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Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

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Final Report for Period: 04/2009 - 09/2009**Submitted on:** 12/31/2009**Principal Investigator:** Eckardt, Michael .**Award ID:** 0554545**Organization:** University of Maine**Submitted By:**

Eckardt, Michael - Principal Investigator

Title:

Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

Project Participants**Senior Personnel****Name:** Eckardt, Michael**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Project Director

Name: Shaler, Stephen**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Co Director of FBRI

Name: Wagner, Robert**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Associate Director of FBRI, leader of Theme 1

Name: Pendse, Hemant**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Co Director of FBRI

Name: van Heiningen, Adriaan**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Core faculty person, leader of theme 2

Name: Neivandt, David**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Core faculty of FBRI part of original project, theme 2, from UMaine Orono

Name: Bousfield, Douglas**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Focus area: Our current work is looking at how to produce nano-scale fibers from wood using enzyme treatments and shear fields. These fibers may have unique properties in terms of reinforcing polymers or other materials.

Professor of Chemical Engineering, UMaine Orono

Name: Rubin, Jonathan**Worked for more than 160 Hours:** Yes**Contribution to Project:**

professor of research economics, works at UMaine, Orono

Focus: Research into the transition pathways to a forest bioproducts industry by evaluating the feasibility of commercial production of cellulosic ethanol and biodiesel along with other cellulose based bio-products.

Name: Fort, Raymond

Worked for more than 160 Hours: Yes

Contribution to Project:

Focus area: vision of a biorefinery, hemicelluloses first will be extracted from wood. Professor of Chemistry, UMaine, Orono

Name: Nemeth, Vicki

Worked for more than 160 Hours: Yes

Contribution to Project:

Maine NSF EPSCoR Associate Project Director - oversight of project

Name: Ruthven, Douglas

Worked for more than 160 Hours: Yes

Contribution to Project:

Core Faculty of FBRI, Professor of Chemical Engineering, UMaine, Orono

Name: Millard, Paul

Worked for more than 160 Hours: Yes

Contribution to Project:

Core Faculty member, theme 2, from UMaine, Orono

Name: Donahue, Darrell

Worked for more than 160 Hours: Yes

Contribution to Project:

core faculty of FBRI; professor of chemical engineering, UMaine, Orono

Name: Wilson, Jeremy

Worked for more than 160 Hours: Yes

Contribution to Project:

Focus area: Research focuses on forest stand dynamics and implications for forest. Associate professor, forest resources, UMaine, Orono

Name: Gardner, Douglas

Worked for more than 160 Hours: Yes

Contribution to Project:

Focus area: My work on the project is involved with understanding the surface and adhesive bonding (gluing) characteristics of wood strands, fibers, particles, and other solid residues being generated from the forest biorefinery processes. professor of wood science, UMaine, Orono

Name: Cole, Barbara

Worked for more than 160 Hours: Yes

Contribution to Project:

Focus area: UMaine vision of a biorefinery, hemicelluloses first will be extracted from wood. Professor of Chemistry, UMaine Orono

Name: Jellison, Jody

Worked for more than 160 Hours: Yes

Contribution to Project:

core faculty, part of original proposal, theme 3; focus interested in the use of microorganisms to break down and modify wood

Name: Bilodeau, Michael

Worked for more than 160 Hours: Yes

Contribution to Project:

Focus area: Liaison with Industrial stakeholders.

Director of Pulp and Paper Process Development Center, UMaine, Orono

Name: Bell, Kathleen

Worked for more than 160 Hours: Yes

Contribution to Project:

associate faculty added to FBRI from UMaine, Orono

Name: Benjamin, Jeff

Worked for more than 160 Hours: Yes

Contribution to Project:

associate faculty, theme 1, focus interest in bioenergy and bioproducts

Name: Leahy, Jessica

Worked for more than 160 Hours: Yes

Contribution to Project:

associate faculty added to FBRI, theme 1; focus preliminary stakeholder research

Name: Lilieholm, Robert

Worked for more than 160 Hours: Yes

Contribution to Project:

Associate Faculty of FBRI, associate professor of forest resources

focus area: Forests have the potential to yield a wide array of high-valued bioproducts as new processes, products, and markets emerge; cost barriers are overcome; and markets grow. Increasingly, the emergence of a bioproducts sector that can augment and/or replace petroleum-based products is seen as a critical step in transitioning the U.S. economy toward energy independence and a more sustainable, renewable resource-based future

Name: Mason, Michael

Worked for more than 160 Hours: Yes

Contribution to Project:

Mike is associated with the UMaine, Orono

Name: Porter, Terry

Worked for more than 160 Hours: Yes

Contribution to Project:

Associate faculty added to FBRI and assigned to theme 1, from UMaine Orono

Name: Genco, Joseph

Worked for more than 160 Hours: Yes

Contribution to Project:

Associate faculty of FBRI, Theme 3, from UMaine Orono

Name: Correia, David

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Correia will pursue data acquisition from USFS NE FIA

David is Assistant Professor of Geography at the University of Maine at Farmington

Name: Vaux, Peter

Worked for more than 160 Hours: Yes

Contribution to Project:

to establish Maine Woods Web site to host a broad spectrum of multi-disciplinary informations

Vaux is Research Associate Professor at the Senator George J Mitchell Center for Environmental and Watershed Research at the University of Maine

Name: Schmitt, Catherine

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Wise, John

Worked for more than 160 Hours: Yes

Contribution to Project:

John Pierce Wise is Professor of Toxicology and Molecular Epidemiology at the University of Southern Maine. Focus area: to help in the use of woody biomass to create new products by studying the toxicity of cellulose nanoparticles as a first step towards identifying modifications to the nanoparticles that may make them less toxic and safer for human and environmental exposure

Name: McCourt, Matthew

Worked for more than 160 Hours: Yes

Contribution to Project:

to work with undergraduate students to acquire skills necessary to implement the Participatory Geographic Information Systems component of a larger natural resource inventory centered on the Rangeley Lake Region in Maine.

Co-PI of outreach project with Matthew McCourt and Tanya Swain

Name: Engle, Stephen

Worked for more than 160 Hours: Yes

Contribution to Project:

He has implemented participatory GIS projects throughout northern New England.

Co-PI of outreach partner project: The aim of this outreach project is to provide an educational experience for undergraduate students to directly contribute to technology-enabled, community-based research focused on 500,000 forestland in Western Maine.

Engle is adjunct professor of geography at University of Maine, Farmington

Name: Barton, Andrew

Worked for more than 160 Hours: Yes

Contribution to Project:

Outreach Partner working with David Coreia.

