

Poster Session Abstract Book

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Climbing Toward Energy Sustainability

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From the Forest to the Classroom: Energy Literacy as a Co-Product of Biofuels Research

Audra Cochran, Randy Brooks, Rob Keefe, & Armando MacDonald

A comparison between homogeneous, consistent feedstock laboratory-derived pellets and pellets manufactured with a portable, small-scale pelletizing unit that utilizes all components of woody biomass from logging operations (i.e. branches, needles, bark) was examined. Pellets were manufactured from homogeneous chips from three major commercial conifer species in the Pacific Northwest. These species included: Douglas-fir (*Pseudotsuga menziesii* var. *glauca*), ponderosa pine (*Pinus ponderosa*), and lodgepole pine (*Pinus contorta* var. *latifolia*). Pellets were manufactured using a laboratory sized, industrial pellet mill and a PTO driven pellet mill. Pellets were analyzed for ash content, BTU output, and pellet density. Both laboratory-derived and mobile-unit derived pellet types were cross-compared against commercially available pellets of homogeneous species. Finally, pellets were tested in a household pellet-burning stove to test the burning duration and qualities of each pellet type. Qualities that were examined were ash production, energy output, and pellet density. Ash quantity, as well as other qualities, will be used to compare and assess quality of pellets for customer appeal. Pellets with high ash and other undesirable characteristics, may be better used as fuel-grade pellets. In summary, a cross-comparison of two types of pellet mills, pellets produced from different tree species, and pellet quality was conducted to define characteristics exhibited by each separate pellet type and provide analysis for potential markets to promote the sale of woody biomass as a bioenergy source.

Audra Cochran
audrac@uidaho.edu

Audra Cochran is a first year master's student at the University of Idaho studying under Extension Forestry Specialist, Dr. Randy Brooks. Audra is currently working on the Bioenergy Alliance Network of the Rockies (BANR) grant, which is focusing on producing sustainable biofuel feedstocks from beetle-killed timber, specifically ponderosa and lodgepole pine. Audra received her B.S. degree at the University of Idaho in 2012 and started her MNR program under Dr. Brooks in 2014.

Professional Development for Energy Literacy

Karla Eitel, Justin Hougham, Jenny Schon, Aaron Boyles, & Ashlee Fliney

The McCall Outdoor Science School (MOSS) is a program of the University of Idaho College of Natural Resources. Every year more than 3000 K12 students and teachers participate in residential inquiry-based field science programs. MOSS is a partner in the Northwest Advanced Renewables Alliance (NARA). Featuring a broad alliance of private industry and educational institutions, the Northwest Advanced Renewables Alliance (NARA) takes a holistic approach to building a supply chain within WA, OR, ID and MT based on using forest residuals to make aviation biofuel. The alliance is tasked with increasing efficiency for each supply chain step from forestry operations to conversion processes; creating new bio-based products; providing economic, environmental and social sustainability analyses; engaging stakeholder groups; and improving bioenergy literacy for students, educators, professionals and the general public.

MOSS has developed two models of professional development designed to support teachers as they develop their own energy literacy and bring energy literacy to their classrooms. The first is a series of webinars supporting coaches for the Imagine Tomorrow problem-solving competition. The second is an intensive four-day workshop using problem-based learning to explore bioenergy questions.

Karla Eitel

gouldm@anr.msu.edu

Karla Bradley Eitel is an Assistant Professor in the Conservation Social Sciences Department of the University of Idaho and the Director of Education for the McCall Outdoor Science School, a graduate residency and K12 teacher professional development and outreach program operated by the University of Idaho's College of Natural Resources. She holds a PhD in Natural Resources, an M.S. in Conservation Social Sciences and an M.Ed. in Curriculum and Instruction all from the University of Idaho. She earned her BA in Studio Art and American Studies from Williams College.

4-H Energy: Using the Science of Energy to Teach STEM to Tennessee Youth

Elizabeth Gall & Daniel Sarver

4-H Energy was formed as a partnership between Tennessee 4-H and Tennessee Department of Environment and Conservation, Office of Energy Programs to stimulate youth's interest in science, while teaching them the science of energy. Reaching roughly 50 counties each year, the 4-H Energy program is an important part of programming across the State of Tennessee. The participating counties receive funds that can be used for travel and supplies to conduct 4-H Energy programs. In order to qualify for funding, participating County Extension Professionals must agree to conduct three energy lessons and one community outreach activity within the one-year contract period. The county must also send one representative to a six hour (one day) training each year. The National Energy Education Development (NEED) project is the main curriculum tool used in the 4-H Energy program but Extension professionals are encouraged and do use additional materials. As each new county is enrolled, they receive four base NEED for 4-H energy kits: Light, Motion, Chemical, and Heat. These four kits provide a general overview of the science of energy, and the different types and transformations of energy. Additional materials supplied to counties in continuing years highlight different energy subject matter such as fossil fuels, hydropower, nuclear, wind, and solar.

The 4-H Energy project uses hands-on activities to teach energy concepts. Through hands-on activities, youth also learn important critical thinking and scientific method skills. From its inception in 2008, the 4-H Energy program has reached 268,693 youth.

Elizabeth Gall
egall1@utk.edu

Elizabeth Gall received a MS in Youth Development and Agricultural Education from Purdue University in West Lafayette, IN and a BS in Environmental Science from St. Joseph's College in Rensselaer, IN. Shortly after completing her MS degree, she began as the Youth Energy and Environment Specialist at the University of Tennessee in Knoxville, Tennessee. Her experience includes informal environmental education in the classroom and camp settings, STEM curriculum development, and energy conservation and efficiency adult education and outreach.

Using Demonstration Units as a Teaching Tool: Are they worth the expense and hassle?

Milton Geiger

The use of demonstration units are a prominent teaching tool in many types of Extension programming. The experience of the University of Wyoming Extension with its "Renewable Energy for Home, Farm, and Ranch" demonstration trailer and the Exploring Energy Efficiency and Alternatives (E3A) teaching trunks will be presented to provoke discussion addressing one key question:

"In a time of limited funding, are demonstration units a cost effective teaching tool?"

