1 - Experimentally develop a table of drying properties for herbaceous bioenergy feedstocks of switchgrass, Miscanthus, sorghum, high-moisture baled corn stover, and poplar chips. Objective 2 - Formulate a physics-based drying model for moving bed dryers relevant to a model based control system in order to minimize drying time and energy consumption. Objective 3 - Validate market assumptions about market proposition and develop a concise commercialization plan for phase II and beyond.

SBIR Example Two:

ACCESSION NO: 0226262 **SUBFILE:** CRIS
PROJ NO: OREW-2011-02364 **AGENCY:** NIFA OREK
PROJ TYPE: SMALL BUSINESS GRANT **PROJ STATUS:** NEW
CONTRACT/GRANT/AGREEMENT NO: 2011-33610-30781 **PROPOSAL NO:** 2011-02364
START: 01 SEP 2011 **TERM:** 31 AUG 2013
GRANT AMT: $460,000 **GRANT YR:** 2011
AWARD TOTAL: $460,000

INVESTIGATOR: Stanton, B. J.

PERFORMING INSTITUTION:
GREENWOOD RESOURCES, INC.
1500 SW 1ST AVE SUITE 940
PORTLAND, OREGON 97201

ALDER GENETIC IMPROVEMENT FOR THE PACIFIC NORTHWEST FOREST PRODUCTS INDUSTRY.

NON-TECHNICAL SUMMARY: Red alder is the predominant commercial hardwood species of the Pacific Northwest. It is an early successional species that rapidly regenerates following fire or clearcutting and normally precedes the establishment of the historically preferred Douglas-fir. As such, past conifer forestry management practices were designed to speed the transition to Douglas-fir through alder eradication efforts. Consequently, today there is a critical shortage of quality alder logs at the same time the species has become highly prized in domestic and international hardwood furniture, cabinetry, and specialty product markets. Accordingly, red alder plantations are now the leading strategy to forestall the supply shortage of quality saw logs because of favorable rates of financial return in addition to their unique contribution to overall ecosystem function. The success of an alder plantation industry is contingent upon elite, well-adapted planting stock, capable of improved yields and wood quality. GreenWood Resources proposes an alder genetic improvement program that replicates its highly successful and integrated hybrid poplar genetic improvement and plantation management programs. Phase II results will lead to improved alder varieties capable of high yields, reduced risk of spring frost injury, increased site adaptability and improved wood quality. Our work will lead directly to development of GreenWood Resources' red alder nursery business. This is a necessary and important prelude to GreenWood's development of a short-rotation, high-yield alder tree farm investment fund. This fund will secure the Pacific Northwest's red alder sawmilling, lumber, furniture, door, cabinetry, and specialty products industries.

OBJECTIVES: The goal is to develop improved alder planting stock to optimize an alder plantation program that will improve the supply of quality alder logs for the Pacific Northwest's hardwood sawmilling industry. Controlled inter-specific hybridization and

varietal selection and propagation will encompass four project objectives that will resolve specific questions necessary for commercializing the improvement strategy: I. Inter-specific red alder hybridization. The objective is to determine the value of first generation hybrids of multiple inter-specific taxa as candidates for short-rotation plantation operations. Inherent technical questions are: a. Do one or more hybrid taxa exhibit heterosis of yield and/or wood quality b. What is the extent of within-family segregation c. Can complementary traits be combined within hybrid taxa to widen the range of site adaptability d. Are reciprocal crossing effects important (i.e. maternal inheritance) II. Recurrent red alder breeding. The objective is to create a population of the 2nd generation of red alder bred from superior 1st generation varieties and to evaluate the magnitude of genetic gain. Inherent technical questions are: a. How is genetic variation expressed in the 2nd generation What is the proportion of additive and non-additive variation b. How much varietal variation is there within families III. Establishment of red alder and white alder breeding populations. The objective is to establish base populations of the two cornerstone, native species in order to establish a long-term intra- and inter-specific improvement program for breeding zones of southwest Washington and northwest Oregon region coinciding with two plantation development zones. IV. Vegetative propagation. The objective is to refine the success of the Phase I macro- and micro-propagation work for the establishment of varietal progeny trials as well as to multiply elite selections to quantities sufficient to initiate commercial deployment. Key underlining questions are: a. Can Phase I propagation success be increased in Phase II by beginning earlier in the year and with closer control on cutting quality b. How much variation among hybrid taxa is there in adventitious rooting and survival

IMPACT: 2011/09 TO 2012/08
We made the following observations during the hybridization of A. rubra and A. rhombifolia: 1. There was no apparent difference in the yield of pollen between the two species. Nor was there any apparent difference in pollen viability; 2. Scion wood of the A. rhombifolia parents was appreciably smaller than the scion wood of the A. rubra parents. Nonetheless, we did not experience any difference in grafting success. (We grafted scion wood of each species on to seedling understock of the same species.); 3. A. rubra fruits were larger than the fruits of A. rhombifolia. Perhaps as a consequence, hybrid seed produced by the A. rubra parents was noticeably larger than hybrid seed collected from the A. rhombifolia parents; 4. Seed production of the A. rubra females exceeded the production of the A. rhombifolia females by nearly five fold; 5. Germination percentage and germination energy did not appear to differ between the two species. We have successfully produced developing strobili for the majority of the second generation A. rubra crosses. Nearly all of the failed crosses result from the fact that the understock had begun to grow at the time the grafts were made in May, a consequence of a January ice storm and the subsequent late collection of scion wood in March. We observed adventitious rooting from first-order branches (layering) on trees growing in our 2009 A. glutinosa trial. This may indicate a good opportunity for adventitious rooting - and thereby clonal propagation - from detached hardwood macro-cuttings. Moreover, we will devise a method to initiate layering in a high-density nursery bed. The layered branches would be removed to make hardwood cuttings that can be

replanted to complete the cloning process. This vegetative propagation technique if successful will allow cost-effective field rooting of small diameter hardwood macro-cuttings. Our ongoing attempts at clonal propagation by greenwood macro-cuttings and in vitro produced micro-cuttings have shown that: 1. The rooting and vigor of macro-cuttings is enhanced when the Frankia symbiont is directly introduced by pipetting a crushed nodule slurry in to planting containers compared with mixing forest soil with the horticultural soil used in filling the containers and 2. The A. rubra x A. glutinosa taxon initiates callus and proliferates in vitro shoots more rapidly than other alder species or inter-specific hybrid taxa.

PUBLICATIONS (not previously reported): 2011/09 TO 2012/08
No publications reported this period

Program 8: Agriculture and Food Research Initiative Sustainable Bioenergy Challenge: Joint Feedstock Genomics for Bioenergy

The AFRI Joint Feedstock Genomics for Bioenergy program began in 2006 and focuses on fundamental investigations of biomass genomics, with the aim of harnessing nonfood plant biomass for the production of biofuels or renewable chemical feedstocks. The program integrates DOE's capabilities in genomic sequencing and analysis for production of biofuels with USDA's long experience in crop improvement. Funded projects aim to accelerate the breeding of optimized dedicated bioenergy feedstocks through a better understanding of complex interactions between bioenergy feedstock plants and their environment, allowing the development of new regionally-adapted bioenergy feedstock cultivars with maximal biomass or seed oil yield and traits leading to more sustainable production systems, such as minimal water usage and nutrient input requirements.

Accomplishments:

- Elucidation of the regulation of gene networks, proteins, and metabolites to improve plant feedstock productivity and sustainability, that has advanced our understanding of carbon partitioning and nutrient cycling;
- New fundamental knowledge of the structure, function, and organization of plant genomes, that has led to innovative strategies for feedstock characterization, breeding, or manipulation;
- Characterization of plant germplasm collections and advanced breeding lines of dedicated bioenergy crops to discover and deploy valuable alleles for key bioenergy traits. In virtually all cases this leverages the use of USDA-ARS and Land-grant University germplasm collections while providing characterization information that makes these collections even more valuable and;
- Development of new "phenomics" methods and and theory to integrate key genomics-assisted approaches into biomass research, and when combined with

high-throughput and traditional field-based phenotyping methods has enabled advanced breeding strategies for cultivar improvement.

