

**National Institute of Food and Agriculture
Bioeconomy-Bioenergy-Bioproducs
Portfolio Strategic Plan
2015 Progress and Implementation Report**

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Introduction

The National Institute of Food and Agriculture (NIFA) Bioeconomy-Bioenergy-Bioprocess (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-Bioprocess Program Portfolio is a critical component of a continuum 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, augmenting 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, industrial chemicals, and biobased products.

In order to create and sustain jobs in rural and other locations, enhance existing food and fiber production systems, create ecosystem services (reduced greenhouse gases, improved water quality, wildlife and pollinator habitat), and provide energy options that will reduce the use of fossil carbon, the B3 Portfolio is focusing on facilitating the development of regional sustainable production systems for biofuels and biobased products. The B3 Portfolio arrays a powerful suite of programs including:

- Agriculture and Food Research Initiative (AFRI)
 - Bioenergy, Natural Resources, and Environment (BNRE) Foundational Program
 - Sustainable Bioenergy and Bioproducts Challenge Area
 - Regional Systems for the Sustainable Production of Biofuels and Biobased Products Coordinate Agricultural Project (CAP) Program
 - Stimulating the Next Generation of Students, Teachers, and Researchers Standard Education Grant Program
 - Standard Research Grant Programs:
 - Feedstock Crop Protection
 - Co-products Production
 - Socio-economics and Public Policy
 - Water-Energy Nexus
 - Carbon Sequestration
 - Land-use Change
 - Impacts on Pollinators and Wildlife

- Joint Plant Feedstock Genomics for Bioenergy Program (with DOE Office of Science)
- Biomass Research and Development Initiative (BRDI, with DOE Bioenergy Technology Office)
- Biodiesel Education Program
- Small Business Innovation Research (SBIR) Program
- Sun Grant Initiative

Goals

- 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 and trade-offs on communities and economies, environmental services and natural resource management, and techno-economic feasibility.

Knowledge Gaps:

A fair assessment of knowledge gaps that need to be addressed to achieve these goals is daunting. Strategic documents^{1, 2} have attempted to catalog these gaps for biofuel systems, and require many pages to do it. Add to that biopower, industrial chemicals, and value-added non-food biobased products and the list is compounded. However, some general areas have been identified that are highly relevant to the programs and goals of the B3 Portfolio:

- Regional Biomass Supply Chain System Elements
 - Feedstock Genetic Development
 - Feedstock Availability Assessment
 - Sustainable Feedstock Production
 - Feedstock Logistics
 - Post-harvest/collection, size reduction, transportation, storage, and pre-processing
 - Conversion
 - Markets and Distribution
- System Integration

- Sustainability Assessment
 - Economic, Environmental, Social Factors
- Workforce Development
- Biofuel, Biopower, Bioproduct Literacy
- Community Outreach and Engagement
- Extension and Technology Transfer to Industry
- Risk Evaluation and Mitigation

All of the above areas will need to be addressed for each iteration of a regional/local supply chain leading to fuels, chemicals, power, or products. Over time we have accumulated a large knowledge base for certain supply chains and individual feedstocks that are founded on many decades of work on food production systems, waste handling, and forest-based systems. Almost any emerging regional supply chain will leverage this wealth of knowledge and experience.

What we have grown to understand, however, is that each system will have its nuances, some large, some small that will impact the sustainability of an emerging bio-industrial enterprise. For example, the forest products industry has been harvesting and processing woody biomass for over a century, and has continued to build a diversified portfolio of products. However, an amazing amount of biomass (tree tops, branches, small-diameter trees, and trees that have been damaged and killed by insects and disease) whose usefulness as pulp, paper, and lumber are left in the forests or are burned for power generation. Materials left in the forest are often required to be burned to reduce wildfire risk. Two of the large regional CAP projects have undertaken the challenge of sustainably removing forest residuals and low-value small-diameter timber and insect-killed trees, transporting them to biorefineries and converting these materials into fuel, chemicals, and products. Even though woody biomass has been handled for decades, removing and processing these low-value materials has required in-depth research and sustainability analysis at every step of the supply chain. As communities are highly variable, these projects require integrating research, education, and extension, with community engagement being critical components for probable outcomes.

Progress Toward Goals within NIFA B3

For 2014 - 2015, there has been a hiatus of spending funds on new projects in the AFRI Program. Couple this with the greatly diminished funding for BRDI from \$40 M per annum to \$3 M requiring a combining of 2014-2015 funds (panel convening early 2016) most of the activity in B3 has been in the area of post-award management and the stewardship of seven continuing regional CAP projects.