To address this core question, the poster will focus on a description of the technical specifications, initial costs, and operation and maintenance expenses of both the trailer and trunks. The poster will provide examples of their use in Wyoming, including use by field educators. The advantages of having a tangible teaching tool will also be considered.

Though reviewing the experience of the University of Wyoming with simple (trunks) and complex (trailer) demonstration units, other institutions can carefully evaluate the costs and benefits from developing their own examples. In addition, opportunities for regional partnerships will also be proposed.

Milton Geiger

mgeiger1@uwyo.edu

Milt Geiger serves as the Energy Extension Coordinator for UW Extension and the School of Energy Resources, a position he has held since 2009. In his role, he is tasked with building UW's inaugural energy extension effort, addressing energy efficiency, distributed renewables, and the impacts of large-scale energy development. Milt is a graduate of Colgate University (B.A. Environmental Economics) and the University of Wyoming (M.S. Agricultural and Applied Economics & Environment and Natural Resources), he is also a LEED Green Associate and an Association of Energy Engineers Certified Energy Manager (CEM) and Renewable Energy Professional (REP).

Online Bioenergy Training for Extension Educators

M. Charles Gould

The online Bioenergy Training Center provides educational training resources for Extension educators focused not only on the technical feasibility of bioenergy generation, but also on approaches and processes that assist communities in understanding the comprehensive implications of bio-based alternative energy. The intended outcome of the Bioenergy Training Center is to bring viable bioenergy projects into communities by providing Extension educators with tools and knowledge they can use to make this happen. Tools and knowledge are in the form of three peer-reviewed, research-based modular courses – sustainable bioenergy, on-farm energy conservation efficiency, and anaerobic digestion – plus a bioenergy and renewable energy community assessment toolkit. Course and toolkit content was developed by experts from across the North Central Region.

Charles Gould

gouldm@anr.msu.edu

Charles Gould provides relevant expertise in the areas of bioenergy, bioproducts and energy conservation to Michigan farmers that enable them to be sustainable now and in the future. He has authored numerous publications on anaerobic digestion, including a web-based curriculum and most recently, a textbook chapter. For the last several years he has worked to design a low cost, robust digester for the 100 cow dairy in temperate climates. Charles received his Bachelor's degree from Utah State University and his Masters degree from The University of Georgia. He has been with Michigan State University Extension since 1995.

Certified Biomass Procurement Specialist

Mark Hall

These courses are designed to train students to work with farmers and landowners to produce switchgrass or short rotation hardwoods that will be used as the feedstock for a biorefinery. The idea for this program came from observing the poultry industry. In the poultry industry, poultry companies contract with growers to grow the chickens they need. Farmers cannot show up at the processing plant any time they want with whatever kind and size of chicken they happen to have. The poultry companies hire specialists that work with the growers. These specialists make sure that they have the exact type and the exact size of chicken the processor needs at the time they need it.

As a certified biomass procurement specialist, graduates will work for a biorefinery that's making fuel or other bio-products. Like the poultry field specialist, the certified biomass procurement specialist will insure that their employer has the inputs it needs to keep the plant running.

Graduates will work with the farmers and landowners to produce switchgrass or short rotation hardwoods in an environmental and socially accountable way that meets the specifications of the biorefinery. These specifications are sure to include size, amount and delivery time.

Mark Hall

hallmah@auburn.edu

Mark Hall is the Sustainable Energy Specialist for the Alabama Cooperative Extension System. He coordinates and provides leadership for educational programs pertaining to production and utilization of sustainable fuels and the production of feedstocks for renewable energy in Alabama.

Willow Bioenergy: Extension Approaches to Common Questions and Challenges

Justin Heavey, Timothy Volk, & Mark Eisenbies

There are currently 1200 acres of commercial willow crops in northern New York State. The biomass from these crops is being utilized by ReEnergy Holdings LLC to produce renewable electricity and heat. SUNY-ESF is proving extension services to support the stability and expansion of this regional bioeconomy. This presentation will explore some of the challenges still facing the industry, related questions frequently asked by current and prospective growers, and how these issues are being addressed through extension services in partnership with NYSERDA and NEWBio. For example: Is it profitable? ESF recently released an updated version of the financial analysis tool "EcoWillow" based on new data from commercial willow operations and feedback from growers and other stakeholders. The tool is user-friendly yet highly customizable, and example production scenarios demonstrate the impact of key variables on profitability. Isn't willow high in moisture and ash? ESF has been monitoring willow chip quality in commercial operations since 2012 and disseminating this information. Levels and variability of key quality indicators are similar to other sources of woody biomass such as forest residues, making willow suitable for current end-user specifications and feedstock blending. Am I doing this right? Studies have shown that limited knowledge of important cultural practices of novel bioenergy crops like willow can be a substantial barrier and setback to the industry. ESF is providing grower training programs and educational materials with an emphasis on direct interaction with growers in the field and innovative uses of technology. Do I add fertilizers? How can I improve my crops and bottom line? What are the environmental or other benefits? Extension-based approaches and answers to these questions in the context of willow bioenergy will be summarized in this presentation, touching on topics such as soil sampling, crop monitoring, GIS analyses, best practice targets, incentive programs, research summaries, equipment access and value-added bioremediation opportunities.

Justin Heavey
jpheavey@syr.edu

Justin Heavey has been managing energy and sustainability projects in higher education since 2008 with a focus on shrub willow since 2011. He currently provides a range of extension services to the willow bioenergy industry in New York State and supports related research projects. He is a Senior Extension Personnel and equipment program manager with the Northeast Woody/Warm-season Biomass Consortium (NEWBio). He holds a B.S. in Environmental Studies/Renewable Energy and an M.S. in Natural Resources Management from SUNY-ESF.

Environmental Professionals' Perceptions of Bioenergy and Bioproducts

Marina Heppenstall, Patricia Townsend, Orion Lekos, Nora Haider & Betsy Fradd

From climate change to land-use, wildlife, and river ecology, bioenergy is relevant to all areas of environmentalism. Environmental professionals are in a unique position to drive research and policy for renewable energy and products. Understanding their knowledge level and perceptions of different forms of bioenergy and bioproducts is important in providing the most useful information to these groups. It is also important for extension agents to communicate the concerns of environmental professionals to researchers. An online survey of environmental professionals working for NGOs in the Pacific Northwest found that the attitudes towards bioenergy and bioproducts vary greatly among individuals. Respondents cited field tours and demonstrations followed by websites as the most useful forms of communication.