Associate Professor of Biology, University of Maine, Farmington

Name: van Walsum, G. Peter

Worked for more than 160 Hours: Yes

Contribution to Project:

Areas of Interest: Conversion of Hemicellulose Extract into Ethanol

Name: Weiskittel, Aaron

Worked for more than 160 Hours: Yes

Contribution to Project:

Biometrician Faculty, Theme I

Name: Ni, Yanghao

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Kravit, Nancy

Worked for more than 160 Hours: Yes

Contribution to Project:

New Enzymes for Biopulping

I am bioprospecting for microorganisms that cleave ether bonds between lignin and hemicellulose

Name: Schauffler, Molly

Worked for more than 160 Hours: Yes

Contribution to Project:

Outreach grant partner. Project title: Teaching middle and high school science using real environmental data

Name: Halog, Anthony

Worked for more than 160 Hours: Yes

Contribution to Project:

Associate Professor Industrial Ecology & Life Cycle Assessment

Name: Desisto, William

Worked for more than 160 Hours: Yes

Contribution to Project:

Part of Thermal Conversion thrust for FBRI. Professor and staff of chemical engineering

Name: Frederick, Brian

Worked for more than 160 Hours: Yes

Contribution to Project:

Part of Thermal Conversion thrust

Name: Norris, Gregory

Worked for more than 160 Hours: Yes

Contribution to Project:

Consultant basis with Life Cycle Analysis

Name: Wheeler, M. Clayton

Worked for more than 160 Hours: Yes

Contribution to Project:

Team leader in thermal conversion thrust processes to convert wood waste to chemicals

Name: Xie, Hong

Worked for more than 160 Hours: Yes

Contribution to Project:

Outreach faculty

Name: Bernhardt, George

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Call, Michael

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Tripp, Carl

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Shockey, Tod

Worked for more than 160 Hours: Yes

Contribution to Project:

Outreach faculty

Name: Delvecchio, Tandy

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Hillary, William

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Moyer, Jonathan

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Frankel, David

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo

Post-doc

Name: Fick, Joerg

Worked for more than 160 Hours: Yes

Contribution to Project:

Works with Core Faculty memeber, David Neivandt

Name: Um, Byung-Hwan

Worked for more than 160 Hours: Yes

Contribution to Project:

Area of Interest: Optimization of ethanol production from concentrated substrate

Name: Yang, Han-Seung

Worked for more than 160 Hours: Yes

Contribution to Project:

Postdoctoral Assistant in Cellulose Nanocomposites. Duties coordinate, manage and conduct cellulose nanocomposite research.

Name: Bhandar, Gurbakhash

Worked for more than 160 Hours: Yes

Contribution to Project:

New hire, post doc in the life cycle analysis

Name: Li, Rongxia

Worked for more than 160 Hours: Yes

Contribution to Project:

Biometrician post doc. Research area develops forest planning models using optimization techniques

Name: Hurley, Keith

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Christensen, Warren

Worked for more than 160 Hours: No

Contribution to Project:

Postdoc in physics education participated in Amie Gellen's year 3 outreach project.

Name: Leitas, Laura

Worked for more than 160 Hours: No

Contribution to Project:

School of Forest Resources post-doc

Name: Tunc, Mehmet

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Engelberth, Abigail

Worked for more than 160 Hours: No

Contribution to Project:

Chemical & Biological Engineering post-doc

Graduate Student

Name: Siddiqui, Nazia

Worked for more than 160 Hours: Yes

Contribution to Project:

To study the surface and adhesion properties of extruded wood plastic composites (WPCs) and to improve their bondability through chemical, physical, energetic and mechanical modification.

Name: Li, Lei

Worked for more than 160 Hours: Yes

Contribution to Project:

Works with core faculty David Neivandt

Focus area: My research focus is employing high intensity light to study cellulose surfaces. This will enable me to tell how the cellulose has been changed by certain chemical and biological treatments. These treatments are needed to make new products and processes to efficiently use cellulose.

Name: Chen, Xiaowen

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with core faculty member Dr Adriaan van Heiningen

Name: Oporto, Gloria

Worked for more than 160 Hours: Yes

Contribution to Project:

working with Dr Douglas Gardner, core faculty of FBRI

focus area: To study the surface and adhesion properties of extruded wood plastic composites (WPCs) and to improve their bondability through chemical, physical, energetic and mechanical modification.

Name: Deshpande, Sagar

Worked for more than 160 Hours: Yes

Contribution to Project:

Research topic is Kinetics of degradation of lignin-carbohydrate model compounds associated with Dr. Adriaan van Heiningen research

Name: Walton, Sara

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Topic: Ethanol from hemicellulose wood extracts by Escherichia coli K011. associated with core faculty member Dr Adriaan van Heiningen

Name: Beaupre, James

Worked for more than 160 Hours: Yes

Contribution to Project:

works with core faculty Adriaan van Heiningen lab and research

Name: Graham, LeRae

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with research with Dr. Barbara Cole and Dr. Ray Fort, core faculty of FBRI

Name: Heldmann, Gretchen

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with associate FBRI faculty, Jessica Leahy

Focus area: tasks involve exploratory research into forest landowner willingness to engage in biomass harvesting

Name: Howell, Caitlin

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with core FBRI faculty, Jody Jellison, \Focus area: Biodegradation assays, wood modification by fungi fungal culturing and general lab support

Name: Mao, Haibo

Worked for more than 160 Hours: Yes

Contribution to Project:

Works with Professor Joseph Genco in research

Name: McBride, Peter

Worked for more than 160 Hours: Yes

Contribution to Project:

works with Associate FBRI Faculty, Jeff Benjamin, theme 1, stakeholders research
Focus are: conduct preliminary application of life cycle assessment

Name: Mercier, Wilfred

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with core FBRI faculty, Jeremy Wilson.
Focus area: develop methods for rtyoing stands using high resolution satellite imagery of life cycle assesment

Name: Mills, Ryan

Worked for more than 160 Hours: Yes

Contribution to Project:

Works with core faculty member, Dougals Gardner
Focus area: The thrust of the research is involved in getting natural components soluble and miscible in synthetic materials.

Name: Paredes, Juan

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with Co-PI Stephen Shaler, Scientific Director of FBRI

Name: Rioux, Robert

Worked for more than 160 Hours: Yes

Contribution to Project:

working with core faculty Douglas Bousfield

Name: Wiggins, Julian

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with associate FBRI faculty, Rob Lillieholm, researching stakeholders

Name: Tunc, Mehmet

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with core faculty member Dr Adriaan van Heiningen

Name: Blanchette, Roger

Worked for more than 160 Hours: Yes

Contribution to Project:

works with Dr Bruce Segee, outreach partner in research to refine and test in classroom a data visualization method that utilizes individual laptop computers

Name: LaCerte, Carlyne

Worked for more than 160 Hours: Yes

Contribution to Project:

duties focus on conducting the toxicological investigations including: setting up experiments, running assays, microscopy and image analysis.

Student working with John Pierce Wise at the University of Southern Maine.

Name: Jara, Rory

Worked for more than 160 Hours: Yes

Contribution to Project:

Research area: Hydrolysis of the Near-Neutral Hemicellulose Extract by SO₂. Advisor Adriaan vanHeiningen

Name: Girouard, Maria

Worked for more than 160 Hours: Yes

Contribution to Project:

The Wabanaki Center (Native American Studies) focus on STEM recruitment and retention efforts on tribal communities. Project title: Native Scholar Educational Outreach

Name: Nagpure, Bhupendra

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student for outreach grant partner, Molly Schauffler, to coordinate updates to the Maine Environment Monitoring and Assessment Program Index and develop web resources available on the Center for Science and Mathematics Education Research web site.