Notable exceptions to this include preparation for 2016 requests for applications, and competitive programs leading to new projects in Feedstock Genomics, SBIR, Biodiesel Education, and the Sun Grant Initiative.

The Team B3 has continued to foster relationships with other agencies through collaborative funding programs, such as:

- Joint Plant Feedstock Genomics for Bioenergy Program (with DOE Office of Science)
- Biomass Research and Development Initiative (BRDI, with DOE Bioenergy Technology Office)

Additionally, Team B3 has been strengthening existing relationships and building new ones with other Federal partners in an effort to enhance collaboration, synergies, and reduce duplication. Examples include:

- Biomass Research and Development Board Bioeconomy Initiative
- Feedstock Coordination Committee
- Bioeconomy Coordination Council
- Federal Alternative Jet Fuel Research Strategic Plan
- Biomass Board's Feedstock Logistics IWG
- Biomass Board's Analysis IWG
- Federal Woody Biomass Utilization Working Group

Progress Toward Goals: NIFA Partners

The first cohort of five AFRI Regional CAPs completed their fourth year of funding in 2015. The two remaining CAPs completed years two and three, respectively. Evaluation of all seven projects showed impressive progress on most fronts. For example:

Sustainable Bioproducts Initiative

(SUBI), led by Louisiana State University Ag Center (LSU-AC) – The SUBI project has come a long way. Focusing on emerging biomass crops, energy cane and sweet sorghum, the project is unique in that there are multiple carbohydrate streams (sucrose, cellulosic sugars, organic acids, and fiber) that may be directed toward different products creating an exciting array of potential commercial outcomes. The project has accomplished most of the project goals and is moving toward interacting with potential investors to reach commercial outcomes that would be transformative in an economically depressed region of the Southeast. The leadership team of Drs. John Russin and Don Day have noticeably increased project integration across both supply chain elements and among research, education, and outreach. Internal and external project communication has been greatly enhanced. Academic, Federal, and industrial partners have all stepped up to work together to address and reach project objectives. The entire SUBI team should be proud of their accomplishments and remain focused on creating the commercial outcomes that will mean so much to their region. Specific Objective Assessment:

- Feedstock development
 - The Agricultural Research Service Sugarcane Research Unit and LSU-AC have developed cold-tolerant energy cane, as well as site-adapted genotypes.
 - Genetic markers for energy cane cold-tolerance and biomass yield are under development.
 - Near-Infrared Spectroscopy (NIR) has been developed as a non-destructive high throughput method for evaluating energy cane and sweet sorghum quality.
- Feedstock production
 - Cultivation parameters for energy cane and sweet sorghum has been designed, tested, and are ready for commercial scale planting.
 - Energy cane yields averaged 9-12 dry tons per acre, with some of the best cultivars reaching more than 20 dry tons/acre in the warmer areas near the coast. (In comparison, good switchgrass cultivars produce 4-5 dry tons/acre!)
 - In addition to the biomass both energy cane and sweet sorghum produce sugar (2,000-4,000 pounds per acre for energy cane and 600-6,000 pounds per acre for sweet sorghum).
 - Extension projects are underway to provide landowners and growers relevant information about these two new regional crops.
- Feedstock logistics
 - Logistic scenarios for 6, 9 and 11 month mill/biorefinery operations have been developed using energy cane, bagasse, sweet sorghum, and syrups.
 - Plant siting models have identified potential sites, but the model needs upgrading to include transportation infrastructure.
- Syrup mill operations and syrup production
 - Significant redesign and troubleshooting the pilot plant at the LSU-AC Audubon Sugar Institute have been successfully completed.
 - Sugar syrups from energy cane and sweet sorghum have been produced in sufficient quantity to allow testing for the production of butanol and jet fuel.
 - Methods of reducing organic compound and inorganic (ash content) inhibitors in syrup that could interfere with product production have been developed.
 - Work continues on producing high quality syrups that will be cost competitive with dextrin/corn syrup. Current syrups will compete well with molasses.
- Bioplastics
 - “Tuneable” bioplastics have been developed from aconitic acid a significant component of energy cane extracts. This suite of bioplastics is very promising for a wide range of uses and is biodegradable.
 - Intellectual property protection is being developed.