Marina Heppenstall

marina.heppenstall@wsu.edu

Marina is an Extension Coordinator at Washington State University Extension. Marina is developing outreach materials about the AHB project for stakeholders, policy makers and the general public. She completed her M.S. in Environmental Science with a focus in soil science and sustainable agriculture at Washington State University where she researched greenhouse gas emissions and the potential for carbon sequestration on organic farms.

Assessing Energy Literacy in an Outdoor Learning Center

Justin Hougham, Jenny Schon, Karla Eitel, William Stubblefield,
& Justin St. Onge

The McCall Outdoor Science School (MOSS) is a program of the University of Idaho College of Natural Resources. Every year more than 3000 K12 students and teachers participate in residential inquiry-based field science programs. MOSS is a partner in the Northwest Advanced Renewables Alliance (NARA). Featuring a broad alliance of private industry and educational institutions, the Northwest Advanced Renewables Alliance (NARA) takes a holistic approach to building a supply chain within WA, OR, ID and MT based on using forest residuals to make aviation biofuel. The alliance is tasked with increasing efficiency for each supply chain step from forestry operations to conversion processes; creating new bio-based products; providing economic, environmental and social sustainability analyses; engaging stakeholder groups; and improving bioenergy literacy for students, educators, professionals and the general public. Members of the education team have developed and pilot-tested a energy literacy assessment tool for broad use in a number of settings. As part of pilot testing and implementation MOSS has used the tool to assess energy literacy development in students participating in our residential K12 and teacher programs. Instrument development and descriptive results will be presented here.

Justin Hougham

justin.hougham@ces.uwex.edu

Dr. R. Justin Hougham. Justin Hougham is assistant professor at the University of Wisconsin-Extension and serves as the director of the Upham Woods Outdoor Learning Center. He holds a Ph.D. in education from Washington State University, emphasizing in sustainability and natural resource education.

Education at the Speed of Research: An Overview of the NARA approach to BioEnergy Literacy

Justin Hougham

The Northwest Advanced Renewables Alliance (NARA) is a biofuel research project that includes a holistic educational approach to energy literacy. NARA research is focused on woody biomass as a feedstock for biofuels and associated co-products, particularly in the forested areas of the U.S. Pacific Northwest. Extending beyond the science of biofuels, the NARA project examines many social elements of our energy economy, including education. Projects that can combine research and connections to educational venues provide excellent opportunities to expand the impact of grant funded proposals. Keys to making this possible include coordination across disciplines, interpretation of research results, and research processes in the field coupled with investment into integrated educational strategies within the project. This presentation outlines elements of the NARA approach to energy literacy, offering strategies for approaches to broader impacts in projects beyond the energy sector. Developing sustainable alternatives to conventional energy sources an important 21st century challenge, one that will require a future workforce prepared to succeed in the bioenergy sector. Moving education forward at the speed of research will require a transformational shift in academic approaches, away from entrenched disciplinary specialization and towards pedagogies rooted in authentic, experiential learning and real-world issues (Hougham, et al 2012). The overarching goal of the education component of this project is to recruit, motivate, and train students to become next-generation bioenergy professionals by transforming bioenergy-based education.

Justin Hougham

justin.hougham@ces.uwex.edu

Dr. R. Justin Hougham is an assistant professor at the University of Wisconsin-Extension and Director of Upham Woods Outdoor Learning Center where he supports the delivery of a wide range of science education topics for K-12 students, graduate students, and in-service teachers. Justin is also an energy literacy researcher with the Northwest Advanced Renewables Alliance. Justin's scholarship is in the areas of place-based pedagogies, STEM education, energy literacy, and education for sustainability.

Making the Energy Connection: National Grassroots Extension Initiatives on Sustainable Living Education and Climate Science **Christopher Jones & Catherine Elliott**

National professional associations provide opportunities for professional colleagues across wide geographic areas to learn from each other and engage on important topics and emerging issues at the grassroots level. Members of the Association of Natural Resources Extension Professionals (anrep.org) have created two national initiatives: the National Network of Sustainable Living Educators (NNSLE) in 2004 and the Climate Science Initiative (CSI) in 2011. The purpose of both initiatives is to connect colleagues who are engaged in sustainability education and climate science-related programs. They are open to anyone, even those who are not ANREP members. Energy education is an important part of both sustainability and climate science-related issues; therefore building the connection between all educators working in energy, sustainability and climate-related Extension programming benefits each other. For example, atmospheric carbon dioxide is the by-product of carbon-based fuels used for the large majority of energy needs. Forests are crucial for carbon sequestration that helps mitigate the acceleration of global warming; viable forest biomass energy projects are a key economic solution for better forest management. Also, making personal choices to conserve energy through technology (using CFC light bulbs or solar panels, driving a “hybrid” car) or less energy-intensive lifestyles (carpooling or riding a bike to work) are sustainable living practices involving energy education. NNSLE meets monthly on conference calls to discuss projects. Two NNSLE-produced publications include the Sustainable Living Handbook: A Citizen’s Guide to Thoughtful Action (Apel et al., 2011), and Climate Change Handbook: A Citizen’s Guide to Thoughtful Action Issues (Apel et al., 2010). CSI hosts monthly webinars that feature two climate-related Extension or partner programs (sites.google.com/site/anrepreclimate). We are also working to develop training modules to help Extension educators better address climate-related issues. Opportunities to address Extension Energy education through NNSLE and CSI are welcome; let’s join forces!

Christopher Jones
ckjones@cals.arizona.edu

Christopher Jones is an Associate Extension Agent at the University of Arizona in Gila County, Arizona. His background includes a Bachelor of Science in Forestry (Northern Arizona University, 1987) and Master of Science in Renewable Natural Resources (University of Arizona, 1995). He served as a Peace Corps Volunteer in Guatemala and as Territorial Forester in American Samoa before becoming a Cooperative Extension Agent. He conducts programs in horticulture and natural resources, including programming addressing climate change impacts on natural resources since 2003. Chris leads the Association of Natural Resources Extension Professionals’ Climate Science Initiative (sites.google.com/site/anrepreclimate).