Name: Baddam, Rakhi

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student assisting in Peter van Walsum's lab research of biotechnology thrust

Name: Panahiazar, Maryam

Worked for more than 160 Hours: Yes

Contribution to Project:

Supervisor Nancy Kravit, working on research to improve woody biomass separation by enzymatic means and working on DNA approach

Name: Briedis, Julia

Worked for more than 160 Hours: Yes

Contribution to Project:

theme 1 graduate student working with Jeremy Wilson. Research project is related to woody biomass availability and implication of harvesting for Maine forests.

Name: Coup, Charles

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student theme 1, faculty advisor Jeffrey Benjamin. Research are related to biomass harvest systems in low-value beech dominated hardwood stands

Name: Gaetemartinez, Victor

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student theme 2 works with Steve Shaler.

Name: Ghampson, Isaac

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student in Thermal Conversion thrust. design and develop clean, inexpensive, highly active catalysts to make the conversion of wood to fuels and chemicals possible and efficient.

Name: Marciano, James

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate Student in theme 1 working with Robert Lilieholm. Jim's role is to analyze the general public's views and attitudes toward the emerging forest-based bioproducts industry.

Name: Zivanovic, Ana

Worked for more than 160 Hours: Yes

Contribution to Project:

part of theme 1 works with Terry Porter. Research are is the evaluation of the social acceptability of the forest bioproducts industry.

Name: Lehtonen, Heini

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Neupane, Binod

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Peshlov, Boyan

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Pollock, Rachel

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Rigdal, Rikard

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Rijal, Baburam

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Ryder, Roger

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Southworth, Margaret

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Thibodeau, Timothy

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Burke, Andrea

Worked for more than 160 Hours: No

Contribution to Project:

Graduate student on Tod Shockey's outreach project.

Name: Mitchell, Nitisha

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student on Amie Gellen's year 3 outreach project.

Name: Murphy, Casey

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student on Amie Gellen's year 3 outreach project.

Name: Willett, Sara

Worked for more than 160 Hours: Yes

Contribution to Project:

Graduate student on the Wabanaki Center's year 3 outreach project.

Name: Feeley, Roger

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Kvaal Anderson, Mindi

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Leland, Matthew

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Schultz, Lisa

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Van Deventer, Joel

Worked for more than 160 Hours: No

Contribution to Project:

Participant in Amie Gellen's year 3 outreach project.

Name: Abdulrahman, Aymn

Worked for more than 160 Hours: Yes

Contribution to Project:

MixALCO project

Name: Aghazadeh, Madieh

Worked for more than 160 Hours: Yes

Contribution to Project:

MixALCO project

Name: Bhatia, Mohit

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo Conversion project

Name: Chen, Rongkai

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo Conversion project

Name: Goundie, Benjamin

Worked for more than 160 Hours: No

Contribution to Project:

DOE Thermo Conversion project

Name: Karunarathne, Ashoka

Worked for more than 160 Hours: Yes

Contribution to Project:

MixALCO project

Name: Mukkamala, Saikrishna

Worked for more than 160 Hours: Yes

Contribution to Project:

MixALCO project

Name: Ruiz, Pamela

Worked for more than 160 Hours: Yes

Contribution to Project:

Visiting student on DOE Thermo Conversion project

Name: Wright, Joshua

Worked for more than 160 Hours: No

Contribution to Project:

Physics student collaborating on DOE Thermo Conversion project

Name: Brevin, Kate

Worked for more than 160 Hours: No

Contribution to Project:

School of Forest Resources graduate research assistant

Name: Pekol, Joseph

Worked for more than 160 Hours: No

Contribution to Project:

School of Forest Resources graduate research assistant

Name: Russell, Matthew

Worked for more than 160 Hours: No

Contribution to Project:

School of Forest Resources graduate research assistant

Name: Nelson, Richard

Worked for more than 160 Hours: Yes

Contribution to Project:

Chemical & Biological Engineering graduate research assistant

Undergraduate Student

Name: Gramlich, William

Worked for more than 160 Hours: No

Contribution to Project:

Research Topic: Effects on adhesion of WPC surface treatment by flame, chromic acid, ammonical hydrogen peroxide and water.

Name: Montgomery, Dylan

Worked for more than 160 Hours: Yes

Contribution to Project:

Research topic: Study of chemical methodologies for removing lignin from hemicelluloses. Dylan works for Ray Fort and Barbara Cole in Chemistry

Name: Contractor, Kersi

Worked for more than 160 Hours: Yes

Contribution to Project:

Works with theme 1, support with Jeff Benajmin in research and data collection

Name: D'Alessandro, Nikki

Worked for more than 160 Hours: Yes

Contribution to Project:

associated with core faculty Jonathan Rubin, research economics

Name: Duplin, Jesse

Worked for more than 160 Hours: Yes

Contribution to Project:

works with Associate FBRI Faculty, Jeff Benjamin, theme 1, stakeholders

Name: Enman, Sarah

Worked for more than 160 Hours: Yes

Contribution to Project:

to work with core FBRI faculty, Darrell Donahue, to create Near-IR image database of liquid extracts and dry wood products

Name: Fields, Matthew

Worked for more than 160 Hours: Yes

Contribution to Project:

worked with Ray Fort and Barbara Cole of software database creation

Name: O'Brien, Tim

Worked for more than 160 Hours: Yes

Contribution to Project:

works with Associate FBRI Faculty, Jeff Benjamin, theme 1, stakeholders

Name: Schwartz, Tom

Worked for more than 160 Hours: Yes

Contribution to Project:

works with core FBRI faculty, Adriaan van Heiningen to work on simplification of the quantification of lignin carbohydrate complexes in hardwood and softwood pulp

Name: Turcotte, Amanda

Worked for more than 160 Hours: Yes

Contribution to Project:

working with core FBRI Faculty, Jody Jellison for fungal culturing and lab support

Name: St. Peter, Amy

Worked for more than 160 Hours: Yes

Contribution to Project:

Amy to work with core FBRI faculty, Darrell Donahue to create a Near-IR image database of liquid extracts and dry wood products

Name: Trudel, Julie

Worked for more than 160 Hours: Yes

Contribution to Project:

the student will investigate changes in water quality parameters in a local lake (Cross Lake) during winter. The student will measure dissolved oxygen, temperature and phosphorus through the ice several times during the season in order to draw

conclusions about winter stress to fish population in a lake.

Working with Kim Borges-Therien, Assoc Professor of Environmental Studies at UMaine, Fort Kent

Name: Wise, James

Worked for more than 160 Hours: Yes

Contribution to Project:

helping in toxicological studies

Working with John Pierce Wise, Professor of Toxicology & Molecular Epidemiology at the University of Southern Maine

Name: Okeny, Mark

Worked for more than 160 Hours: Yes

Contribution to Project:

Mark is an undergraduate at the University of Southern Maine with a strong interest in biology

Name: Baldwin, Tionna

Worked for more than 160 Hours: Yes

Contribution to Project:

Participated in summer program 'Orono High School - University of Maine Research Experience'. Research program focused on Sustainable Forst Bioproducts. Mentor was David Neivandt. Undergraduate student at UMaine in chemical engineering.

Name: Hamilton, Abigail

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Area: Identification of Forest Bioproducts Process components through near-infrared spectroscopy. Works with Darrell Donahue

Name: Walz, Benjamin

Worked for more than 160 Hours: Yes

Contribution to Project:

Working with Dr Stephen Shaler on Volatile Organic Compound (VOC) testing using extracted and non-extracted strands will be made.