Program 9: Agriculture and Food Research Initiative Sustainable Bioenergy Challenge: Loblolly Pine Genome

AFRI Pine Genome, description and accomplishments

The AFRI Pine Genome priority area aims to develop a high quality reference genome sequence for loblolly pine, Douglas-fir and sugar pine to empower the forest tree biology research community and the broader biological research community in the practical use and application of this resource. Conifers present numerous challenges for successful genome sequencing, mainly due to their large size and complexity. The complete genome sequence of loblolly pine will have impacts in industrial forestry, ecosystem management and more broadly in genome sequencing in general. With a reference genome sequence of pine made available, efforts to find crucial genes and gene regulators will be facilitated and the development of trees adapted to the production of biofuels accelerated. The AFRI funded $15 million pine genome project was funded in 2010 and is led by a UC Davis team, and the genome assembly stages are led by Johns Hopkins University and the University of Maryland. Other collaborating institutions include Indiana University, Bloomington; Texas A&M University; Children's Hospital Oakland Research Institute; and Washington State University.

Accomplishments:

- In 2014, the loblolly pine genome sequence assembly (version 1.01) was completed and published in two journals, *Genetics* and *Genome Biology*. The sequence is currently the best, most contiguous and complete large conifer assembly to date and is publicly available.
- The MaSuRCA assembler was significantly improved and used to assemble the genome. The assembler has been published and released to the public under an open source license.
- The primary complete transcripts of the first loblolly pine transcriptome reference that was generated by the team were used in the current genome annotation to identify over 50,000 expressed loci in version 1.01 of the genome assembly. The transcriptome reference sequence is of the highest quality, very deep and informative alone as functional references, and have been demonstrably essential to deciphering gene activity in the genome reference of loblolly pine.
- The *TreeGenes* database was improved with the addition of the complete conifer repeat library generated by the team. In addition, TreeGene resources for viewing genome annotations were developed in Gbrowse and WebApollo. The latest version of the on-line annotation tool (Genome Sequence Annotation

Server) GenSAS v2.0 is now being beta tested by several researchers to help annotate/curate genomes of interest.

- Tutorial modules, started in grant year 2, were completed and reviewed by Project PDs and staff and subsequently produced at Oregon State University and made available via the *eXtension plant breeding and genomics* website.
- Outreach presentations about how the reference genome sequence can be used were made to regional tree improvement cooperatives. Short-term impacts include facilitating genomic-based breeding for wood products and energy, developing diagnostic tools to estimate risk and impacts caused by changing environments, and facilitating genome sequencing in other conifers.

Program 10: Sun Grant Initiative

The purpose of this program is to provide a consortium of universities made up of a university from each of the sun grant regions and subcenter region with a grant to support a North-Central, Southeastern, South-Central, Western, and Northeastern Sun Grant Center and a Western Insular Pacific Subcenter. A Sun Grant Center or Subcenter will use 75 percent of grant funds to provide competitive grants within each region that are multi-institutional and integrated, multistate research, extension, and education programs on technology development and technology implementation and address bioenergy, biomass, or bioproducts research priorities.

Sustainable Feedstocks for an Oilseed Based Biofuel Industry in the Dakotas
South Dakota State University
Non-food oilseed crops targeted for semi-arid and arid agro-ecozones have the potential to transform the economy of the region with minimal impact on global food supplies. The seed and plant oil production potential of promising oilseed crops for the semi-arid and arid regions of the Dakotas such as winter camelina, juncea canola/ brown mustard, crambe, field pennycress, flax, and safflower was evaluated across a range of agro-ecozones. The plant oil profile was characterized to evaluate their potential for various bio-fuel markets. Educational programming is being developed to assist producers and oil processors in developing an oilseed based biofuel industry in the Dakotas.

Revised Project Timeline of Bioeconomy Bioenergy Bioproducts (B3) Portfolio Activities

	2014	2015	2016	2017	2018
Prepare a Bioeconomy Strategic Plan for NIFA that builds on the President's Initiatives and Bioenergy Plan		X	X	X	X
Expand National Program Leadership Areas to Bioenergy/Bioeconomy Issues	**X**	X	X	X	X
Perform Continuous Assessment of Existing Projects to Identify Gaps	**X**	X	X	X	X
Initiate a Strategic National Plan for the Bioeconomy	X	X	X	X	X
Establish a Core Set of Bioeconomy Priorities that are included in other NIFA Portfolios		X	X	X	X
Establish an External Advisory Panel on the Emerging Bioeconomy and Agriculture			X	X	X
Organize and Produce Syntheses Products based on the Bioenergy Portfolio	**X**	X	X	X	X
Develop Interagency Collaborations for bioenergy/Bioeconomy	**X**	X	X	X	X
Help Design and Implement Bioenergy/Bioeconomy Communities of Practice with eXtension	**X**	X	X	X	X
Produce a Strategic Communication and Marketing Plan for NIFA Activities Focusing on Bioeconomy			X	X	X
Collaborate with NOAA Sea-Grant for Climate Extension	**X**	X	X		
X indicates activities underway or completed					

Sustainable Bioenergy Annual Project Director (PD) Meeting

USDA-NIFA AFRI Sustainable Bioenergy
Annual Project Director (PD) Meeting

Renaissance Capital View Arlington Hotel
2800 South Potomac Ave
Arlington, VA 22202

AGENDA

October 29, 2014

3:00 – 4:30 PM		Poster set-up and Registration **Virginia Tech Staff**
4:30 – 5:30 PM		Welcome and Opening Remarks **Dr. Louie Tupas Deputy Director of IBCE NIFA**
5:30 – 7:00 PM		Poster Session #1 and Networking Reception

October 30, 2014

7:30-8:30 AM Room:TBA		Poster Set-up and Registration **Virginia Tech Staff**
8:30 – 9:00 AM Room:TBA		Formal Welcome **Dr. Sonny Ramaswamy Director of NIFA**
9:00-9:30 AM Room:TBA		System For Advanced Biofuels Production From Woody Biomass In The Pacific Northwest **Richard Gustafson** **University of Washington**
9:30-10:00 AM Room:TBA		Northwest Advanced Renewables Alliance (NARA): A New Vista for Green Fuels, Chemicals, and Environmentally Preferred Products (EPPs) **Ralph Cavalieri** **Washington State University**
10:00-10:30 AM Room:TBA		Agro-ecosystem Approach to Sustainable Biofuels Production via the Pyrolysis-Biochar Platform (AFRI-CAP) **Kenneth Moore** **Iowa State University of Science and Technology**
10:30-10:45 AM		BREAK
10:45-11:15 AM Room:TBA		A Regional Program for Production of Multiple Agricultural Feedstocks and Processing to Biofuels and Biobased Chemicals **Donal Day** **Louisiana State University Agricultural Center**
11:15-11:45 AM Room:TBA		Southeast Partnership for Integrated Biomass Supply Systems **Timothy Rials** **University of Tennessee**
11:45-1:15 PM		LUNCH
1:15-1:45 PM Room: TBA		NEWBio: Northeast Woody/Warm-season Biomass Consortium **Thomas Richard**