- Sustainability Analysis
 - Strong Life Cycle Assessment (LCA) analysis has shown that energy cane is far superior to corn for greenhouse gas emissions reduction.
- Education/Outreach
 - Integration of the LSU-AC pilot plant into undergraduate and graduate education has great potential for addressing the issue of a trained workforce for mill/plant operations.
 - New curricula have been developed for engineering students
 - Thousands of youths and adults have been reached through a robust suite of outreach efforts.
- Commercialization
 - Both industrial partners Virent (jet fuel) and Optinol (butanol) have shown that syrups produced in the pilot plant at LSU-AC perform well as feedstock for their respective processes. The catalytic Virent process requires syrups with very low ash content. Ash is not a factor for the Optinol process.
 - Modular fixed bed bioreactors for producing butanol in a continuous process were developed and optimized. More IP here.
 - Scale up for the production of butanol is made far less challenging by the inexpensive modular bioreactor design. Does not need bigger reactors, just more.
 - A proprietary process for extracting butanol from the continuous bioconversion processing stream was developed.
 - Syrups may also be used by Virent to produce para-xylene for use in bioplastic drink bottles (Coca Cola is one of Virent's partners).
 - Both Optinol and Virent are small technology development companies that will need significant capital investment to scale up and site syrup mills and biorefineries. Toward this end, SUBI leadership and Advisory Board members are developing a commercialization strategy to involve landowners, industrial partners, and other potential investors, and stakeholders through targeted outreach and demonstration.

CenUSA Bioenergy (led by Iowa State University) and NEWBIO (led by Penn State University) Star at the Global Bioenergy Partnership (GBEP) Workshop (Stockholm, Sweden) on Bioenergy and Water:

Integrating Perennial Bioenergy Crops to Enhance Agricultural Water Quality:

- CenUSA's vision is to create a regional system for producing advanced transportation fuels and other bioproducts derived from perennial grasses grown on land that is either unsuitable or marginal for row crop production. In addition to producing advanced biofuel and bioproducts, the proposed system will improve

the sustainability of existing cropping systems by reducing agricultural runoff of nutrients and soil and increasing carbon sequestration. The project is organized around ten primary systems needed to make this vision a reality: feedstock improvement; feedstock production on marginal land; feedstock logistics; modelling system performance; feedstock conversion into biofuels and other products; marketing; health and safety; education; outreach; and commercialization.

- **NEWBio (Northeast Woody/Warm-season Biomass Consortium)** is a transdisciplinary regional effort to integrate research and development, education, workforce development, extension, outreach, technology transfer, and sustainability analysis (economic, environmental, social) in the northeastern U.S., where biomass has been a resource for energy and materials for hundreds of years. The region has high agricultural productivity, well-developed transportation and fuel distribution infrastructure, technologically adept human and financial resources, and substantial demand for advanced biofuels, biopower, and bioproducts. Perennial energy crops, especially willow and warm-season grasses grown on abandoned and marginal agricultural and mine lands, as well as winter grasses harvested as energy double crops, can play a central role in creating a sustainable bioenergy future for the region.

Lessons Learnt:

- Biomass energy crops, especially perennial crops and winter grasses, can dramatically improve water quality outcomes without substantial conflicts with food or fiber production.
- Planting and harvesting biomass from these vegetative strips or winter fields reduces nutrient and sediment losses and improves soil and water quality.
- Adding payments for ecosystem services to market prices for biomass can improve the economics of both sustainable energy and achieving water quality goals.

Challenges

There are several distinct challenges facing the portfolio:

- Price of oil and natural gas
 - While the low price of oil is contrived, it appears that it will remain low for a long time, reducing investment in renewable fuels.
 - Natural gas prices are also low driven by increased capacity and production. It is unclear how sustainable the availability (average gas well lifespan is ~ three years) and low cost of natural gas will be in the future.
- Policy uncertainty
 - The lack of a credible energy plan and support for the Renewable Fuel Standard (driven in part by special interest misinformation campaigns) have also undercut investment in renewables.