Name: Walsh, Brenna

Worked for more than 160 Hours: Yes

Contribution to Project:

mentor Dr. Brian Frederick working in the lab at LASST on biothermal conversion

Name: Moberg, Daniel

Worked for more than 160 Hours: Yes

Contribution to Project:

mentor Dr. Brian Frederick working in the lab at LASST on biothermal conversion

Name: Blodgett, Matthew

Worked for more than 160 Hours: Yes

Contribution to Project:

Supervisor Douglas Bousfield nano-technology thrust leader

Name: Lilly, Jonathan

Worked for more than 160 Hours: Yes

Contribution to Project:

Supervisor Douglas Bousfield nano-technology thrust leader

Name: Hamilton, Ian

Worked for more than 160 Hours: Yes

Contribution to Project:

Supervisor Douglas Bousfield nano-technology thrust leader

Name: Kierstad, Tara

Worked for more than 160 Hours: Yes

Contribution to Project:

working with Jessica Leahy doing data entry on a mail survey of landowners that includes measuring biomass harvest risk perceptions and willingness to engage in supplying forest biomass

Name: Lockhart, Ryan

Worked for more than 160 Hours: Yes

Contribution to Project:

working with Jessica Leahy doing data entry on a mail survey of landowners that includes measuring biomass harvest risk perceptions and willingness to engage in supplying forest biomass

Name: Montgomery, Zachary

Worked for more than 160 Hours: Yes

Contribution to Project:

working with Jessica Leahy doing data entry on a mail survey of landowners that includes measuring biomass harvest risk perceptions and willingness to engage in supplying forest biomass

Name: Therriault, Charles

Worked for more than 160 Hours: Yes

Contribution to Project:

working with Jessica Leahy doing data entry on a mail survey of landowners that includes measuring biomass harvest risk perceptions and willingness to engage in supplying forest biomass

Name: Jones, Benjamin

Worked for more than 160 Hours: Yes

Contribution to Project:

working with Jeff Benjamin. Working in biomass harvesting equipment. Duties include compiling a database of equipment commercially available and assess applicability to harvesting small stems

Name: Wetmore, Amber

Worked for more than 160 Hours: Yes

Contribution to Project:

Under graduate student works with Nancy Kravit in enzymes research

Name: Suja, Hamida

Worked for more than 160 Hours: Yes

Contribution to Project:

Undergraduate student on Hong Xie's outreach project.

Name: MacDonald, Katy

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Boser, Brittany

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Boyd, Carl

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Buchsmaum, Emily

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Cadwallader, Nora
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Curtis, Nathan
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Davison, Anne
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Dawes, Ryan
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: DeMaio, Sophia
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Dhungel, Shashi
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Doing, Monica
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Ecker, James
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Edwards, Matthew
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Fisher, Meaghann
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Galle, Jeffrey
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Gosz, Nicholas
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Hafford, Kerry

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Hicks, Jacob

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Hoskins, Ashley

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: MacNeil, Jamie

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Manley, Evan

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Muzzy, Sara

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Neang, Chanrasmey

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Polling, Elisabeth

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Ramos, Jenna

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Reider, Danielle

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Wheeler, Lauren

Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Kendall, Stacey

Worked for more than 160 Hours: No
Contribution to Project:

Undergraduate student in secondary education and mathematics participated in Amie Gellen's year 3 outreach project.

Name: Janoch, Drew

Worked for more than 160 Hours: No

Contribution to Project:

University of Maine at Fort Kent student on the Habitat Planning outreach project.

Name: Barron, Kathleen

Worked for more than 160 Hours: No

Contribution to Project:

Eastern Maine Community College student participated in Amie Gellen's year 3 outreach project.

Name: Brown, Timothy

Worked for more than 160 Hours: No

Contribution to Project:

University of Maine student participated in Amie Gellen's year 3 outreach project.

Name: Drew, Charles

Worked for more than 160 Hours: No

Contribution to Project:

University of Maine student participated in the College of Engineering's 4-H/Girl Scouts outreach project.

Name: Gelin, Gesie

Worked for more than 160 Hours: No

Contribution to Project:

Eastern Maine Community College student participated in Amie Gellen's year 3 outreach project.

Name: Juntura, Jamie

Worked for more than 160 Hours: No

Contribution to Project:

Mathematics & Statistics student participated in Tod Shockey's outreach project.

Name: Meirmo, Nicole

Worked for more than 160 Hours: No

Contribution to Project:

Eastern Maine Community College student participated in Amie Gellen's year 3 outreach project.

Name: Morrill, Andrea

Worked for more than 160 Hours: No

Contribution to Project:

Mathematics & Statistics student participated in Tod Shockey's outreach project.

Name: Pederson, Sherrie

Worked for more than 160 Hours: No

Contribution to Project:

Eastern Maine Community College student participated in Amie Gellen's year 3 outreach project.

Name: Phillips, Sherry

Worked for more than 160 Hours: No

Contribution to Project:

Eastern Maine Community College student participated in Amie Gellen's year 3 outreach project.

Name: Rideout, Rhonda

Worked for more than 160 Hours: No

Contribution to Project:

Eastern Maine Community College student participated in Amie Gellen's year 3 outreach project.

Name: Todd, Jeremy

Worked for more than 160 Hours: No

Contribution to Project:

University of Maine student participated in Amie Gellen's year 3 outreach project.

Name: Williams, Jacob

Worked for more than 160 Hours: No

Contribution to Project:

Mathematics & Statistics student participated in Tod Shockey's outreach project.

Name: Braun, Matthew

Worked for more than 160 Hours: No

Contribution to Project:

Undergraduate student on John Wise's Year 3 Outreach project.

Name: Wallick, Katherine

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo

Name: Beote, Brendon

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo Conversion project

Name: Bousfield, Justin

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Case, Paige

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo Conversion project

Name: Hessler, James

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo Conversion project

Name: McGuire, Timothy

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo Conversion project

Name: Foley, Amy

Worked for more than 160 Hours: No

Contribution to Project:

MixALCO project

Name: Holyoke, Paul

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo

Name: Lukas, Jarrett

Worked for more than 160 Hours: No

Contribution to Project:

FBRI undergraduate research intern

Name: Tokas, Nikolas

Worked for more than 160 Hours: No

Contribution to Project:

Chemical & Biological Engineering undergraduate research assistant

Technician, Programmer

Name: Lawoko, Martin

Worked for more than 160 Hours: Yes

Contribution to Project:

To study the surface and adhesion properties of extruded wood plastic composites (WPCs) and to improve their bondability through chemical, physical, energetic and mechanical modification. manager of Dr. van Heiningen lab area

Name: Nash, Erik

Worked for more than 160 Hours: Yes

Contribution to Project:

Erik works with Robert Wagner, core faculty, Forest thinning

Name: Swain, Tanya

Worked for more than 160 Hours: Yes

Contribution to Project:

She is an outreach partner (Co-PI) working with Matthew McCourt and Stephen Engle. Co-PI on outreach grant year 1 She serves as executive director of the westernmountains alliance

The aim of this outreach project is to provide an educational experience for undergraduate students to directly contribute to technology-enable, community-based research focused on 500,000 forestland in Western Maine.