		The Pennsylvania State University
1:45-2:15 PM Room:TBA		Sustainable biofuel feedstocks from beetle-killed wood: Bioenergy Alliance Network of the Rockies (BANR) **Keith Paustian** **Colorado State University**
2:15-2:30 PM		BREAK
2:30-4:30 PM Room:TBA		**Concurrent Sessions** Track 1: Co- Products Led by Dr. **Shing Kwok, NIFA National Program Leader** Engineering Neurospora crassa for improved cellobionate production from cellulosic biomass **Zhiliang Fan** **University of California-Davis** Regioselective synthesis of cellulose derivatives without the need for protecting groups **Kevin Edgar** **Virginia Tech** Engineering High Value Oil Production into Biofuel Crops **Joseph Chappell** **University of Kentucky** Engineering *Lactobacillus casei* for the production of L(+)-lactic acid from renewable feedstocks **Jeff Broadbent** **Utah State University**
Room: TBA		Track 2: Wildlife Pollination & Crop Protection Room: TBA Led by Dr. **Mary Purcell, NIFA National Program Leader** **Crop Protection** *Titles TBA* **Gregg Johnson** **University of Minnesota** **Ted Wilson/Tim Reagan** **Louisiana State University** **Carolyn Malmstrom** **Michigan State University** **Kris Giles/ Tim Kring** **University of Arkansas** **Claudio Gratton** **University of Wisconsin**

		Wildlife Pollination *Titles: TBA* **Rob Fletcher** **University of Florida** **Frank Forcella** **USDA Agricultural Research Service** **Patrick Keyser/Chris Lituma** **University of Tennessee**
Room: TBA		Track 3: Carbon Sequestration, Land Use & Water Room: TBA Led by **Dr. Nancy Cavallaro, NIFA National Program Leader** Contributions Of Upland And Lowland Switchgrass Ecotypes Associated Mycorrhizal Fungi To Soil Carbon Storage **Gail Wilson** **Oklahoma State University** Greenhouse Gas Emission And Carbon Mineralization In An Eroded Landscape Amended With Biochar **Thomas Schumacher** **South Dakota State University** At The Root Of Sustainable Bioenergy: Using Genetic Variation In Root Traits To Maximize Soil Carbon Sequestration And Biomass Yields **Marie-Anne de Graaff** **Boise State University** Carbon Sequestration And Gaseous Emissions In Perennial Grass Bioenergy Cropping Systems In The Northeastern U.S. **Brian Richards** **Cornell University**
		Track 4: Policy Options & Socioeconomic Impacts Led by **Dr. Fen Hunt, NIFA National Program Leader** Socioeconomic Impacts of Biofuels on Rural Communities **James Finley** **Pennsylvania State University**

		The Effect of Existing and Novel Policy Options on the Sustainable Development of Regional Bioenergy Systems **Christopher Galik** **Duke University** Evaluating Policy Incentives For Regional Biofuels Production Systems With A Scenario-Based Decision Support Tool. **Gary Radloff** **University of Wisconsin**
4:30-6:00 PM Room:TBA		Poster Session #2 & Reception

October 31, 2014

8:00 – 8:30 AM Room:TBA		Introduction: **Dr. Daniel Cassidy, NIFA National Program Leader**
8:30: 9:00 AM Room:TBA		Place based Opportunities for Sustainable Outcomes and High hopes: POSOH The Board of Regents of the University of Wisconsin System **Richard Amasino**
9:00-9:30 AM Room:TBA		Northeast Bioenergy and BioProducts (NBB) Educational Program: Providing Faculty with Training, Tools and In-classroom Support Cornell University **Corine Rutzke**
9:30 – 10:00 AM		Break
10:00 -11:30 AM Room:TBA		The Future of Bioeconomy and Audience Q&A **Dr. Sonny Ramaswamy Director of NIFA**
11:30-11:45 AM Room:TBA		Closing Remarks **Dr. Bill Goldner National Program Leader, NIFA**

Active Funded NIFA Bioenergy Bioeconomy Bioproducts (B3) Projects (2010 to Present)

- **Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-05061	Southeast Partnership for Integrated Biomass Supply Systems	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	The University of Tennessee	225502	Timothy G. Rials	5,850,000
2010-05066	Northwest Advanced Renewables Alliance (NARA): A New Vista for Green Fuels, Chemicals, and Environmentally Preferred Products (EPPs)	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Washington State University	225437	Ralph P. Cavalieri	15,600,000
2010-05069	A Regional Program for Production of Multiple Agricultural Feedstocks and Processing to Biofuels and Biobased Chemicals	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Louisiana State University Agricultural Center	225397	Donal F Day	6,874,165
2010-05050	2011 SOUTHERN FOREST TREE IMPROVEMENT CONFERENCE	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Mississippi State University	225372	Cetin Yuceer	27,108
2010-05051	2011 Plant Metabolic Engineering GRC/GRS	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Gordon Research Conferences	225351	Natalia Dudareva	20,000
2010-05073	Agro-ecosystem Approach to Sustainable Biofuels Production via the Pyrolysis-Biochar Platform (AFRI-CAP)	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Iowa State University of Science and Technology	225366	Kenneth J Moore	9,750,000

2010-05080	System For Advanced Biofuels Production From Woody Biomass In The Pacific Northwest	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	University of Washington	225392	Richard Gustafson	15,600,000
2010-05048	Database Development for Integrated Sustainability Assessment of Forest Based Biofuels Supply Chain	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Univ. of Maine System acting through the Univ. of Maine	225358	Stephen Mark Shaler	149,861
2010-05052	Increasing the capacity of Extension educators to initiate and participate in bioenergy programs and community projects.	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Michigan State University	225503	Merrill Charles Gould	49,892
2012-00772	Bioenergy and I95 Rural Economic Development Summit	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Clemson University	230397	James R. Frederick	50,000
2012-00774	NEWBio: Northeast Woody/Warm-season Biomass Consortium	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	The Pennsylvania State University	229798	Thomas Lehman Richard	2,000,000
2013-04661	A Regional Program for Production of Multiple Agricultural Feedstocks and Processing to Biofuels and Biobased Chemicals	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Louisiana State University Agricultural Center	225397	Donal F Day	3,489,667
2013-04662	Southeast Partnership for Integrated Biomass Supply Systems	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	The University of Tennessee	225502	Timothy G. Rials	3,000,000
2013-04663	Northwest Advanced Renewables Alliance (NARA): A New Vista for Green Fuels, Chemicals, and Environmentally	Development and Sustainable Production of Regionally Appropriate Biomass	Washington State University	225437	Ralph P. Cavalieri	8,000,000

	Preferred Products (EPPs)	Feedstocks, AFRI				
2013-04664	NEWBio: Northeast Woody/Warm-season Biomass Consortium	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	PENNSYLVANIA STATE UNIVERSITY -UNIV PARK	229798	Thomas Lehman Richard	2,000,000
2013-03867	Sustainable biofuel feedstocks from beetle-killed wood: Bioenergy Alliance Network of the Rockies (BANR)	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Colorado State University	1001665	Keith Paustian	1,820,000
2013-03855	Development of sorghum mutant population for biomass feedstock functional genomics research in C4 grasses.	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Oklahoma State University	1001496	Million Tadege	150,000
2013-03856	Enhancing Agriculture`s Ecosystem Services Through Sustainable Bioenergy Production	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Regents of the University of Minnesota	NULL	Jason Hill	30,000
2012-03454	Agro-ecosystem Approach to Sustainable Biofuels Production via the Pyrolysis-Biochar Platform (AFRI-CAP)	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Iowa State University of Science and Technology	225366	Kenneth J Moore	68,025
2013-04685	System For Advanced Biofuels Production From Woody Biomass In The Pacific Northwest	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	University of Washington	225392	Richard Gustafson	8,000,000
2013-05145	Agro-ecosystem Approach to Sustainable Biofuels Production via the Pyrolysis-Biochar Platform (AFRI-CAP)	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Iowa State University of Science and Technology	225366	Kenneth J Moore	5,000,000
2012-00792	New Crops: Bioenergy, Biomaterials, Food and Health	Development and Sustainable Production of	University of Arizona	230338	Dennis T Ray	36,000