- Industry would rather have certain bad policy than overall policy uncertainty.
- Cost of cellulosic feedstock
- SBE Division understaffing. Currently working to recruit:
 - NPL Agricultural Bioproducts
 - NPL Feedstock Logistics
 - Division Director
 - Awaiting another full-time Program Specialist (Rodney Vance now split with Climate Change)

External Success Stories

1) SBIR: Forest Concepts licenses WoodStraw® to ECI for the Northwest



Forest Concepts has licensed the production and sale of WoodStraw® erosion control mulch for the northwestern states to Erosion Control Innovations (ECI) of Enumclaw, WA. ECI also acquired Forest Concepts' production equipment to produce both regular bales and large bales and is moving production to the former Weyerhaeuser Enumclaw sawmill site on Highway 410 now owned by Miles Sand and Gravel. The new expansive location will enable capacity for maintaining larger inventories of both bale sizes which means increased availability of WoodStraw® for projects in the northwest.

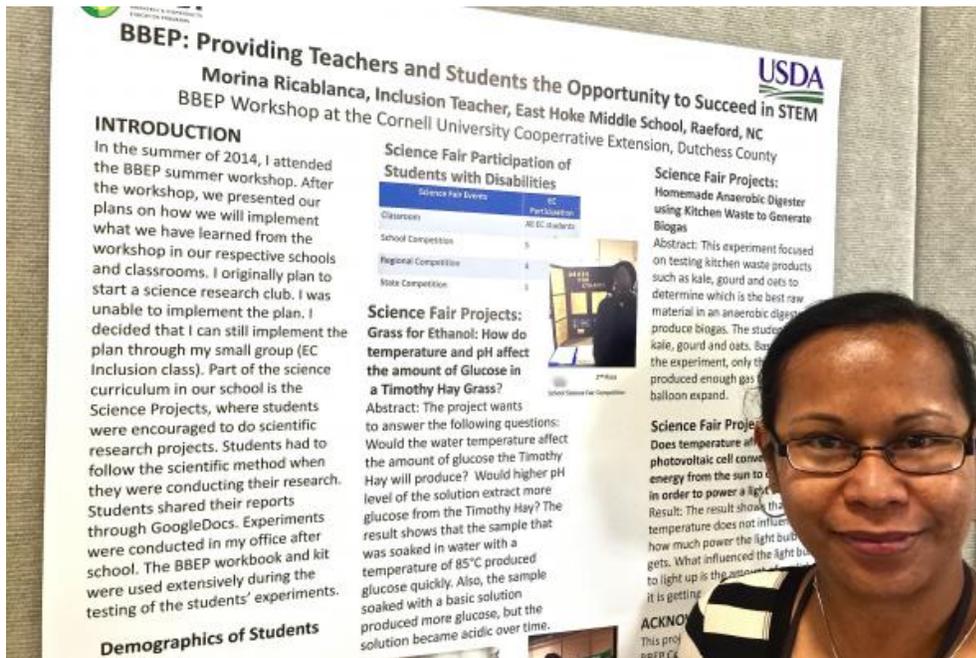
WoodStraw® developed through a USDA Small Business Innovation Research (SBIR) Program research and development grant is an erosion control mulch is widely used as a replacement for agricultural straw, rolled erosion blankets, wattles and hydromulch. WoodStraw® is produced from low grade veneer and is an effective water and wind erosion stabilizer, inherently 100% weed-free, resistant to high winds, long lasting for 4+

years, durable, attractive, promotes revegetation and is easy to apply by hand, straw blower and helicopter. WoodStraw® does not require staples or tackifiers like ag straw, blankets and wattles nor does it require large volumes of water like hydromulch.

Erosion Control Innovations is Forest Concepts' second regional licensee for WoodStraw® technology. The first licensee was Mountain Pine Manufacturing located in Steamboat Springs, CO and serving the Rocky Mountain states. Forest Concepts is in discussions for a third regional licensee to be located in northern Arizona to serve Southern California and the southwestern states and a fourth to be located in the mid-Atlantic states on the east coast.

The use of WoodStraw® has been approved by the Washington State Department of Ecology and the Departments of Transportation for Washington, Idaho, Oregon, Colorado and Mississippi with more state approvals pending.

2) Bioenergy, Bioproducts Education Program builds student confidence, equips educators



Being an educator is in Morina Ricablanca's blood. Growing up in a family of teachers in the Philippines, she knew she would someday pursue a career in education. Ricablanca participated in an outreach program assisting troubled youth while attending Manuel L. Quezon University Law School in Manila. She realized then it was time to join the family business of teaching.

Her decision has led her to a successful career working with special needs students at East Hoke Middle School in rural North Carolina. Ricablanca was named the “2014 Teacher of the Year” for her school district, partly due to her work helping three of her students win the school’s science fair.