Name: Kwon, Heok

Worked for more than 160 Hours: Yes

Contribution to Project:

support for pulp and paper process development center theme 2 support for pulp and paper process development center theme 2 under Dr Adriaan van Heiningen

Name: Luu, Wing

Worked for more than 160 Hours: Yes

Contribution to Project:

support for pulp and paper process development center theme 2 under Dr Adriaan van Heiningen

Name: Zhang, Dongcheng

Worked for more than 160 Hours: Yes

Contribution to Project:

support for pulp and paper process development center theme 2 under Dr Adriaan van Heiningen

Name: Johnson, Donna

Worked for more than 160 Hours: Yes

Contribution to Project:

support for pulp and paper process development center theme 3 under Dr Adriaan van Heiningen

Name: Hutto, Dwane

Worked for more than 160 Hours: Yes

Contribution to Project:

support for pulp and paper process development center theme 3 under Dr Adriaan van Heiningen

Name: Hubbard, Jennifer

Worked for more than 160 Hours: Yes

Contribution to Project:

Temporary research assistant in Theme I, Promote Forest Health for a Stable BioEconomy. Helping with stakeholder survey and analysis.

Name: Dickerson, Catherine

Worked for more than 160 Hours: Yes

Contribution to Project:

Research area: Provides research support to Theme I interdisciplinary team of economists, engineers, and forest ecologists to examine the market potential of cellulosic biofuels. Faculty advisor: Jonathan Rubin

Name: Crouse, Justin

Worked for more than 160 Hours: Yes

Contribution to Project:

Research technician - duties include supporting all equipment, supervising student use of equipment; works with faculty to develop standard operating procedure manuals, working with outside client in research and experiments

Name: Maloney, Patricia

Worked for more than 160 Hours: Yes

Contribution to Project:

State Coordinator Project Learning Tree for outreach educational grant partner

Name: Carr, Tish

Worked for more than 160 Hours: Yes

Contribution to Project:

Outreach partner, Education Coordinator for Maine Association of Conservation Districts. Awarded outreach grant for reaching more Maine High School through Envirothon to promote environmental awareness and hands-on

Name: Gellen, Amie

Worked for more than 160 Hours: Yes

Contribution to Project:

Outreach grant partner. Amie is part of the University of Maine's Center for Science and Mathematics Education Research. Working to expand year 1 project with summer conference and summer academy collaborative with area science teachers.

Name: Hill, Nathan

Worked for more than 160 Hours: Yes

Contribution to Project:

part of thermal conversion thrust

Name: Huber, Sherry

Worked for more than 160 Hours: Yes

Contribution to Project:

Director of maine tree foundation. Working with K-12 teachers to promote science

Name: Kelly, Renee

Worked for more than 160 Hours: Yes

Contribution to Project:

Director of the University Student Innovation Center. hold seminars and workshop for Green Campaign

Name: Kohlmetz, Dale

Worked for more than 160 Hours: Yes

Contribution to Project:

works with Theme 1, Jessica Leahy, Jeff Benjamin and Robert Lilieholm. He assists in entering data collected from stakeholders, landowners and mill operators

Name: Neuman, Deborah

Worked for more than 160 Hours: Yes

Contribution to Project:

Assist with Student Innovation Center

Name: Schmidt, Katherine

Worked for more than 160 Hours: Yes

Contribution to Project:

outreach consultant with Nancy Kravit on search for new enzymes that can break apart wood structure into its major components.

Name: Simons, Erin

Worked for more than 160 Hours: Yes

Contribution to Project:

Assistant Scientist (Spatial Analysis of Forest Wildlife Habitat)

Name: Cline, Amos

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Perry, Thomas

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Raymond, Del

Worked for more than 160 Hours: No

Contribution to Project:

Consultant

Name: Detrick, Liv

Worked for more than 160 Hours: Yes

Contribution to Project:

Institute for Broadening Participation outreach project.

Name: MacKay, Donal

Worked for more than 160 Hours: Yes

Contribution to Project:

Forest Research LLC outreach project.

Name: MacKay, Susan

Worked for more than 160 Hours: Yes

Contribution to Project:

Forest Research LLC outreach project.

Name: Saywell, Dana

Worked for more than 160 Hours: Yes

Contribution to Project:

Institute for Broadening Participation outreach project.

Name: Stenstrup, Alan

Worked for more than 160 Hours: No

Contribution to Project:

Maine TREE Foundation outreach project.

Name: Vaillancourt, Doreen

Worked for more than 160 Hours: No

Contribution to Project:

College of Engineering 4-H/Girl Scouts outreach project.

Name: Valaitis, Susie

Worked for more than 160 Hours: Yes

Contribution to Project:

Institute for Broadening Participation outreach project.

Name: Young, Steve

Worked for more than 160 Hours: Yes

Contribution to Project:

Habitat Planning outreach project.

Name: Blanchette, Vicky

Worked for more than 160 Hours: Yes

Contribution to Project:

FBRI Communications Specialist

Name: Bryan, Robert

Worked for more than 160 Hours: Yes

Contribution to Project:

FBRI Theme I Independent Contractor

Name: Drake, Thomas

Worked for more than 160 Hours: Yes

Contribution to Project:

Consultant

Name: Eckert, Wendy

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Edgar, Russell

Worked for more than 160 Hours: Yes

Contribution to Project:

Consultant

Name: Ellis, Lucas

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Gagnon, Gerard

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Gosz, James

Worked for more than 160 Hours: Yes

Contribution to Project:

Independent Contractor

Name: Higgins, Scott

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Parag, Dhake

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Spender, Jonathan

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Zou, Haixuan

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Park, Seongkyung

Worked for more than 160 Hours: Yes

Contribution to Project:

Process Development Center staff

Other Participant

Name: Growe, Cynthia

Worked for more than 160 Hours: Yes

Contribution to Project:

Main support staff of FBRI

Name: Lavery, Roberta

Worked for more than 160 Hours: No

Contribution to Project:

Name: Wolters, Megan

Worked for more than 160 Hours: Yes

Contribution to Project:

Megan assisted Sandra Neily with research and web work in years 1 and 2. In year 3 she was hired as a temporary administrative assistant in the EPSCoR office.

Name: Neily, Sandra

Worked for more than 160 Hours: No

Contribution to Project:

Communications & outreach coordinator, maintains relationships with faculty, produces brochures, and printed materials

Name: Rose, Judith

Worked for more than 160 Hours: Yes

Contribution to Project:

Assist in the EPSCoR office

Name: Dunham, Jennifer

Worked for more than 160 Hours: Yes

Contribution to Project:

Administrative Assistant in the NSF EPSCoR office, duties include organizing meetings, reimbursements.

Name: Agri, Julie

Worked for more than 160 Hours: Yes

Contribution to Project:

Admin Asst to Sherry Huber in the Maine Tree foundation outreach EPSCoR educational grant award

Name: Jacobs, Abbe

Worked for more than 160 Hours: Yes

Contribution to Project:

offer administrative support for the Student Innovation Center Think Green Campaign. Outreach grant participants

Name: Allen, Summer

Worked for more than 160 Hours: Yes

Contribution to Project:

Administrative assistant for the Center for Research on Sustainable Forests. Administers outreach project.