		Regionally Appropriate Biomass Feedstocks, AFRI				
2012-00793	GROWING ENERGY CROPS ON CONTAMINATED LAND FOR THE COMBINED BENEFITS OF PHYTOREMEDIATION AND SUSTAINABLE ENERGY PRODUCTION	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Temple University -Of The Commonwealth System of Higher Educ	230345	Benoit Van Aken	149,977
2014-06511	Southeast Partnership for Integrated Biomass Supply Systems	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	The University of Tennessee	225502	Timothy G. Rials	3,000,000
2014-06512	Northwest Advanced Renewables Alliance (NARA): A New Vista for Green Fuels, Chemicals, and Environmentally Preferred Products (EPPs)	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Washington State University	225437	Ralph P. Cavalieri	8,000,000
2014-06513	NEWBio: Northeast Woody/Warm-season Biomass Consortium	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	PENNSYLVANIA STATE UNIVERSITY -UNIV PARK	229798	Thomas Lehman Richard	2,000,000
2014-06517	System For Advanced Biofuels Production From Woody Biomass In The Pacific Northwest	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	University of Washington	225392	Richard Gustafson	8,000,000
2014-06518	Agro-ecosystem Approach to Sustainable Biofuels Production via the Pyrolysis-Biochar Platform (AFRI-CAP)	Development and Sustainable Production of Regionally Appropriate Biomass Feedstocks, AFRI	Iowa State University of Science and Technology	225366	Kenneth J Moore	5,000,000
Total						**39,185,977**

- **Sustainable Bioenergy Research – Carbon Sequestration, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-03948	Prairie cordgrass-based production of polysaccharide biopolymers	Sustainable Bioenergy: Sustainable Bioenergy Research	South Dakota State University	224149	Thomas P. West	150,000
2010-03874	Optimization of Pyrolytic Bio-oil Production to Maximize Biochar Utility Using Selected Biomass Feedstocks	Sustainable Bioenergy: Sustainable Bioenergy Research	South Dakota State University	224395	Thomas Edward Schumacher	200,000
2010-03880	Loblolly pine-switchgrass intercropping for sustainable timber and biofuels production in the Southeastern United States	Sustainable Bioenergy: Sustainable Bioenergy Research	North Carolina State University	224209	John King	173,601
2010-03883	Decision support tool for integrated biofuel greenhouse gas emission footprints	Sustainable Bioenergy: Sustainable Bioenergy Research	Colorado State University	224350	Keith Paustian	199,988
2010-03891	Carbon sequest. and greenhouse gas emissions assoc. with cellulosic bioenergy feedstock prod. on marginal agric. lands in the Lower Miss.	Sustainable Bioenergy: Sustainable Bioenergy Research	Louisiana State University Agricultural Center	224176	Michael Allen Blazier	199,870
2010-03894	Understanding plant-soil-microbial processes to enhance soil carbon sequestration in bioenergy feedstock production	Sustainable Bioenergy: Sustainable Bioenergy Research	Oklahoma State University	224256	Gail W.T. Wilson	183,803
2010-04081	Membrane Reactor Technology for the Efficient Conversion of Biomass to Industrial Chemicals	Sustainable Bioenergy: Sustainable Bioenergy Research	Kansas State University	224150	Mary E Rezac	188,369
2010-04150	Managing Insect Pests and Diseases in Multi-Use Landscapes of Bioenergy and Conventional Cropping Systems in the Gulf Coast	Sustainable Bioenergy: Sustainable Bioenergy Research	Louisiana State University Agricultural Center	224568	Michael J. Stout	199,892
2010-03853	Impacts of Biomass Sorghum Feedstock Production on Carbon Sequestration and Greenhouse Gas	Sustainable Bioenergy: Sustainable Bioenergy Research	Texas A&M Research Foundation	224230	Frank Hons	198,843

	Emissions in the Southcentral Region					
2010-03860	Life Cycle Assessment of Sequestration and Exchange of Water, Carbon and Nitrogen in the Dedicated Bioenergy Feedstock, Energy Cane	Sustainable Bioenergy: Sustainable Bioenergy Research	The Regents of the University of California	224406	David Grantz	181,958
2010-03865	Greenhouse gas life cycle analysis of biochar effects on marginal land conversion to switchgrass production	Sustainable Bioenergy: Sustainable Bioenergy Research	The Pennsylvania State University	224165	Roger T. Koide	199,484
2010-03866	Carbon sequestration and greenhouse gas emissions associated with short-rotation woody biomass production in the Upper Great Lakes Region	Sustainable Bioenergy: Sustainable Bioenergy Research	Michigan State University	224182	David Rothstein	199,739
2010-03868	Carbon Sequestration and Nitrogen Cycling for Green House Gas Mitigation by Southeastern US Annual and Perennial Energy Crops	Sustainable Bioenergy: Sustainable Bioenergy Research	Fort Valley State University	224197	Bharat P. Singh	170,968
2010-03869	Carbon sequestration and gaseous emissions in perennial grass bioenergy cropping systems in the Northeastern U.S.	Sustainable Bioenergy: Sustainable Bioenergy Research	Cornell University	224158	Brian K Richards	199,619
2010-04194	Developing Best Practices Plan for Prevention and Treatment of Zooplankton Contamination in Algal Crop Production	Sustainable Bioenergy: Sustainable Bioenergy Research	Arizona Board of Regents for Arizona State University	224484	Danxiang Han	199,392
2010-04031	Enhancing the value of biofuels derived from algae and perennial grass feedstocks through integration of a lactic acid fermentation	Sustainable Bioenergy: Sustainable Bioenergy Research	Utah State University	224087	Jeff R. Broadbent	199,999
2010-03996	Acquisition of a Liquid Chromatography System for Analysis of Complex Biomass-derived Mixtures	Sustainable Bioenergy: Sustainable Bioenergy Research	South Dakota School of Mines and Technology	224104	Todd J. Menkhaus	85,838

2010-04017	Development of high value carbon based adsorbents from thermochemically produced biochar	Sustainable Bioenergy: Sustainable Bioenergy Research	South Dakota State University	224069	Zhengrong Gu	197,650
2010-03838	Carbon sequestration and Greenhouse Gas Emissions from Sustainable Inter cropping of Switch grass and Hybrid Poplar for Bioenergy Production	Sustainable Bioenergy: Sustainable Bioenergy Research	Washington State University	224247	Steven Fransen	160,581
2010-03848	Effects of Nitrogen Management Strategies on Biofuel Crop Biochemical and Soil Carbon Stocks.	Sustainable Bioenergy: Sustainable Bioenergy Research	William Marsh Rice University	224163	Caroline Ann Masiello	171,600
2011-04528	Understanding plant-soil-microbial processes to enhance soil carbon sequestration in bioenergy feedback production	Sustainable Bioenergy: Sustainable Bioenergy Research	Oklahoma State University	224256	Gail W.T. Wilson	736,814
2011-04530	Decision support tool for integrated biofuel greenhouse gas emission footprints	Sustainable Bioenergy: Sustainable Bioenergy Research	Colorado State University	224350	Keith Paustian	599,219
2011-04531	Optimization of Pyrolytic Bio-oil Production to Maximize Biochar Utility Using Selected Biomass Feedstocks	Sustainable Bioenergy: Sustainable Bioenergy Research	South Dakota State University	224395	Thomas Edward Schumacher	800,000
2011-04533	Greenhouse gas life cycle analysis of biochar effects on marginal land conversion to switchgrass production	Sustainable Bioenergy: Sustainable Bioenergy Research	The Pennsylvania State University	224165	Roger T. Koide	764,059
2011-04537	Effects of Nitrogen Management Strategies on Biofuel Crop Biochemical and Soil Carbon Stocks	Sustainable Bioenergy: Sustainable Bioenergy Research	William Marsh Rice University	224163	Caroline Ann Masiello	271,941
2011-04542	High density southern pine feedstock production and carbon sequestration	Sustainable Bioenergy: Sustainable Bioenergy Research	THE UNIIVERSITY OF GEORGIA RESEARCH FOUNDATION, INC.	224404	Daniel Markewitz	688,813
2011-04549	Loblolly pine-switchgrass	Sustainable Bioenergy:	North Carolina	224209	John King	629,369