Catherine Elliott
ckjones@cals.arizona.edu

Dr. Catherine Elliott is an Associate Professor and Extension Specialist at the University of Maine Cooperative Extension in Orono, Maine. She conducts programs in sustainable living education and wildlife conservation. Her education includes a Bachelor of Science in Forestry and Wildlife (University of New Brunswick, 1979), a Master of Science in Wildlife Management (University of Maine, 1982) and a PhD in Wildlife Ecology (University of Maine, 1986). Dr. Elliott’s career includes work in wildlife, forestry, biodiversity, service learning, and environmental education. Cathy leads the Association of Natural Resources Extension Professionals’ National Network for Sustainable Living Education (anrep.org/people/initiatives/nnsle).

CenUSA Bioenergy Informal Youth Outreach **Matthew Kararo & Kathryn Orvis**

This poster will describe two nonformal educational outreach programs focused on the topics of renewable energy and second-generation biofuels. Both of these programs are made possible by a NIFA/USDA grant entitled CenUSA Bioenergy, which is researching a comprehensive production cycle for second-generation biofuels. One program is a three-day summer camp for high-school aged 4-H members that is on the campus of Purdue University as a subject track in 4-H Science Workshops for the past two years. The other program is an interpretive signage educational walking tour that will be installed this spring and will be located beside demonstration plots of second-generation biofuel grasses at the Indiana FFA Center.

The poster will describe how high school aged 4-H members participating in the renewable energy science workshop are given real-world learning tasks, such as developing a renewable energy action plan for an area of the state. Additionally, the career-centric activities youth are able to experience will be discussed. These include a detailed tour of a wind turbine farm, hands-on biofuel feedstock-related experiences at the Purdue agronomy research farm, and a behind the scenes tour of a large biodigester facility. In addition to a discussion of the workshop, data from the assessment of the program thus far will be presented.

The poster will also describe how FFA members are expected to interact and learn from the educational signage program at the demonstration plots. The creation and development of the eight sign walking tour, along with visual representation of the finalized sign versions, a discussion of planned assessment protocol, and a discussion of the challenges associated with this type of project will also be presented.

Matthew Kararo
mkararo@purdue.edu

Matthew Kararo has been working as a graduate research assistant on the CenUSA Bioenergy grant since the grant began in 2011. He is a Ph.D student in the department of Youth Development & Agricultural Education (YDAE) at Purdue University. He received a B.S. in Biological Sciences from Northern Illinois University in 2009 and a M.S. in YDAE from Purdue in 2011.

Increasing Residential Wood Energy Extension Program Outreach

Jonathan Kays

Wood is the fastest growing residential heat fuel in the United States and accounts for 75% of the residential renewable energy produced. Residential users have figured out that heating with wood and/or pellets can save significant amounts on their energy bills, especially if they are using propane, fuel oil or electric. However, most wood stoves are older (pre-EPA certified-1988) and polluting, leading to prohibitions in some communities and inefficient use of wood. Many users lack an understanding of how to properly season wood, operate the stove, or maintain a safe installation. They also don't know about the advances in wood and pellet stove technology. The University of Maryland Extension developed a research and extension outreach program consisting of research, publications, webinars, and evening workshops that have resulted in increased knowledge, purchase of newer stoves, and improved seasoning of wood. Research on outdoor boilers has resulted in best practices to reduce the emissions of existing outdoor wood boilers. This presentation will discuss the program and what has been learned from exit and followup evaluations. PowerPoint materials developed for the workshops will be shared. Publications and webinars are available at: www.extension.umd.edu/woodland.

Jonathan Kays
jkays@umd.edu

Jonathan Kays is a professional forester and Natural Resource Extension Specialist with the University of Maryland Extension since 1988. He has responsibility for development and implementation of extension programs in the following areas: forest stewardship, woodland owner volunteer training, wood energy, wildlife damage management, alternative income opportunities utilizing natural resources, and the use of biosolids to grow forest trees on gravel spoils. In April 2010 he organized the Maryland Wood Energy Coalition in cooperation with the Maryland DNR Forest Service, with the goal to increase the adoption of woody biomass for high-efficiency wood energy technologies in commercial and residential applications. He has authored many publications on wood energy and other related topics that are available at www.extension.umd.edu/woodland.

Site Selection Methodology for Northwest Biofuel Supply Chain

Cody Lane

The Integrated Design Experience (IDeX) team at Washington State University is currently researching how to efficiently improve a supply chain that takes woody biomass from forest residuals, and through the Northwest Advanced Renewables Alliance (NARA) procedure, create a sustainable biojet fuel. For this process, slash piles are utilized as the primary biomass, whereas, currently they are being burned on site for no capital benefit and contribute as a carbon source – polluting the atmosphere. Local communities would also greatly benefit from this, because it would add jobs and stability to their community.

Moreover, to begin the process of identifying potential sites the IDeX team did a regional analysis of the Pacific Northwest region of Washington, Idaho, Montana and Oregon by using various physical and social factors. Using ArcGIS to design geographical maps – multiple parameters were created and then overlaid one another to highlight potential regions of interest. This gave the team regional hot spots that could be analyzed for the most suitable locations for the NARA process, which included current pulp and paper mills, chip mills, saw mills and integrated bio-refinery facilities. Once the regional analysis was done, the site process continued by choosing the top 50 sites from the regional analysis. This top 50 gave the team the ability to examine the facilities on a site-by-site basis, and create a site inventory that utilized more detailed factors to further rank these top sites. These factors included biomass availability, labor costs, electricity rates, building and operations taxes, creative vitality index, poverty rates, natural gas rates, acreage, transportation on site, environmental permitting, wastewater treatment availability, boiler availability, and the type of the facility being examined. These factors gave the team the ability to rank the top five potential site locations for each facility type that could add the NARA supply chain process.