Name: Almeida, Wendy

Worked for more than 160 Hours: No

Contribution to Project:

Maine 4-H parent served as an advisor on an outreach project.

Name: Almeida, Delfino

Worked for more than 160 Hours: No

Contribution to Project:

Maine 4-H parent served as an advisor on an outreach project.

Name: Braley, James

Worked for more than 160 Hours: No

Contribution to Project:

Maine 4-H parent served as an advisor on an outreach project.

Name: Dyer, Karen

Worked for more than 160 Hours: No

Contribution to Project:

Maine 4-H parent served as an advisor on an outreach project.

Name: Fitzpatrick, Christy

Worked for more than 160 Hours: No

Contribution to Project:

Houlton High School teacher acted as chaperone for 4-H outreach project.

Name: Kern, Penny

Worked for more than 160 Hours: No

Contribution to Project:

Parent served as a chaperone on Maine 4-H outreach project.

Name: LeBlanc, Sarah

Worked for more than 160 Hours: No

Contribution to Project:

UMaine Cooperative Extension staff member acted as chaperone on Maine 4-H outreach project.

Name: Merrill, Reva

Worked for more than 160 Hours: No

Contribution to Project:

UMaine Cooperative Extension staff member acted as chaperon on Maine 4-H outreach project.

Name: Smith, Roxanne

Worked for more than 160 Hours: No

Contribution to Project:

Parent acted as chaperone on Maine 4-H outreach project.

Name: Barclay, Wendy

Worked for more than 160 Hours: No

Contribution to Project:

Temporary Administrative Assistant for EPSCoR.

Name: Beis, Sedat

Worked for more than 160 Hours: Yes

Contribution to Project:

DOE Thermo Conversion project

Name: Bennett, Proserfina

Worked for more than 160 Hours: Yes

Contribution to Project:

Process Development Center staff

Name: Hill, Jonathan**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Process Development Center staff

Name: Pendse, Sheila**Worked for more than 160 Hours:** Yes**Contribution to Project:**

DARPA project and earmark

Name: Slusarz, Lynne**Worked for more than 160 Hours:** Yes**Contribution to Project:**

FBRI administrative assistant

Research Experience for Undergraduates**Name:** Lena, Ryan**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It! Building the Next Generation of Sustainable Energy.

Faculty advisor - Douglas Bousfield. Area of interest: Imaging of Nanofibrils by Atomic Force Microscopy

Years of schooling completed: Sophomore**Home Institution:** Other than Research Site**Home Institution if Other:** Tufts University**Home Institution Highest Degree Granted(in fields supported by NSF):** Bachelor's Degree**Fiscal year(s) REU Participant supported:** 2007**REU Funding:** REU site award**Name:** Vacanti, Nathaniel**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It! Building the Next Generation of Sustainable Energy.

Faculty advisor - Stephen Shaler. Area of interest: Life Cycle Inventory on the Production of OSB in the Northeast United States

Years of schooling completed: Junior**Home Institution:** Other than Research Site**Home Institution if Other:** University of Connecticut**Home Institution Highest Degree Granted(in fields supported by NSF):** Bachelor's Degree**Fiscal year(s) REU Participant supported:** 2007**REU Funding:** REU site award**Name:** Kavkewitz, Jacob**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It! Building the Next Generation of Sustainable Energy.

Faculty advisor - Jonathan Rubin. Area of interest: Biomass Availability in Maine

Years of schooling completed: Junior

Home Institution: Other than Research Site
Home Institution if Other: University of Tennessee
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: O'Farrell, Andru

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It!
 Building the Next Generation of Sustainable Energy.
 Faculty advisor - Raymond Fort, Jr and Barbara Cole. Area of interest: Xylanase Enzyme

Years of schooling completed: Junior
Home Institution: Same as Research Site
Home Institution if Other: University of Colorado
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: Oetter, Brittany

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It!
 Building the Next Generation of Sustainable Energy.
 Faculty advisor - Sara Walton. Area of interest: Acetic Acid Inhibition of E. coli K011 during
 Fermentation.

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: University of Colorado, Bolder
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: Andrews, Gracson

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It! Building the Next Generation of
 Sustainable Energy.
 Faculty advisor - Weiping Ban. Area of interest: Pre Extraction Research

Years of schooling completed: Sophomore
Home Institution: Other than Research Site
Home Institution if Other: University of Colorado, Bolder
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: Patel, Nimish

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It! Building the Next Generation of
 Sustainable Energy.
 Faculty advisor - Michael Mason. Area of interest: The Investigation of Value Added Applications of Paper Products in Areas of
 Bio-separations and Bio-detections.

Years of schooling completed: Sophomore
Home Institution: Other than Research Site
Home Institution if Other: University of Connecticut
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: Canney, Alexander

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It! Building the Next Generation of Sustainable Energy.

Faculty advisor - Clayton Wheeler, Brian Frederick. Area of interest: Role of Pore Size on Thermalconversion and Catalytic Product Distribution

Years of schooling completed: Sophomore
Home Institution: Other than Research Site
Home Institution if Other: Pensacola Christian College
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: Gramlich, Stewart

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Experience for Undergraduates (REU) program sponsored by NSF called Explore It! Building the Next Generation of Sustainable Energy.

Faculty advisor - Jody Jellison. Area of interest: Optimization of Soil Block Assay Techniques and the Analysis of the Effect of Fenton Chemistry on Cellulose Crystallinity.

Years of schooling completed: Junior
Home Institution: Same as Research Site
Home Institution if Other:
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: Rush, Kelsey

Worked for more than 160 Hours: Yes

Contribution to Project:

Topic of research: Bringing it to Middle Schools - Why is it important to cultivate science and technology early. Get students hooked on science. Kelsey worked with 2 RET teachers on this project

Years of schooling completed: Junior
Home Institution: Same as Research Site
Home Institution if Other:
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2007
REU Funding: REU site award

Name: Barclay, Christian

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior

Home Institution: Other than Research Site
Home Institution if Other: Miami University
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Capecelatro, Jesse

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: SUNY, Binghamton
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Grundy, James

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: Harvard University
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Jacobson, Peter

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: West Virginia University
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Khamaturova, Tatyana

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: University of Texas
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Knox, Andrew

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: Whitman College
Home Institution Highest Degree Granted(in fields supported by NSF): Bachelor's Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Rhine, Melody

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: Emory University
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Scofield, Marcienne

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Same as Research Site
Home Institution if Other:
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Stone, Ian

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: Louisiana State University
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Andrusyk, Lucas

Worked for more than 160 Hours: Yes

Contribution to Project:

Years of schooling completed: Junior
Home Institution: Other than Research Site
Home Institution if Other: Iowa State Unversity
Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree
Fiscal year(s) REU Participant supported: 2008
REU Funding: REU site award

Name: Bowman, Rachel

Worked for more than 160 Hours: Yes

Contribution to Project:

REU participant from MIT

Years of schooling completed: Sophomore

Home Institution: Other than Research Site

Home Institution if Other: Massachusetts Institute for Technology

Home Institution Highest Degree Granted(in fields supported by NSF): Doctoral Degree

Fiscal year(s) REU Participant supported: 2010

REU Funding: No Info

Organizational Partners

University of Southern Maine

University of Maine Farmington

University of Maine Fort Kent

Colby College

Bates College

Bowdoin College

Maine Mathematics and Science Alliance

STEM Education partner

Institute for Broadening Participation

STEM Education partner

Other Collaborators or Contacts

Dr. Gregory Norris, President, Sylvatica, Adjunct Faculty, Harvard University

Russell Read, Chief Investment Officer, California Public Employees' Retirement System (CalPERS)

Dr. Richard Siegel, Professor, materials Science & Engineering Director, Rensseler Nanotechnology Center, RPI

Nancy Kravit, President, Tethys Research, LLC.