	intercropping for sustainable timber and biofuels production in the Southeastern United States	Sustainable Bioenergy Research	State University			
2011-04558	Life Cycle Assessment of Sequestration and Exchange of Water, Carbon and Nitrogen in the Dedicated Bioenergy Feedstock, Energy Cane	Sustainable Bioenergy: Sustainable Bioenergy Research	The Regents of the University of California	224406	David A. Grantz	785,748
2011-04576	Carbon sequestration and gaseous emissions in perennial grass bioenergy cropping systems in the Northeastern U.S.	Sustainable Bioenergy: Sustainable Bioenergy Research	Cornell University	224158	Brian K Richards	797,467
2011-04584	Carbon sequestration and Greenhouse Gas Emissions from Sustainable Inter cropping of Switch grass and Hybrid Poplar for Bioenergy Production	Sustainable Bioenergy: Sustainable Bioenergy Research	Washington State University	224247	Steven Fransen	792,615
2011-04586	Carbon sequestration and greenhouse gas emissions associated with short-rotation woody biomass production in the Upper Great Lakes Region	Sustainable Bioenergy: Sustainable Bioenergy Research	Michigan State University	224182	David Rothstein	798,891
2011-04588	Impacts of Biomass Sorghum Feedstock Production on Carbon Sequestration and Greenhouse Gas Emissions in the Southcentral Region	Sustainable Bioenergy: Sustainable Bioenergy Research	Texas A&M Research Foundation	224230	Frank Hons	796,257
2011-04589	Carbon sequestration and greenhouse gas emissions associated with cellulosic bioenergy feedstock production on marginal agricultural lands i	Sustainable Bioenergy: Sustainable Bioenergy Research	Louisiana State University Agricultural Center	224176	Michael Allen Blazier	773,469
2011-04590	Carbon Sequestration and Nitrogen Cycling for Green House Gas Mitigation by Southeastern US Annual and Perennial Energy Crops	Sustainable Bioenergy: Sustainable Bioenergy Research	Fort Valley State University	224197	Bharat P. Singh	800,000

2012-04171	Greenhouse gas life cycle analysis of biochar effects on marginal land conversion to switchgrass production	Sustainable Bioenergy: Sustainable Bioenergy Research	Brigham Young University	231737	Roger T. Koide	733,884
Total						**14,429,740**

Sustainable Bioenergy Research: Feedstock Crop Protection, AFRI

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-04344	Evaluation and Mitigation of Anthracnose Disease Pressure Due to the Introduction of Sorghum for Feedstock Production	Sustainable Bioenergy: Sustainable Bioenergy Research	The Pennsylvania State University	224436	Surinder Chopra	199,548
2010-04151	Control and Mitigation of Generalist Pests in Perennial Grass-Dominated Bioenergy Landscapes	Sustainable Bioenergy: Sustainable Bioenergy Research	Michigan State University	224562	Carolyn Marie Malmstrom	198,244
2010-04156	Mitigating insect herbivory of warm-season bioenergy grasses - getting ahead of the curve	Sustainable Bioenergy: Sustainable Bioenergy Research	USDA-Agriculture Research Service	224487	Gautam Sarath	199,548
2010-04177	Impact of bioenergy crops on pests, natural enemies and pollinators in agricultural and non-crop landscapes	Sustainable Bioenergy: Sustainable Bioenergy Research	University of Arkansas	224538	Timothy Kring	187,621
2010-04178	The Role of diversified bioenergy cropping systems in enhancing biological control of the soybean aphid.	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Minnesota	224490	Gregg Johnson	192,922
2010-04195	Identification of genes controlling disease resistance to mitigate disease pressure of bioenergy crops	Sustainable Bioenergy: Sustainable Bioenergy Research	The Regents of the University of California	224524	PAMELA RONALD	199,984
2010-04160	Preparing for likely below-ground pests of bioenergy crops: genomics of the corn rootworm beetle	Sustainable Bioenergy: Sustainable Bioenergy Research	Board of Trustees of the University of Illinois	224696	Hugh Robertson	196,964

2011-04446	Control and Mitigation of Generalist Pests in Perennial Grass-Dominated Bioenergy Landscapes	Sustainable Bioenergy: Sustainable Bioenergy Research	Michigan State University	224562	Carolyn Marie Malmstrom	792,975
2010-04167	Management of the switchgrass rust disease by deploying host resistant genes and monitoring the dynamics of pathogen populations	Sustainable Bioenergy: Sustainable Bioenergy Research	Virginia Polytechnic Institute and State University	224506	Bingyu Zhao	200,000
2010-04183	Landscape structure and natural pest-suppression services in bioenergy landscapes: implications for regional food and fuel production	Sustainable Bioenergy: Sustainable Bioenergy Research	The Board of Regents of the University of Wisconsin System	224485	CLAUDIO GRATTON	199,553
2011-04455	The Impacts of Lignin Modification on Fungal Pathogen and Insect Interactions in Sorghum for Cellulosic and Thermal Bioenergy	Sustainable Bioenergy: Sustainable Bioenergy Research	USDA Agricultural Research Service	224481	Scott Edward Sattler	778,504
2011-04456	Mitigating insect herbivory of warm-season bioenergy grasses - getting ahead of the curve	Sustainable Bioenergy: Sustainable Bioenergy Research	USDA-Agriculture Research Service	224487	Gautam Sarath	798,193
2011-04458	Impact of bioenergy crops on pests, natural enemies and pollinators in agricultural and non-crop landscapes	Sustainable Bioenergy: Sustainable Bioenergy Research	University of Arkansas	224538	Timothy Kring	750,483
2011-04459	Evaluation and Mitigation of Anthracnose Disease Pressure Due to the Introduction of Sorghum for Feedstock Production	Sustainable Bioenergy: Sustainable Bioenergy Research	The Pennsylvania State University	224436	Surinder Chopra	799,561
2011-04453	The Role of diversified bioenergy cropping systems in enhancing biological control of the soybean aphid	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Minnesota	224490	Gregg Johnson	771,689
2011-04454	Identification of genes controlling disease resistance to mitigate disease pressure of bioenergy crops	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of California	224524	PAMELA RONALD	799,936
2011-04441	Landscape structure and natural past-suppression in	Sustainable Bioenergy: Sustainable	The Board of Regents of the	224485	Claudio Gratton	798,210

	bioenergy landscapes: implications for regional food and fuel production	Bioenergy Research	University of Wisconsin System			
2011-04443	Preparing for likely below-ground pests of bioenergy crops: genomics of the corn rootwork beetle	Sustainable Bioenergy: Sustainable Bioenergy Research	Board of Trustees of the University of Illinois	224696	Hugh Robertson	787,858
2011-04448	Management of the switchgrass rust disease by deploying host resistant genes and monitoring the dynamics of pathogen populations	Sustainable Bioenergy: Sustainable Bioenergy Research	Virginia Polytechnic Institute and State University	224506	Sucheta Tripathy	800,000
2011-04451	Developing Best Practices Plan for Prevention and Treatment of Zooplankton Contamination in Algal Crop Production	Sustainable Bioenergy: Sustainable Bioenergy Research	Arizona Board of Regents for Arizona State University	224484	Danxiang Han	797,570
2011-04457	Managing Insect Pests and Diseases in Multi-Use Landscapes of Bioenergy and Conventional Cropping Systems in the Gulf Coast	Sustainable Bioenergy: Sustainable Bioenergy Research	Louisiana State University Agricultural Center	224568	Michael J. Stout	799,568
Total						**11,248,931**

- **Sustainable Bioenergy Research: Enhanced-value Co-product Development**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-04036	Co-production of gluconic acid and isobutanol from cellulosic biomass	Sustainable Bioenergy: Sustainable Bioenergy Research	The Regents of the University of California	224079	Zhiliang Fan	199,673
2010-04045	High-value Nano-fibrillated Cellulose	Sustainable Bioenergy:	USDA Forest	224090	Ronald	