Cody Lane

cody.lane@email.wsu.edu

I am currently a Senior Civil Engineering student at Washington State University. For my senior design project I am working on a collaborative project with the Interdisciplinary Design Experience (IDeX) Team. For our project, we are working on Northwest Advanced Renewables Alliance's (NARA's) Wood-To-Wing Project since August of 2014. Over the past six months we have been researching the process of converting woody biomass into a biojet fuel. Throughout this project I have assisted in the design for a site selection process to find potential facilities for the NARA supply chain, partaken in undergraduate research for pretreatment methods of woody biomass, and done site design for a liquids depot facility.

Effective Extension Material for Biofuel Technologies

Orion Lekos, Patricia Townsend, Nora Haider, Marina Heppenstall & Betsy Fradd

Describing how cellulosic biofuels are made can be difficult to people outside of the industry. There are more technologies available for the conversion of biomass to biofuels than traditional biodiesel or ethanol and there are more plants and waste products that can be used as the feedstock. This poster will describe various effective educational outreach materials that extension educators can use including infosheets, policy maker briefs, educational videos, field tours and webinars.

Orion Lekos

orion.lekos@wsu.edu

Orion Lekos is a Biofuels Specialist for Advanced Hardwood Biofuels Northwest at WSU Extension and focuses on the technology of converting the poplars to fuels and chemicals. He has worked in the biomass derived fuels and chemicals field for the last decade and has taught classes focused on renewable energy. Orion earned his Ph.D. in biological engineering from the University of Washington and his M.S. in Environmental Chemistry from Huxley College of the Environment.

Community Biomass Handbook Volume 1: Thermal Wood Energy and Financial App - an iBook approach

Eini Lowell, Dennis R. Becker, Dan Bihn, Roy Anderson, & Steve Taff

Significant time and resources are often spent in pursuing biomass utilization projects that are not suitable or appropriate for the situation. To assist communities and partners in rapidly evaluating a variety of thermal energy options without having to invest, we have developed the Community Biomass Handbook. The handbook is a multimedia electronic library that showcases successful projects from around the country using text, photos, video interviews, diagrams, and – most importantly – contains an interactive financial computer app. Checklists for assessing opportunities, engaging your community, and moving project proposals forward are included. The Handbook connects forest planning with value chain and pre-feasibility analysis in an interactive PDF, iBook, and conventional webpage format. The interactive sections can be projected on screens so groups can collaboratively explore the various options. Presentation of community and project considerations as well as demonstration of the financial application and components of the interactive iBook can be viewed. Bring your iPad if you have one!

Eini Lowell

elowell@fs.fed.us

Ms. Lowell is a Research Scientist with the USDA Forest Service Pacific Northwest Research Station in Portland, OR. She has been involved with wood quality and wood utilization research for almost 30 years. In the 1980's, she worked on biomass energy and land management issues in New England while working with the Maine Department of Conservation in the Forest Products Marketing and Assessment Program and as an independent consultant. Her research over the years has addressed land management activities and their effect on trees and wood product quality. She has been with the PNW Research Station for 25 years addressing issues that include deterioration and utilization of dead and dying trees (as a result of disturbance), utilization of hardwoods, and opportunities (with a value-added emphasis) for using biomass and small diameter trees focusing on integration of markets specifically at the rural community level.

Teaching Biomass Energy with Rocket Stoves

Art Nash

Rocket stoves are an efficient option for using loose biomass fuels in the environment. Wood gasses and oxygen mix in insulated chambers that concentrate the fire on the tip of the wood. The result is a more efficient burn using less wood and producing fewer emissions than traditional stoves. Rocket stoves are great for cooking and heating in camps and emergency situations. Teaching the fundamentals of combustion, gasification, and wood care for fuel stock in a 2 hour construction lab class has been a popular outreach for Alaska Cooperative Extension with residents who are often on the go in remote outdoor locations or wanting to be prepared for emergencies and disasters.

Art Nash

alnashjr@alaska.edu

Since coming to Alaska in the early 1990's trained and licensed in secondary social studies teaching, Art has worked with housing/energy construction while providing educational services in various parts of the state. Obtaining a master's in resource economics from University of Alaska Fairbanks (UAF) and having worked for UAF Cooperative Extension for three years now Art's outreach teaching and research interests include home energy/cost efficiency, Universal Home Design for disabled and aging residents, remote energy, and biomass energy.

Woody Biomass in Alaska - Is It Economical?

Art Nash & Glen Holt

Increasingly, Alaskan manufactured wood pellets and chips are being used from fire remediation efforts, wastestreams and non-lumber wood pulp. they have also been a major export to nearby Pacific Rim countries. What advantages and challenges exist in the Alaska forest products industry, and how is one innovative school district in the interior of the state taking advantage of creating electricity and heat with such product?

Art Nash

alnashjr@alaska.edu

Since coming to Alaska in the early 1990's trained and licensed in secondary social studies teaching, Art has worked with housing/energy construction while providing educational services in various parts of the state. Obtaining a master's in resource economics from University of Alaska Fairbanks (UAF) and having worked for UAF Cooperative Extension for three years now Art's outreach teaching and research interests include home energy/cost efficiency, Universal Home Design for disabled and aging residents, remote energy, and biomass energy.

Woody Biomass in Alaska - What Community Development is Taking Advantage of Local Wood Resources?

Art Nash

In the last dozen years, over four dozen Alaskan rural communities have applied for pre-feasibility studies to convert from oil to predominately cord wood boilers. Community leaders were interviewed by Alaska Cooperative Extension Service and the Alaska Center for Energy and Power to report what economic, social and logistical factors were present in those locations where the conversions led to savings anywhere from 10,000 to 50,000 of displaced oil per year for annual monetary savings of \$80,000 to \$400,000 in fuel costs.

Art Nash

alnashjr@alaska.edu

Since coming to Alaska in the early 1990's trained and licensed in secondary social studies teaching, Art has worked with housing/energy construction while providing educational services in various parts of the state. Obtaining a master's in resource economics from University of Alaska Fairbanks (UAF) and having worked for UAF Cooperative Extension for three years now Art's outreach teaching and research interests include home energy/cost efficiency, Universal Home Design for disabled and aging residents, remote energy, and biomass energy.