Dr. Arvind Lali, Mumbai University Insistute of Chemicl Technology, Mumbai, India

Corinth Wood Products, Bangor, Maine

Activities and Findings

Research and Education Activities:

Please see attached final report file.

Findings:

Please see attached final report file.

Training and Development:

Please see attached final report file.

Outreach Activities:

Please see attached final report file.

Journal Publications

Van Heiningen A., "Converting a Kraft Pulp Mill into an Integrated Forest Biorefinery.", Pulp and Paper Canada, 107(6), 38-43(2006)., p. 38-43, vol. 107(6), (2006). Published,

X. Chen and A. van Heiningen, "Direct Causticization Kinetics of Kraft Black Liquor by Titanates during Low Temperature Gasification", Accepted for publication in the January/February 2007 issue of JPPS, p. , vol. , (2006). Accepted,

Saunders, M.R. and R.G. Wagner., "IN PRESS. Allometric relationships for tree species of central Maine: Height-diameter models with random coefficients and site variables.", Annals of Forest Science., p. , vol. , (2008). Accepted,

Wagner, R.G., and A.P. Robinson., "Critical period of interspecific competition for four northern conifers: Ten-year growth and associated vegetation dynamics. Canadian Journal of Forest Research 36: 2474-2485.", Canadian Journal of Forest Research, p. 3474-2485, vol. 36, (2006). Published,

Little, K.M., I. Willoughby, R.G. Wagner, P. Adams, H. Frochot, J. Gava, S. Gous, R.A. Lautenschlager, G. Årlander, K.V. Sankaran and R.P. Wei., "Towards reduced herbicide use in forest vegetation management.", Southern African Forestry Journal, p. 63-80, vol. 207, (2006). Published,

Etheridge, D.A., D.A. MacLean, R.G. Wagner, and J.S. Wilson, "Effects of intensive forest management on stand and landscape characteristics in northern New Brunswick, Canada (1945?2027). Landscape Ecology 21: 509?524", Landscape Ecology, p. 509-524, vol. 21, (2006). Published,

Wagner, R.G., K.M. Little, B. Richardson, and K. McNabb, "The role of vegetation management for enhancing productivity of the world's forests", Forestry, p. 57-79, vol. 79(1), (2006). Published,

Gramlich, W. M. ; Gardner, D. J. ; Neivandt, D. J., "Surface Treatments of Wood Plastic Composites (WPCs) to Improve Adhesion", Journal of Adhesion Science and Technology, p. 1873-1887, vol. 20, (2006). Published,

Gloria S. Oporto, Douglas J. Gardner, George Bernhardt, David J. Neivandt, "Characterizing the mechanism of improved adhesion on modified wood plastic composite (WPC) surfaces.", Journal of Adhesion Science and Technology, p. 1873, vol. 20, (2006). Published,

R. Mills, D Gsdner, A. van Heiningen, "Impact of Hygrothermal Aging on the Dynamic Mechanical Properties of Sheet Molding Compound", Journal Materials Science, p. 9822, vol. 42, (2007). Published,

M.Q. Snyder, SA Trebukhove, B Ravdel, MC Wheeler, J DiCarlo, CP Tripp, WJ Desisto, "Synthesis and characterization of atomic layer deposited titanium nitride thin films on lithium titanate spinel powder as a lithium-ion battery anode", Journal of Power Sources, p. 379, vol. 165, (2007). Published,

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URL(s):

<http://forestbioproducts.umaine.edu>;
<http://www.umaine.edu/epscor>; <http://www.researchfunding.umesp.maine.edu/FundOpCalSearch.asp>;
<http://www.maineinnovation.com>
<http://www.umaine.edu/vme/>

Description:

Website of the project's Forest Bioproducts Research Initiative; Maine EPSCoR website; Funding Ops website; State website

Other Specific Products

Product Type:

Data or databases

Product Description:

A database of University of Maine faculty and professional staff has been created to allow for greater information-sharing, collaboration, and public access to resources at the University. The database will include dozens of informational parameters about faculty and staff, and will allow anyone to i.e. find who is engaged in what research on campus, who has what expertise, who has published what, etc.

Sharing Information:

The database is currently available to college administrative units, and will proceed into more publicly available formats in the coming year.

Product Type:

Data or databases

Product Description:

A comprehensive Funding Opportunities database has been created that lists upcoming grant opportunities and deadlines.

Sharing Information:

This database is on-line and available to anyone in the state to search on.

Product Type:

Software (or netware)

Product Description:

Society of American Foresters, Forest Bio-products

Sharing Information:

This is shared on Wiki Encyclopedia

Contributions

Contributions within Discipline:

Please see attached final report file.

Contributions to Other Disciplines:

Please see attached final report file.

Contributions to Human Resource Development:

Please see attached final report file.

Contributions to Resources for Research and Education:

Please see attached final report file.

Contributions Beyond Science and Engineering:

Please see attached final report file.

Conference Proceedings

Categories for which nothing is reported:

Any Conference



Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

FINAL REPORT

For NSF EPSCoR award # EPS 05-54545

**Covering the time period of:
April 1, 2006 to September 30, 2009**

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Maine NSF EPSCOR EPS-05-54545
“Investing in Maine Research Infrastructure – Sustainable Forest Bioproducts”

Table of Contents

| | Page: |
|--|--------------|
| A) Final Report Executive Summary:..... | 4 |
| 1) General Information & RII Vision..... | 4 |
| 2) Overview of Project Efforts | 4 |
| a. Research..... | 6 |
| b. Diversity..... | 6 |
| c. Workforce Development..... | 6 |
| d. Cyberinfrastructure..... | 6 |
| e. Outreach and Communication..... | 6 |
| f. Evaluation and Assessment..... | 7 |
| g. Sustainability..... | 7 |
| h. RII Project Management & Structure..... | 8 |
| 3) Overview of Key Accomplishments..... | 8 |
| a. Project Highlights..... | 8 |
| b. Intellectual Merit..... | 8 |
| c. Broader Impacts..... | 9 |
| 4) Actions Taken in Response to Recommendations..... | 10 |
| B) Final Report Detail..... | 10 |
| 1) RII Participants..... | 10 |
| 2) RII Project Description..... | 10 |
| a. Research Accomplishments and Plans..... | 10 |
| b. Diversity and Broadening Participation..... | 15 |
| c. Workforce Development..... | 17 |
| d. Cyberinfrastructure..... | 17 |
| e. Outreach and Communication..... | 18 |
| f. Evaluation and Assessment..... | 19 |
| g. Sustainability..... | 26 |
| h. Management Structure..... | 27 |
| i. Jurisdictional and Other Support..... | 27 |
| j. Unobligated Funds..... | 27 |
| 3) Jurisdiction Specific Terms and Conditions..... | 28 |
| 4) Experimental/Computational Facilities..... | 28 |
| 5) Publications and Patents..... | 29 |
| 6) Honors and Awards..... | 28 |
| C) Research and Education Highlights..... | 29 |
| D) Maine EPSCoR Detail Tables: | |
| Appendix 1: State EPSCoR Committee Members | 33 |
| Appendix 2: Project Goals and Objectives..... | 34 |
| Appendix 3: Project Personnel..... | 37 |
| Appendix 4: Project Personnel Diversity..... | 53 |
| Appendix 5: Grant Proposals Submitted..... | 54 |
| Appendix 6: FBRI Equipment Purchased..... | 65 |