	Polymer Reinforcement as a Biofuel Co-product	Sustainable Bioenergy Research	Service		Charles Sabo	198,819
2010-04046	Cogent design of lignin-based plastics	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Minnesota	224162	Simo Sarkanen	199,991
2010-04055	Nanofiber Intermediates, Binderless Films and Adhesives as Co-Products of Bioenergy Systems	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Minnesota	224169	William Tze	198,515
2010-04057	Regiospecific Synthesis of High-value Cellulose Esters and Ethers from Biomass	Sustainable Bioenergy: Sustainable Bioenergy Research	Virginia Polytechnic Institute & State University	224166	Kevin J Edgar	181,994
2010-04019	Fuel and Oxygenate Co-Products From Biomass Fractionation and Advanced Catalytic Conversion Processes	Sustainable Bioenergy: Sustainable Bioenergy Research	Auburn University	224185	Mario Richard Eden	200,000
2010-04025	Engineering High Value Oil Producion Into Biofuel Crops	Sustainable Bioenergy: Sustainable Bioenergy Research	University of Kentucky Research Foundation	224098	Joseph Chappell	199,373
2010-04027	Multiple Enhanced-value Co-products from Regionally Important Oilseed Feedstocks	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Idaho	224275	Matthew J. Morra	42,878
2010-04033	A Novel Foundry Fuel Source Utilizing Biomass Co-Products as Binders and Fuel	Sustainable Bioenergy: Sustainable Bioenergy Research	The Pennsylvania State University	224089	Nicole R. Brown	199,999
2011-04437	Co-production of gluconic acid and isobutanol from cellulosic biomass	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of California	224079	Zhiliang Fan	799,118
2011-04438	Regiospecific Synthesis of High-value Cellulose Esters and Ethers from Biomass	Sustainable Bioenergy: Sustainable Bioenergy Research	Virginia Polytechnic Institute & State University	224166	Kevin J Edgar	634,055
2011-04439	Fuel and Oxygenate Co-Products From Biomass Fractionation	Sustainable Bioenergy: Sustainable	Auburn University	224185	Mario Richard Eden	800,000

	and Advanced Catalytic Conversion Processes	Bioenergy Research				
2011-04440	Engineering High Value Oil Producion Into Biofuel Crops	Sustainable Bioenergy: Sustainable Bioenergy Research	University of Kentucky Research Foundation	224098	Joseph Chappell	785,784
2011-04442	Cogent design of lignin-based plastics	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Minnesota	224162	Simo Sarkanen	799,825
2011-04444	Membrane Reactor Technology for the Efficient Conversion of Biomass to Industrial Chemicals	Sustainable Bioenergy: Sustainable Bioenergy Research	Kansas State University	224150	Mary E Rezac	398,058
2010-04061	Engineering succinate production by Actinobacillus succinogenes on glycerol	Sustainable Bioenergy: Sustainable Bioenergy Research	Michigan State University	224479	Claire Vieille	199,820
2011-04445	Development of high value carbon based adsorbents from thermochemically produced biochar	Sustainable Bioenergy: Sustainable Bioenergy Research	South Dakota State University	224069	Zhengrong Gu	394,765
2011-04447	High-value Nano-fibrillated Cellulose Polymer Reinforcement as a Biofuel Co-product	Sustainable Bioenergy: Sustainable Bioenergy Research	USDA Forest Service	224090	Ronald Charles Sabo	788,058
2011-04449	Nanofiber Intermediates, Binderless Films and Adhesives as Co-Products of Bioenergy Systems	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Minnesota	224169	William Tai Yin Tze	794,769
2011-04450	Enhancing the value of biofuels derived from algae and perennial grass feedstocks through integration of a lactic acid fermentation	Sustainable Bioenergy: Sustainable Bioenergy Research	Utah State University	224087	Jeff R. Broadbent	799,876
2011-04452	Multiple Enhanced-value Co-products from Regionally Important Oilseed Feedstocks	Sustainable Bioenergy: Sustainable Bioenergy Research	Regents of the University of Idaho	224275	Matthew J. Morra	556,332
2011-04435	Engineering succinate production by Actinobacillus succinogenes on glycerol	Sustainable Bioenergy: Sustainable Bioenergy Research	Michigan State University	224479	Claire Vieille	757,762
2011-04436	A Novel Foundry Fuel Source Utilizing	Sustainable Bioenergy:	The Pennsylvania	224089	Nicole R.	

	Biomass Co-Products as Binders and Fuel	Sustainable Bioenergy Research	State University		Brown	694,508
Total						**10,823,972**

- **Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2012-00942	Regional Bioenergy Policy Effectiveness: Compatibility, Innovation, and Coordination across the Supply Chain	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Regents of the University of Minnesota	230883	Dennis R Becker	349,996
2012-00888	Evaluating policy incentives for regional biofuels production systems with a scenario-based decision support tool.	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	The Board of Regents of the University of Wisconsin System	229858	GARY RADLOFF	345,327
2012-00893	DEVELOPING A LIFE CYCLE ASSESSMENT MODEL FOR EVALUATING POLICY IMPLICATIONS OF BIOFUELS	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Arizona Board of Regents for Arizona State University	229795	Amy Elaine Landis	350,000
2012-00896	Developing a Sustainable Biofuels System in the PNW: Economic, Policy and Commercialization Analysis	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Oregon State University	229953	Penelope Louise Diebel	349,624
2012-03358	Policies to Develop Perennial Grass-based Advanced Biofuel Supply Chains in the Southeast U.S.	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Mississippi State University	230840	Keith H. Coble	273,120
2014-01400	Policies to Develop Perennial Grass-based Advanced Biofuel Supply Chains in the Southeast U.S.	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Mississippi State University	230840	Keith H. Coble	-
2012-00829	Effectiveness Of A Pacific Northwest Revenue-Neutral Carbon Tax In The Context Of The Federal	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Washington State University	229864	Gregmar I Galinato	349,993

	Biofuel Policy					
2012-00830	The Effect of Existing and Novel Policy Options on the Sustainable Development of Regional Bioenergy Systems	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Duke University	229908	Christopher Stephen Galik	349,084
2012-00833	Effects of Sugar and Bioenergy Policies on Potential Production of Advanced Fuel Alcohols in the Southeast U.S.	Policy Options for, and Impacts on, Regional Biofuels Production Systems, AFRI	Texas AgriLife Research	229749	Henry Bryant	255,972
Total						**2,623,116**

- **Impacts of Regional Bioenergy Feedstock Production Systems on Wildlife and Pollinators, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2012-00820	Developing sustainable perennial bioenergy crop management for birds and pollinators: effects of harvest, refuges and landscape context	Impacts of Regional Bioenergy Feedstock Production Systems on Wildlife and Pollinators, AFRI	The Board of Regents of the University of Wisconsin System	230567	CLAUDIO GRATTON	496,109
2012-00824	Optimizing Grassland Bird Conservation in an Era of Biofuel Production	Impacts of Regional Bioenergy Feedstock Production Systems on Wildlife and Pollinators, AFRI	Board of Regents of the University of Oklahoma	230853	Eli Bridge	466,534
2012-00804	Multi-scale Assessment of Wildlife Sustainability in Switchgrass Biofuel Feedstock Production in the Eastern US	Impacts of Regional Bioenergy Feedstock Production Systems on Wildlife and Pollinators, AFRI	The University of Tennessee	230952	Patrick D. Keyser	498,367
2012-00811	Promoting pollinators and other beneficial insects through bio-oil production	Impacts of Regional Bioenergy Feedstock Production Systems on Wildlife and Pollinators, AFRI	USDA Agricultural Research Service	230559	Frank Forcella	500,000
2012-00815	Evaluating the sustainability of bioenergy production in	Impacts of Regional Bioenergy Feedstock	University of Florida Board of Trustees	230661	Robert J Fletcher	496,996

	the Southeast on the basis of wildlife and pollinator responses across spatial scal	Production Systems on Wildlife and Pollinators, AFRI				
2012-00802	Partial Funding to Conduct a National Stakeholder Conference on Honey Bee Health	Impacts of Regional Bioenergy Feedstock Production Systems on Wildlife and Pollinators, AFRI	The Pennsylvania State University	229195	James Lewis Frazier	15,000
2012-04195	Impacts of herbaceous bioenergy feedstock production systems on bee communities: implications for pollinator declines and conservation	Impacts of Regional Bioenergy Feedstock Production Systems on Wildlife and Pollinators, AFRI	The Board of Regents of the University of Wisconsin System	231676	Mary Jamieson	499,998
Total						**2,973,004**