Value of Solar: Policy Implications

Ahlmahz Negash & Daniel Kirschen

Because of the potentially unfair cost shifting from net energy metering (NEM) customers to non-NEM customers, some states have begun to show signs of a shift away from traditional NEM policy. Currently, value of solar tariffs (VOST) are emerging as an alternative to NEM. VOST is a tariff that is based on the actual value that solar brings to a utility and is defined as a sum of several distinct, individually calculated value components. In 2014, Minnesota became the first state to design and implement VOST methodologies and policy statewide. As part of this research, we are investigating a region-appropriate method for a VOST in Washington State. In particular, we are comparing the short and long term value of various existing and proposed VOST and NEM policies from the point of view of the utility, as well as from the point of view of the solar customers and non-solar customers. Preliminary results show that a successful VOST in Washington State would be largely policy-dependent.

Ahlmahz Negash

ain@uw.edu

Ahlmahz Negash is currently a PhD candidate in the Electrical Engineering Department at the University of Washington, where she is advised by Professor Daniel Kirschen. Her research interests include renewable energy integration and valuing distributed energy resources. She is currently collaborating with Snohomish Public Utility District (SnoPUD) on a value of solar study and works part-time at EMI Consulting on issues related to energy policy and economics. Ahlmahz is a member the University of Washington Women's Initiative (UWWI) and student coordinator for Promoting Equity in Engineering Relationships (PEERs).

Cross-Discipline Energy Programming Across Multiple Extension Strategic Plans

Tim Prather & Elizabeth Gall

Extension programs too often are placed into the silos of Agriculture and Natural Resources (ANR), Community Economic Development (CED), Family and Consumer Sciences (FCS) or 4-H Youth Development. And Extension agents and specialists traditionally select priority programs and report through these program areas – ANR/CED, FCS or 4-H – according to their appointments. However, energy conservation, efficiency and renewables education programs by their nature cross all demographics and program area boundaries.

The University of Tennessee and Tennessee State University Extension have developed joint Strategic Plans and Strategic business Models under the ANR/CED and FCS program areas, and 4-H youth development will develop new plans during reorganization of the programs. These plans create a framework for program planning, evaluation and reporting to aid in developing priority programs and fewer, but better impact statements. The UT Extension Energy Workgroup is developing a model for cross-discipline program planning, delivery and reporting in a multiple strategic plan environment. Some of the current efforts include:

- A new UT/TSU Extension Energy Education web portal to provide easy access to research-based energy information from all disciplines
- Multidisciplinary in-service and other programs for Extension educators of all disciplines
- A coordinated program evaluation and reporting program
- Coordinated proposal development for energy education, assistance and research/demonstration projects

This poster will describe the operational model and some of the accomplishments of the Tennessee Extension Energy Workgroup.

Ahlmahz Negash

ain@uw.edu

Ahlmahz Negash is currently a PhD candidate in the Electrical Engineering Department at the University of Washington, where she is advised by Professor Daniel Kirschen. Her research interests include renewable energy integration and valuing distributed energy resources. She is currently collaborating with Snohomish Public Utility District (SnoPUD) on a value of solar study and works part-time at EMI Consulting on issues related to energy policy and economics. Ahlmahz is a member the University of Washington Women's Initiative (UWWI) and student coordinator for Promoting Equity in Engineering Relationships (PEERs).

Energy Boom and Bust Labor Market Impacts and Strategies David Ripplinger

This poster will share the results of a North Central Regional Center for Rural Economic Development project to study the Bakken labor market and develop, deliver, and evaluate Extension programming on strategies for local leaders to manage and mitigate labor issues resulting from energy-related development. Implications and strategies will be general in nature and be of value to energy-impacted regions across the country.

David Ripplinger
david.riplinger@ndsu.edu

David Ripplinger is a bioenergy specialist with North Dakota State University (NDSU) Extension and an Assistant Professor in the Department of Agribusiness and Applied Economics at NDSU. In this role he conducts applied research and provides support to farmers and the bioenergy industry. Mr. Ripplinger received a master's degree in agricultural economics from Iowa State University and a Ph.D. in transportation and logistics from NDSU.

Building Sustainable Communities in Ohio's Shale Region

Eric Romich, Nancy Bowen, Myra Moss & Cindy Bond

According to a 2012 International Energy Agency report, as a result of shale energy development the U.S. will overtake Saudi Arabia as the world's biggest oil producer by around 2020. Rural communities throughout the nation are affected by shale energy development and are prone to the long term economic fluctuations experienced by energy dependent economies. The challenge to impacted communities is to effectively manage the immediate impacts of shale development while leveraging the economic boom to build a long-term plan that supports sustainability. To achieve this, it is essential to understand and manage the social, environmental, and economic impacts of development.

In Fall 2013, a nine-member Ohio State University Extension team partnered with four regional Economic Development Districts in eastern Ohio to develop a research-based strategic planning process to leverage manufacturing opportunities in the 25-county shale-impacted region. This 3-year project is funded by a \$200,000 grant from the U.S. Department of Commerce Economic Development Administration (EDA), and is matched 1:1 by OSU Extension.

The five core objectives of this project include:

1. Conducting an advanced industry cluster analysis
2. Performing a Industry capacity assessment
3. Developing a regional GIS Asset map
4. Implementing a sustainable strategic shale energy planning process
5. Establishing implementation strategies

Results and findings from the economic cluster research and strategic planning will inform the implementation strategies that will elevate and expand existing comprehensive economic development plans in all four regional economic development districts.

Eric Romich

romich.2@osu.edu

Eric Romich is an Ohio State University Extension Field Specialist for Energy Development. His background in renewable energy began during his former assignment as an OSU Extension Community Development Educator in Wyandot County. In this position he served as the Director of Wyandot County Office of Economic Development and was deeply involved in the details of finalizing the PSEG Wyandot Solar Project. The PSEG Wyandot Solar Project is a 12 MW 85 acre solar generation facility that is the largest solar facility in Ohio and one of the largest in the Midwest.