In 2014, she attended the [Bioenergy and Bioproducts Education Program \(BBEP\) \(link is external\)](#) workshop in Horseheads, New York. BBEP is an education program administered by Cornell University with \$5 million in funding from the U.S. Department of Agriculture’s National Institute of Food and Agriculture (NIFA) through the 2010 [AFRI Sustainable Bioenergy Challenge Area](#).

“I thought doing a bioenergy project would be difficult to do in the classroom, especially with my special needs students,” she said.

Attending the BBEP workshop supplied her with the knowledge and materials to conduct bioenergy projects with her students when she returned to school.

“The workshop provided me the skills and knowledge I needed to teach about renewable sources of energy, which is part of our school’s science curriculum” said Ricablanca. “I hadn’t thought of doing bioenergy projects with my students because I never considered the different biomass we have all around us that can be used to make bioenergy products.”

The three projects conducted by her students in 2015 include a study of how temperature and pH affect the amount of glucose Timothy grass will produce; an experiment on testing kitchen waste products, such as kale, gourd, and oats to determine which is the best raw material for an anaerobic digester to produce biogas; and a study determining if temperature affects how a photovoltaic cell converts light energy from the sun to electricity in order to power a light bulb.

“My students did not think they could win a competition because of their challenges,” she said. “BBEP provided the opportunity for them to succeed and see that they can achieve great things in life.”

All three projects went on to win the East Hoke Middle School science fair.

“This was the first time in our school’s history that we had this many students with special needs win the science fair competition and represent the school in the regional and state competitions” she said. “The impact is not just on my students, but also on the school, parents, and especially me. It reminded me why I continue to do what I do.”

3) The Rocky Mountain Research Station (RMRS) of the U.S. Forest Service Biomass Research and Development Initiative Project

Title: Integration of biofuels and bioproducts production into forest products supply chains using modular biomass gasification and carbon activation

Program Code: BRDI

Proposal Number 2010-05325

Accession Number 225135

Project Dates: May 1, 2010 to April 30, 2016 (ongoing)

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Project Co-PI Institutions (Sub-awardees)

USFS Rocky Mountain Research Station
USFS Forest Products Laboratory
USFS Southern Research Station
USFS Technology & Development Centers
University of Montana
Humboldt State University
Washington State University
Louisiana State University
Oregon State University

Primary Industrial Partners (Sub-awardees)

Tucker Engineering Associates, Inc.
Tricon Timber, LLC
Jump Trucking, Incorporated
The Coquille Indian Tribe
Green Diamond Resource Company

Other Industry Collaborators and Partners

The Renewable Natural Gas Company
ReVenture Park and Forsite Development
Peterson Pacific Corporation
Steve Morris Logging, LLC
Biochar Solutions, Inc.

Confluence Energy (a member of the Colorado-State University-led BANR CAP)
ARVOS Group/Raymond Bartlett-Snow

Project Overview

The Rocky Mountain Research Station (RMRS) of the U.S. Forest Service is leading a USDA-NIFA Biomass Research and Development Initiative (BRDI) project focused on commercialization of distributed-scale thermochemical conversion systems, with an emphasis on deployment to small and medium sized sawmills. The project is providing critical new knowledge in three primary areas: 1) forest biomass feedstock development, 2) thermochemical conversion technology, and 3) sustainability. The project includes nine research and development focus areas: 1) forest operations and feedstock logistics research to improve feedstock supply chains, 2) development of new trucking and processing equipment to reduce feedstock costs by improving access to dispersed forest treatment residues, 3) development of high resolution, multi-facility tactical feedstock supply models, 4) research and development of a conversion system for forest industry deployment, 5) product development focused on biochar soil amendments, activated carbon, and liquid fuels from synthesis gas, 6) consequential cradle-to-grave life cycle analysis of all system products, 7) field research and modeling to evaluate the effects of biomass harvest on water resources, soil resources and forest ecosystems, 8) financial models for the conversion system co-located at sawmills, and 9) market and non-market economics research to quantify the costs, benefits, and tradeoffs of this conversion technology deployed in the forest sector.