- **Socioeconomic Impacts of Biofuels on Rural Communities, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2012-00946	Socioeconomic Impacts of Biofuels on Rural Communities	Socioeconomic Impacts of Biofuels on Rural Communities, AFRI	West Virginia University Research Corporation	229608	Jingxin Wang	349,952
2012-00948	Socioeconomic Impacts of Woodbased Biofuels Development Strategies on Northern Rocky Mountain communities in the Northwest	Socioeconomic Impacts of Biofuels on Rural Communities, AFRI	Regents of the University of Idaho	231718	Darin Saul	350,000
2012-00899	Assessing socioeconomic impacts of forest biomass based biofuel development on rural communities in the Southern United States (U.S.).	Socioeconomic Impacts of Biofuels on Rural Communities, AFRI	Montclair State University	229744	Pankaj Lal	349,963
2012-00836	Rural Economic Impacts of Green Energy Production from the Agricultural and Forestry Sectors	Socioeconomic Impacts of Biofuels on Rural Communities, AFRI	The University of Tennessee	229741	Dayton M. Lambert	350,000
2012-00837	Social Acceptability of Bioenergy in the U.S. South	Socioeconomic Impacts of Biofuels on Rural	The University of Georgia	229695	J PETER BROSIUS	345,689

		Communities, AFRI	Research Foundation, Inc.			
2012-00839	Socio-Economic Factors and Adoption of Energy Crops	Socioeconomic Impacts of Biofuels on Rural Communities, AFRI	Lincoln University	231498	Haluk Gedikoglu	94,258
2012-00840	Can the Biofuel Industry Access Biomass from Nonindustrial Private Forests?	Socioeconomic Impacts of Biofuels on Rural Communities, AFRI	The Pennsylvania State University	229683	James Craig Finley	348,959
2012-00841	Decision support systems for regional planning and impact assessment of biorefineries	Socioeconomic Impacts of Biofuels on Rural Communities, AFRI	Michigan State University	229682	Satish Joshi	349,695
Total						**2,538,516**

- **Environmental Implications of Direct and Indirect Land Use Change, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2013-07188	Perennial biomass crop establishment and environmental impacts in the Midwestern United States	Environmental Implications of Direct and Indirect Land Use Change, AFRI	University of South Carolina	1002854	Cuizhen (Susan) Wang	440,555
2012-00951	Impacts of forest biomass removal on soil quality and biodiversity	Environmental Implications of Direct and Indirect Land Use Change, AFRI	Regents of the University of Idaho	229553	Mark Coleman	499,009
2012-00953	Direct Effects of Converting Conventional Cropping Systems to Biofuel Cropping Systems on Ecosystem Services for the Southeastern USA	Environmental Implications of Direct and Indirect Land Use Change, AFRI	University of Florida Board of Trustees	229454	John E Erickson	497,851
2012-00902	Impacts of biofuel induced land use change on energy, water, carbon and greenhouse gas balances of the Southwestern U.S. Cotton Belt region	Environmental Implications of Direct and Indirect Land Use Change, AFRI	Texas AgriLife Research	229457	Nithya Rajan	499,619
2012-00903	Sustainable Management of Forests for Bioenergy	Environmental Implications of Direct and Indirect	The Regents of the University of	230872	Sanjai J. Parikh	80,824

	Production	Land Use Change, AFRI	California			
2012-00910	At The Root Of Sustainable Bioenergy: Using Genetic Variation In Root Traits To Maximize Soil Carbon Sequestration And Biomass Yields	Environmental Implications of Direct and Indirect Land Use Change, AFRI	Boise State University	230875	Marie-Anne de Graaff	493,210
2012-00915	Perennial biomass crop establishment and environmental impacts in the Midwestern United States	Environmental Implications of Direct and Indirect Land Use Change, AFRI	The Curators of the University of Missouri	229629	Cuizhen (Susan) Wang	499,447
2012-00850	Full Cost Accounting of Ecosystem Services from Biomass Production Landscapes in the Midwest U.S.	Environmental Implications of Direct and Indirect Land Use Change, AFRI	Regents of the University of Minnesota	231019	Jason Hill	498,786
Total						**3,509,301**

- **Impacts of Regional Bioenergy Systems on Water Availability and Quality, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2013-03902	Evaluating market and policy effects on water quality in biofuel feedstock production systems in Upper Midwest marginal lands	Impacts of Regional Bioenergy Systems on Water Availability and Quality	University of North Dakota	NULL	Haochi Zheng	555,000
2013-03908	A Water and Risk Management Tool for Sustainable Production of Bioenergy Feedstocks	Impacts of Regional Bioenergy Systems on Water Availability and Quality	Texas A&M AgriLife Research	1001289	John L. JIFON	973,000
2013-03912	Increasing water yield and quality through an integrated woody and herbaceous biofuel feedstock production system	Impacts of Regional Bioenergy Systems on Water Availability and Quality	Oklahoma State University	1001708	Rodney Edward Will	500,000
2013-03896	Total Water Use and Source Partitioning in Woody Bioenergy Crops Determined by Coupled Mass Flux and Stable Isotopes Signatures	Impacts of Regional Bioenergy Systems on Water Availability and Quality	Georgia Southern University Research & Service Fdn, Inc	1001014	Douglas P. Aubrey	972,000

Total						**3,000,000**

- **Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-03919	Northeast Bioenergy and BioProducts (NBB) Educational Program: Providing Faculty with Training, Tools and In-classroom Support	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	Cornell University	224317	Corinne Rutzke	999,999
2010-03988	Place based Opportunities for Sustainable Outcomes and High hopes: POSOH	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	The Board of Regents of the University of Wisconsin System	224525	RICHARD M AMASINO	832,912
2011-04599	Northeast Bioenergy and BioProducts (NBB) Educational Program: Providing Faculty with Training, Tools and in-classroom Support	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	Cornell University	224317	Corinne Rutzke	1,000,000
2011-04595	Place based Opportunities for Sustainable Outcomes and High hopes: POSOH	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	The Board of Regents of the University of Wisconsin System	224525	RICHARD M AMASINO	925,034
2012-04025	Northeast Bioenergy and BioProducts (NBB) Educational Program: Providing Faculty with Training, Tools and In-classroom Support	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	Cornell University	224317	Corinne Rutzke	1,000,000

2013-07116	Place based Opportunities for Sustainable Outcomes and High hopes: POSOH	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	The Board of Regents of the University of Wisconsin System	224525	RICHARD M AMASINO	981,324
2013-07117	Northeast Bioenergy and BioProducts (NBB) Educational Program: Providing Faculty with Training, Tools and In-classroom Support	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	Cornell University	224317	Corinne Rutzke	999,944
2012-04198	Place based Opportunities for Sustainable Outcomes and High hopes: POSOH	Sustainable Bioenergy: Investing in America's Scientific Corps: Stimulating a New Era of Students and Faculty in Bioenergy	The Board of Regents of the University of Wisconsin System	224525	RICHARD M AMASINO	948,733
Total						**7,687,946**

- **Sustainable Bioenergy: National Loblolly Pine Genome Sequencing, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-04354	Loblolly Pine Genome Project	Sustainable Bioenergy: National Loblolly Pine Genome Sequencing	The Regents of the University of California	224477	David B. Neale	2,925,000
2011-04601	Loblolly Pine Genome Project	Sustainable Bioenergy: National Loblolly Pine Genome Sequencing	The Regents of the University of California	224477	David B. Neale	2,925,000
2012-04193	Loblolly Pine Genome Project	Sustainable Bioenergy: National Loblolly Pine Genome Sequencing	Regents of the University of California	224477	David B. Neale	2,925,000
2014-01181	Loblolly Pine Genome Project	Sustainable Bioenergy: National Loblolly Pine Genome Sequencing	The Regents of the University of California	224477	David B. Neale	2,925,000