Romich focuses his Extension efforts in the areas of renewable energy development, energy policy, wind energy, solar energy, bioenergy resources, and shale energy development. He works with elected officials, community planners, community residents, and state and federal government agencies to deliver energy programs throughout Ohio.

Engaging Energy in an Outdoor Learning Center

Jenny Schon, Karla Eitel, Justing Hougham, Jim Casey, & Mike Wang-Belt

The McCall Outdoor Science School (MOSS) is a program of the University of Idaho College of Natural Resources. Every year more than 3000 K12 students and teachers participate in residential inquiry-based field science programs. MOSS is a partner in the Northwest Advanced Renewables Alliance (NARA). Featuring a broad alliance of private industry and educational institutions, the Northwest Advanced Renewables Alliance (NARA) takes a holistic approach to building a supply chain within WA, OR, ID and MT based on using forest residuals to make aviation biofuel. The alliance is tasked with increasing efficiency for each supply chain step from forestry operations to conversion processes; creating new bio-based products; providing economic, environmental and social sustainability analyses; engaging stakeholder groups; and improving bioenergy literacy for students, educators, professionals and the general public. As a member of the education team, MOSS has developed and tested curriculum materials to support teaching energy literacy in a field setting based on principles defined by the Department of Energy. This poster presentation will highlight examples of various lessons and resources developed by team members and will report on future directions for curriculum development as the project moves into its final and most exciting phase of development where 1000 gallons of biojet will be produced.

Jenny Schon

jschon@uidaho.edu

Jenny Schon is the program coordinator at the McCall Outdoor Science School (MOSS) and will be helping with the education efforts for the NARA project. The group aims to educate and train a future bioenergy workforce with programs from elementary through graduate school. Schon has a M.A. in teaching from Ashford University and a B.S. in environmental science from Western Washington University. Previously Schon taught middle school science in Montana and conducted field research for the fire ecology group for the National Park Service.

Wood-To-Wing

Ian Smith

The Integrated Design Experience (IDX) team at Washington State University has been working in conjunction with Northwest Advanced Renewables Alliance (NARA) to research biomass to biojet fuel production in the Pacific Northwest. The biomass in this project, known as the Wood-To-Wing Project, is woody residues left over from the existing forest industry. This project has an associated production chain with multiple processes occurring at several different nodes; one such node is labeled as a liquids depot. A liquids depot is a site at which woody biomass is converted into a refinable sugar slurry. This portion of the supply chain is the focus of IDX team's case study design.

The objective of the research is to develop a feasible site design for a liquids depot, taking into account process requirements, environmental, social, and economic factors. The unit processes for a liquids depot are outlined, and the equipment corresponding to these processes are defined. Equipment sizes and necessary efficiencies are found using a resource flow analysis as criteria. A Techno-Economic Analysis (TEA) for the construction of a liquids depot is then developed by taking into consideration the equipment, capacities, and installation costs. The result of this TEA will coexist with the design of the liquids depot facility to assist in the sustainability and feasibility analysis of a liquids depot in the Wood-To-Wing Project.

Ian Smith

ian.d.smith@email.wsu.edu

I am a Senior Civil Engineering student at Washington State University and as my capstone project I am part of the Interdisciplinary Design Experience (IDX) Team. As a part of that team I have been working on Northwest Advanced Renewables Alliance's (NARA's) Wood-To-Wing Project since August of 2014. The project is to research the process of converting woody biomass into a biojet fuel. Part of that project I have done a literature review on the processes used in the proposed liquids depot (biomass-to-sugar) facility, developed a site selection process for facilities in the NARA Supply Chain, collaborated on a Techno-Economic Analysis and site design of a liquids depot facility, and undertook undergraduate research on alternative pretreatment methods of wood biomass.

The URI Energy Fellows Program: Providing Experiential Learning Opportunities to Tomorrow's Energy Workforce **Angela Tuoni, Kate Venturini & Kristina DiSanto**

We propose an oral presentation 1) illustrating the success of the URI Energy Fellows Program in preparing the next generation of energy professionals through a yearlong intensive experiential learning opportunity, 2) next steps to improve the program, and 3) the challenges with training a dynamic workforce in the absence of a robust academic curriculum.

In response to a growing need for experiential learning opportunities for students outside the classroom, the URI Outreach Center created the Energy Fellows Program in 2007 to provide a year-long internship opportunity for graduate and undergraduate students interested in sustainability issues related to energy.

The Outreach Center's Energy Fellows Program Coordinator manages both the fellowship program and energy projects, and recruits and hires undergraduate and graduate students into fellowship positions at the Outreach Center and with external organizations. Students are afforded the invaluable experience of working on real-world, current energy projects in interdisciplinary teams of faculty, research and outreach staff and energy professionals in the field. Fellows also receive training in general energy topics as well as specialized professional development training in leadership and communications. Throughout the course of their internship, Fellows attend field trips statewide, actively participate in outreach events and present their work to the University community and general public at an academic poster session at the end of the year.

Undergraduate and graduate students leave the Energy Fellows Program with an understanding of current energy issues related to conservation, efficiency and renewables in Rhode Island, the New England region, and beyond. Since, 2007, over 80 undergraduate and graduate students have graduated university with the supplemental "URI Energy Fellow" credential, and over 50% have continued on to land jobs in the energy field.

Angela Tuoni
angela_tuoni@my.uri.edu

Angela Tuoni is a third year undergraduate student at the University of Rhode Island from South Kingstown, RI. She is studying Environmental and Natural Resource Economics and pursuing a minor in Public Relations. In 2014 Angela was hired as a URI Energy Fellow as a part of the Energy Literacy team and was rehired as the team's leader for 2015. Angela has experience developing outcome-based educational programming for Rhode Islanders that encourages behavior change towards sustainable energy practices. She coordinated URI's first Home Energy School and Renewable Energy School, daylong workshops targeted towards home and small business owners. After graduation Angela hopes to enter the energy workforce and effectively communicate energy challenges to the public with hopes of creating an energy-conscious and solution-focused citizenry.