Conversion Technology R&D Accomplishments to Date

The Tucker Renewable Natural Gas System (the “Tucker RNG System”) is the core conversion technology of the project and produces a methane-rich energy gas (500-850 Btu/scf) and a high carbon char output (85-95% fixed C) at 980 to 1100°C from a wide range of biomass feedstocks. Conversion system R&D occurred in two phases. In Phase 1, the alpha prototype unit housed in a fabrication shop in Locust, NC, was upgraded to a new pilot-scale configuration that allowed for continuous rather than batch operations. Modifications and upgrades made to the system in Phase 1 included: 1) improved feedstock delivery and airlock system, 2) addition of a secondary heating module and auger system to extend feedstock residence time and improve gas recovery, 3) better insulation and heat capture, 4) char cooling to safe handling temperature, 5) real time gas chromatography, 6) parallel fuel systems to heat the main stage with either propane (original system) or offtake from the energy gas stream, 7) improved gas cleanup, 8) new gas compression and storage capability, 9) integration of a 40kW generator, and 10) improved system instrumentation and computer control

systems. During Phase 1, Tucker RNG system trials were successful with various feedstocks, including mixed conifer microchips from Tricon Timber (a project partner), yellow pine shavings, refuse derived fuels (RDF), and municipal solid waste (MSW) fluff.

In Phase 2, the Tucker RNG team disassembled the system and moved it and all associated components to ReVenture Park in Charlotte, NC. ReVenture Park is a brownfield redevelopment eco-industrial park on the site a former dye factory and Superfund site on the Catawba River. The system was reassembled and installed for commercial operation at ReVenture Park. Phase 2 included significant additional system upgrades and modifications that were important in bringing the system to commercial scale. Leveraging new investment, Phase 2 included industrial high-capacity feedstock rotary drying, a new conveyor and conveyor scale, a larger capacity double-dump valve airlock, a redesigned tar cracking system, larger gas compression and storage systems with a new flare system, an aqueous biochar quench and biochar handling system, a new a Caterpillar 3520 generator set, redesigned control systems, and other improvements. These improvements allowed the system to deliver between 0.8 and 1.2 MW of electricity and produce 10 to 15% biochar (by dry weight) in a low-dust environment.

Achieving a major milestone for the project, in 2015 Tucker Engineering Associates and RNG successfully demonstrated the use of the Tucker RNG System at ReVenture Park. The system was connected to the grid and produced electricity under a renewable power purchase agreement for six months. Following this successful demonstration phase, the Tucker RNG team packaged and shipped biochar from ReVenture Park to RMRS in Moscow, ID, for use in activation trials with Raymond Bartlett Snow (RBS) and in biochar palletization and soil amendment studies. The system is currently offline at ReVenture, while the team is working with a new engineer and commercial partners to improve gas cleanup systems. **Generators are currently producing power for the grid using biogas produced onsite.** The team is also looking for opportunities to manufacture and deploy new units using a wide range of feedstocks.

Other accomplishments with ongoing or near-term commercial impact funded in part or wholly by the project:

- Participation by many private companies in forest operations and feedstock logistics research studies to increase productivity and reduce costs (HSU, Coquille Indian Tribe, Green Diamond Resource Company, Peterson Pacific Corporation, Steve Morris Logging, LLC)
- Design and installation of a small diameter, whole-tree chipping line and integrated screening system to allow production of microchips, including those

used in Tucker RNG trials in both Locust and Charlotte, NC (Tricon Timber, LLC).

- Fabrication and deployment of a road-legal mobile grinding system, paired with a long-reach grapple, for processing disbursed slash piles (John Jump Trucking, Inc.)
- New pellet formulations and production of biochar pellets for energy and soil amendment applications (WSU)
- Design, fabrication and field testing of a forwarder-mounted biochar spreader that can spread both pelletized and raw form biochar. The system was used to spread biochar for forest road rehabilitation in Lolo National Forest (RMRS, MTDC and John Jump Trucking)
- Development of new catalysts for making fuels and chemicals from syngas (LSU)
- Tactical feedstock logistics and procurement tools packaged with support documentation and tutorials in a free ArcGIS add-in (RMRS)

Major Outcomes

1) Commercial Switchgrass



Above: Rob Mitchell, USDA ARS Research Agronomist, University of Nebraska Lincoln.

As the bioenergy industry progresses, 'Liberty' switchgrass is growing alongside it. Drawing near the year-and-a-half mark since its introduction, interest in 'Liberty', the high-yielding cultivar specifically bred for bioenergy use is picking up steam. Husker Genetics' director, Jeff Noel, says the organization plans to have it commercially

available through a seed dealer by spring 2016.