Total						**11,700,000**

- **Biodiesel Fuel Education Program**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-04902	Biodiesel Fuel Education Program	Biodiesel Fuel Education Program	National Biodiesel Board	217317	Donnell Rehagen	760,000
2010-04859	Biodiesel Fuel Education Program	Biodiesel Fuel Education Program	Regents of the University of Idaho	216080	Jon Harlan Van Gerpen	200,000
2011-05568	Biodiesel Fuel Education Program	Biodiesel Fuel Education Program	National Biodiesel Board	217317	Donnell Rehagen	760,000
2011-05569	Biodiesel Education Program	Biodiesel Fuel Education Program	Regents of the University of Idaho	216080	Jon Harlan Van Gerpen	200,000
2012-03327	Biodiesel Fuel Education Program	Biodiesel Fuel Education Program	National Biodiesel Board	217317	Donnell Rehagen	760,000
2012-03328	Biodiesel Education Program	Biodiesel Fuel Education Program	Regents of the University of Idaho	216080	Jon Harlan Van Gerpen	200,000
Total						**2,880,000**

- **Critical Ag Materials**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-03818	Light activated bonding of lignocellulosic material	Critical Ag Materials	Virginia Polytechnic Institute & State University	223540	Scott Renneckar	503,903
2010-03820	Transformation of lignin into building blocks for protective coatings	Critical Ag Materials	Yale University	223608	Julie Zimmerman	500,000
2011-06242	UV-Curable Biobased Wood Flooring Coatings	Critical Ag Materials	PPG Industries, Inc	228211	Shawn Duffy	300,419
2011-06243	The Development of New Coating and Adhesive Systems Derived from Novel Plant Oil-Based	Critical Ag Materials	North Dakota State University	227969	Bret Chisholm	292,277

	Polymers					
2011-06246	Development and demonstration of a low VOC polyurethane coating system using biopolyols derived from crude glycerol	Critical Ag Materials	The Ohio State University	227991	Yebo Li	418,965
2012-04009	Soy-Based Functional Building Blocks for Sustainable Advanced Coatings	Critical Ag Materials	Eastern Michigan University	231707	Vijaykumar Mannari	481,699
2012-04010	Dried Distiller Grain Based Polymer Dispersions For Paper Coatings	Critical Ag Materials	The Board of Regents of the University of Wisconsin System	231720	TROY RUNGE	499,426
2012-04019	A Proposal for Commercialization of Vegetable Oil Macromonomers	Critical Ag Materials	TR Solutions, LLC	1000367	Shelby Freland Thames	433,760
2012-04008	Bio-based Bisphenol-A Free Epoxides for Paint, Coating and Adhesive Applications	Critical Ag Materials	New Jersey Institute of Technology	1000422	Michael Jaffe	500,113
Total						**3,930,562**

- **Sun Grant Program**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-04903	Sun Grant Program -- North Central Region	Sun Grant Program	South Dakota State University	223768	Vance Owens	421,200
2010-04904	FY10 USDA Western Sun Grant Program	Sun Grant Program	Oregon State University	223714	Jan Auyong	421,200
2010-04905	Sun Grant Program - Southeastern Regional Center	Sun Grant Program	The University of Tennessee	223852	Timothy G. Rials	421,200
2010-04906	Sun Grant Program - Northeast Region	Sun Grant Program	Cornell University	223750	Larry P Walker	421,200
2010-04908	Sun Grant Program - South Central	Sun Grant Program	Oklahoma State University	223723	Jonathan V. Edelson	421,200
2011-05788	Sun Grant Program - North Central Region	Sun Grant Program	South Dakota State University	223768	Vance Owens	431,136
2011-05789	Sun Grant Program - Southeastern Regional Center	Sun Grant Program	The University of Tennessee	223852	Timothy G. Rials	431,136

2011-05746	FY 11 USDA Western Sun Grant Program	Sun Grant Program	Oregon State University	223714	John Talbott	431,136
2011-05751	Sun Grant Program - Northeast Region	Sun Grant Program	Cornell University	223750	Larry P Walker	431,136
2011-05829	Sun Grant Program - South Central Region	Sun Grant Program	Oklahoma State University	223723	Jonathan V. Edelson	431,136
2013-05363	Sun Grant Program - Northeast Region	Sun Grant Program	Cornell University	NULL	Larry P Walker	431,949
2013-05364	Western Sun Grant Regional Center and University Transportation Center	Sun Grant Program	Oregon State University	100262 3	John Talbott	431,949
2012-03758	Sun Grant Program - Northeast Region	Sun Grant Program	Cornell University	223750	Larry P Walker	422,400
2012-03345	Sun Grant Program- Southeastern Regional Center	Sun Grant Program	The University of Tennessee	223852	Timothy G. Rials	422,400
2013-05353	Sun Grant Program - North Central Region	Sun Grant Program	South Dakota State University	100234 2	Vance Owens	431,949
2013-05354	Southeast Sun Grant Center	Sun Grant Program	The University of Tennessee	100126 2	Timothy G. Rials	431,949
2013-05355	Sun Grant Program - South Central Region	Sun Grant Program	Oklahoma State University	100149 4	Jonathan V. Edelson	431,948
2012-03330	Sun Grant Program - North Central Region	Sun Grant Program	South Dakota State University	223768	Vance Owens	422,400
2012-03331	Sun Grant Program - South Central Region	Sun Grant Program	Oklahoma State University	223723	Jonathan V. Edelson	422,400
2012-03373	Western Sun Grant Center USDA FY2012 Renewal Request	Sun Grant Program	Oregon State University	223714	John Talbott	422,400
Total						

- **Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy, AFRI**

Proposal Number	Proposal Title	Program Name	AOR's Institution	CRIS Number	PD's Full Name	Total Award Amount
2010-03593	Functional analysis of regulatory networks linking shoot maturation, stem carbon partitioning, and nutrient utilization in Sorghum	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	Board of Trustees of the University of Illinois	022309 1	Stephen Moose	1,000,000
2010-03594	Genomics of Energy Sorghum Biomass Accumulation	Sustainable Bioenergy: Plant Feedstock Genomics for	Texas A&M Research Foundation	022322 3	John Mullet	1,000,000

		Bioenergy				
2011-03502	Genomic and Breeding Foundations for Bioenergy Sorghum Hybrids	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	University of South Carolina	0225793	Stephen Kresovich	1,000,000
2011-03587	Sorghum Biomass Genomics and Phenomics	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	Kansas State University	0226000	Kraig Roozeboom	8,000,000
2012-03305	Genetic Architecture of Sorghum Biomass yield Component Traits Identified Using high-throughput, Field-based Phenotyping Technologies	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	Iowa State University of Science and Technology	0229857	Patrick Schnable	1,425,000
2012-03304	Genomics of Bioenergy Grass Architecture	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	The University of Georgia	0229622	Andrew Patterson	575,000
2013-05424	Accelerated Development of Optimal Pine Feedstocks for Bioenergy and Renewable Chemicals using Genome-Wide Selection	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	University of Florida Board of Trustees	1	Matias Kirst	1,000,000
	STRUCTURAL POLYMORPHISMS AS CAUSES OF HETEROSIS IN POPULUS	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	Oregon State University		Steven Strauss	1,000,000
2014-07659	Exploiting Natural Diversity to Identify Alleles and Mechanisms of Cold Adaption in Switchgrass	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	Michigan State University	1003778	Carol Buell	1,000,000
2014-07664	Advancing Field Pennycress as a New Oilseed Biodiesel Feedstock that does not Require New Land Commitments	Sustainable Bioenergy: Plant Feedstock Genomics for Bioenergy	University of Minnesota	1004021	Michael Marks	1,000,000
Total						**17,000,000**