Integrating Energy Literacy across Extension Disciplines – With an overview of the Biomass Alliance Network of the Rockies (BANR) project

Martin Twer, Peter Kolb, & Randy Brooks

The Bioenergy Alliance Network of the Rockies (BANR) is one of seven Coordinated Agricultural Projects (CAPs) within the Sustainable Bioenergy challenge area funded by the USDA National Institute of Food and Agriculture (NIFA) in its Agriculture and Food Research Initiative (AFRI) program.

BANR was announced in Fall 2013 on a \$10 million grant and brings together scientists, educators, and extension specialists from universities and government agencies across the five-state region of Colorado, Idaho, Montana, Oregon and Wyoming as well as CoolPlanet Energy Systems as a conversion industry partner.

The study aims to explore the use of beetle-killed and other forest biomass as a bioenergy feedstock, and to provide rigorous scientific underpinnings to support a sustainable regional renewable energy industry.

Five task areas address the various aspects of this project:

- **Feedstock Supply** - Integrating field plot data, remote sensing and geospatial layers to estimate feedstock supplies and produce a digital feedstock atlas.
- **Feedstock Logistics & Supply** - Develop cost and production models for bioenergy-specific forest harvest & biomass transport operations; establish specifications for beetle-kill feedstock quality & pretreatment.
- **System performance & Sustainability** - Quantify the ecological impacts of beetle-kill harvest, the financial viability of the supply chain and potential for lifecycle greenhouse gas mitigation, and the value of the biochar co-product; assess economic, social and policy constraints; produce a web-based decision support system.
- **Education** - Promote general bioenergy literacy through the development of middle school and high school educational materials, K12 teacher professional development activities, and undergraduate- and graduate-level course development.
- **Extension Outreach, Health & Safety** - Provide information to communities and stakeholder groups on all aspects of a potential beetle-kill industry in the Rockies; understand and address concerns of communities regarding the health and safety aspects of biofuel and biochar production and transportation.

Martin Twer

martin.twer@umontana.edu

Martin Twer is the Montana State University Extension Forestry BioEnergy Associate Specialist, and holds MSc degrees in Landscape Ecology (University of Muenster, Germany) and Resource Conservation (University of Montana). He is a co-leader of the eXtension Wood Energy Community of Practice and a member of the Montana Statewide Wood Energy Team, tasked with advancing the development of wood energy projects in the state. He is the director of the Montana Natural Resources Youth Camp, coordinator of the Montana Master Forest Steward Program and annual Forestry MiniCollege, and teaches workshops for landowners and forestry professionals on GPS, GIS, Google Earth applications, and Heating with Wood.

Solar Thermal Hot Water Educational Outreach Initiative

Mary Wrege

Solar thermal technology uses the sun's radiation for hot water heating. The Solar Thermal Hot Water Educational Outreach Initiative, leveraged a solar thermal demonstration station, industry professionals, and numerous public and agricultural event venues in order to deliver clear information and case studies in order to explain energy conservation, efficiency and this renewable energy technology. This targeted agricultural programming effort specifically led to local implementation of this technology, thus making significant impacts to lessen carbon emissions associated with electricity consumption. New technologies and educational programs assist the dairy industry and agribusinesses, as well as municipalities, school and residential sectors, in meeting the growing need for sustainable energy knowledge and implementation.

This poster highlights local agricultural installations, including site assessments and views of the solar thermal demonstration station.

The first Oneida County agricultural installation of solar thermal occurred in July 2014 on a 220 milking-cow, robotic dairy operation. This included a collector area of 271.3 square feet with a projected annual electricity savings of 17,749.7 kWh. The estimated \$4000.00 annual utility savings was calculated for the milking component of the farm operation. The second farm installation in November 2014 is the largest agricultural solar thermal installation in New York State using solar-heated water specifically for use in milk harvesting and cleaning. Estimates indicate that the collector area of 804 square feet will result in electricity savings of 65,473.8 kWh and nearly \$12,000 in annual savings solely for this process. Other examples of farm business operations to benefit from this technology include: calf and heifer raising facilities, farm shop, creamery product manufacturing and meat processing. Sixteen other milking dairy operations, 2 calf raising facilities and 3 agribusinesses have completed site assessments and are on track for Winter/Spring 2015 installation.

Mary Wrege
mpw57@cornell.edu

Wrege serves as a Resource Educator with CCE. She served as the Agricultural Coordinator for CCE's New York State Energy and Climate Change Team. Her focused work is to provide education and outreach to diverse audiences to increase awareness of renewable & alternative energy technologies and energy efficiency & conservation strategies. She has developed curriculum in solar thermal and biofuel development. Her educational background includes: Graduate degrees in Environmental Law (Vermont Law School), Education (Cornell University) and undergraduate degrees in plant sciences from Cornell and SUNY-Cobleskill. Wrege resides with her family on their farm in Clinton, NY.

Web-based portals for dissemination of research-based findings to stakeholders on wood-to-biofuel conversion

V. Yadama, S. Dossey, J. Smith, C. Bruke & K. Englund

The focus of this poster will be two web-based portals developed within the Northwest Advanced Renewables Alliance (NARA) project. The objective of these portals is to facilitate bioenergy literacy to varying stakeholder groups. These portals are:

WoodToBiofuel.Org

The purpose of this repository is to advance scientific knowledge and make unbiased information readily available to communities and individuals interested in the conversion of woody biomass into biofuels and co-products.

EnergyLiteracyPrinciples.Org

The NARA Energy Literacy Principles Matrix is a collection of resources related to biofuel solutions that are economically viable, socially acceptable, and meet the high environmental standards of the Pacific Northwest. It provides teaching materials such as lesson plans, datasets, videos, images, activities, software and modules. All of the resources align to the energy principles and concepts as outlined in the Department of Energy's peer reviewed Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education framework.

Vikram Yadama
vyadama@wsu.edu

Vikram Yadama, assistant research professor and extension specialist in Washington State University's Department of Civil and Environmental Engineering, is leading outreach efforts for the Northwest Advanced Renewables Alliance. In particular, he leads efforts to facilitate information exchange with communities and provides a conduit for the transfer of the science and technology of biofuels and important co-products. He has been with WSU's Department of Civil and Environmental Engineering since 1998. He holds a Ph.D. in structures and civil engineering from WSU.