Since its introduction to the industry in August 2013, 'Liberty's' co-developer Rob Mitchell, USDA-ARS agronomist, has seen an increase in the number of trial sites across the country growing the perennial grass. States include: Nebraska, South Dakota, Iowa, Minnesota, Missouri, Wisconsin, Illinois, Indiana, Pennsylvania and Ohio.

But 'Liberty' is currently going through the gauntlet at Huskers Genetics, the foundation seed division of the University of Nebraska's Agricultural Research and Development Center, in Mead, Nebraska where the organization has been given the task of preparing the switchgrass for commercial usage. In 2013 an initial seed stock of 'Liberty' was planted on 10 acres and that seed production field is expected to show results this fall.

"We are anticipating a yield of maybe 200-300 pounds of seed per acre, somewhere in that range," Mitchell said. "This is a fairly common seed yield in this early of the field's life span."

As of now it takes two pounds of pure live seed to be planted in order to create a seed production plot. The seeds are then planted in 20 to 40 inch rows. For biomass production, the amount of pure live seed planted increases by about four pounds. The recommended seeding rate is 30 pure live seeds per square foot, approximately 5.8 pounds per acre depending on the percent purity on the seed lot (PLS is the germination of the seed lot multiplied by the percent purity of the seed lot).

'Liberty' has been shown to produce 25 to 40 percent greater yields than traditional switchgrass varieties. At biomass production test sites across the Midwest, Mitchell hopes to see six to seven tons of biomass per acre.

"I hope that we will see some level of yield uniformity across the region," Mitchell said. "The northern part will have lower yields for sure though. It will take us a little while after the harvesting of the sites to determine the results."

Mitchell stated that seed growers have ordered about 100 pounds of 'Liberty' seed from Husker Genetics this year. For a seed production company to create a commercial distribution for a product like 'Liberty', two steps will have to be taken. The first will be seed being sold to certified seed producers from a Huskers Genetic-like entity, then being sold by that company to farmers.

The demand is expected to only increase as 'Liberty' gains more traction as people begin to hear more about it, Mitchell believes.

The development and testing of Liberty switchgrass was dramatically accelerated as part of the Iowa State University-led CenUSA Regional Bioenergy System CAP. Liberty can reach yields of 8 dry tons per acre and will lead to genotypes that will yield 10 tons per acre, making switchgrass a competitive biomass feedstock crop in the corn belt.

1) Cold-tolerant Energy Cane

The Sustainable Bioproducts Initiative (SUBI) Louisiana State University (LSU)-led Regional Bioenergy System CAP has poised the Southeast for the emergence for a new agricultural system based upon energy cane and sweet sorghum. The key to this development is the development of cold-tolerant energy cane that may be grown away from the Gulf Coast into regions that struggle to produce quality crops since the decline of the cotton industry. The Agricultural Research Service Sugarcane Research Unit, Houma, LA and LSU-Agricultural Center have developed cold-tolerant energy cane, as well as site-adapted genotypes. In addition, genetic markers for energy cane cold-tolerance and biomass yield are well-under development. They have also developed NIR as a non-destructive high throughput method for evaluating energy cane and sweet sorghum quality.

Next Steps

Moving forward in 2016 the B3 Portfolio will continue its emphasis on integrated feedstock supply chains. In addition to the former emphasis on liquid transportation fuels, there will be more opportunities and support for industrial chemicals and value-added biobased products.

A key part of the effort will include support for the development of alternative jet fuel (AJF) as part of a large federal effort to serve the needs of civilian and military aviation. One part of this may be the joint funding of an Advanced Science and Education Center for Aviation Biofuels with the Federal Aviation Administration, Department of Energy, National Science Foundation, and others.

In addition to continuing the integrated CAP Program for Regional Feedstock Systems, there will be emphasis on AFRI Standard Grants in the areas of: Co-products; Feedstock Logistics; Socio-economic policy; Education; and Extension - State Energy Efficiency Partnership (with NIFA Division of Climate Change)

Finally, B3 will have a key role in the Bioenergy, Natural Resources, and Environment AFRI Foundational Program. B3 has designed and will implement a new emphasis area within BNRE: Cover Crops for Biofuels and Biobased Products. This is an important area of research that may unlock the potential for increased farm incomes and new bio-industrial jobs in the manufacture of fuels, chemicals, and products, while providing ecosystem services.

References

¹National Biofuels Action Plan

²Federal Alternative Jet Fuel Research Plan