Appendix 7: FBRI On-site Workshops, Seminars, Presentations.....76
Appendix 8: FBRI Conference Presentations.....80
Appendix 9: FBRI Member Recognitions & Honors.....101
Appendix 10: FBRI Advisory Board.....103
Appendix 11: AAAS Assessment.....105

Maine NSF EPSCOR EPS-05-54545
“Investing in Maine Research Infrastructure – Sustainable Forest Bioproducts”

FINAL REPORT for the period April 1, 2006 to September 30, 2009

A) EXECUTIVE SUMMARY

1) General Information & RII vision:

This project has developed a highly successful and sustainable program through gains in the areas of research, education, workforce development, and outreach infrastructure. The resulting organization has, and will continue to, solidify and strengthen Maine’s R&D capacity and competitiveness in the area of forest bioproducts research. The project’s specific research focus addressed the scientific underpinnings, system behavior, and policy implications for the production of forest-based bioproducts that meet societal needs for materials, chemicals, and fuels in an economically and ecologically sustainable manner. RII efforts have resulted in the successful formation of the Forest Bioproducts Research Initiative (FBRI) at the University of Maine, which is anticipated to achieve Institute status by the end of FY10. The plan for formal Institute status with an accompanying base budget has been forwarded to the Chancellor for a system-level review and submission for approval by the Board of Trustees.

A six-month no-cost extension was granted for this project. The extension was used to complete: 1) educational outreach partner activities; 2) final equipment upgrades to facilitate the transfer of technology to industry partners; 3) further development of the Maine STEM Collaborative project; 4) and the upgrade of the Maine EPSCoR website.

2) Overview of Project Efforts:

a. Research:

The FBRI continues to address the interplay of a sustainable production of biomass, the science & engineering associated with new technologies required for bioproducts, and the social aspects of bioproducts production, marketing, and industrial ecology. Through its theme & thrust clusters, FBRI researchers work on a broad spectrum of forest bioproducts including: 1) ethanol, 2) butanol, 3) green synthetic diesel/jetfuel, 4) green synthetic gasoline, 5) green heating oil, 6) bio-crude, 7) acetic acid, 8) levulinic acid, 9) oligomeric hemi-celluloses, 10) functional substitutes for dry strength additives used in papermaking or additives used in sheet molding compounds, 11) wood pellets, 12) wood-plastic composites, 13) cellulosic nano-composites, 14) lignin-based carbon fibers, and 15) improved oriented strand building materials.

The major goal for the FBRI is to advance the science and engineering capabilities of the State of Maine infrastructure to address the national needs of increased capacity for renewable bioproducts and biofuels. FBRI’s efforts are focused on utilization of wood biomass from forest operations and the integration of these processes with existing uses of these resources (e.g., pulp, paper, oriented strand board, and wood composites). FBRI has brought together 32 core faculty from forestry, wood science, wood composites, chemical and biological engineering, pulp and paper technology, chemistry, physics, biology, resource economics, public policy, and business. These involve four of the five colleges on the UMaine campus, and three private undergraduate Maine colleges (Colby, Bates and Bowdoin).

All of the key new faculty hires that were originally envisioned are now in place. These three new positions include (1) Peter van Walsum, Bio-Processing (Chemical and Biological

Engineering Department), (2) Aaron Weiskettel, Biometrics (School of Forest Resources) and (3) Anthony Halog, Life Cycle Analysis and Industrial Ecology (School of Forest Resources). All of these individuals bring new scientific capabilities to the University and fill critical gaps in the ability to push the vision of FBRI. In addition, these new faculty are showing a strong dedication to an integrated approach to their research mission.

While the NSF portion of FBRI research was focused exclusively on the biological conversion of biomass components into new products, the FBRI infrastructure allowed for an analogous route of thermal conversion processes that presents additional opportunities for using mixed feedstock to generate a different set of bioproducts. A parallel DOE EPSCoR Implementation Award effort has been focused on thermal conversion of woody biomass through pyrolysis oil upgrade, and another DOE award has been focused on an integrated biological and thermochemical conversion platform to produce mixed alcohols from forest and marine biomass.

The original concept of pre-pulping extraction of hemicelluloses from wood chips was fully developed under this NSF EPSCoR project with intellectual property protected through a patent application filed in December 2006. This UMaine technology was deployed at the Old Town Pulp Mill in December 2007. Successful mill extraction trials now are attracting significant national attention to the potential of wood extracts, as UMaine FBRI faculty and Old Town mill staff work together on the development of a satellite biorefinery to convert wood extracts from a pulp mill into liquid transportation fuels. Success of research on hemicelluloses extraction from wood strands has now opened up opportunities to integrate wood extraction with oriented strand lumber (OSL) manufacture involving Louisiana-Pacific OSL mill in Houlton, Maine with support from the Maine Technology Institute. The pre-OSL extraction technologies combined with the pre-pulping extraction significantly expand the wood-derived sugars that will become available as potential feedstocks for conversion into new bioproducts.

Beginning with the initial work on fermenting wood-derived sugars into ethanol, FBRI now has made advances in biological conversion of wood-derived sugars into precursors of bioplastics as well as jet fuels through strategic partnerships. Various research projects are now active in bioplastics and jet fuel production with collaborators from Massachusetts, New Hampshire, and California building on support from DOE, USDA, and DARPA.

Work on biomass conversion technologies was complemented by advances in methods for forecasting future forest composition and growth under various forest management, nutrient cycling, and climate change scenarios. Work on coupling LCA and GIS for land use impact and biodiversity assessment addressed the important triple dimensions of sustainability: *Environment, Economy, and Society*. A collaborative effort between the Maine Forest Service, the University of Maine, and the Trust to Conserve Northeast Forestlands was undertaken to develop woody biomass retention guidelines for Maine. A detailed report outlining environmental considerations with biomass harvesting specific to soil productivity, water quality, and forest biodiversity has been prepared in addition to site specific guidelines. This report and associated guidelines focus on the amount and type of woody biomass that should be retained in the forest after a harvest operation to protect soil productivity, water quality, and site-level biodiversity.

Broader issues of biomass harvesting and conversion to new bioproducts relate to social perceptions of forest biorefinery initiatives, stake holder attitudes, and interplay between forest ecosystems and forest communities. Maine Governor's task forces on Wood-to-Energy and Keeping Maine Forests have dealt with these issues at the state level and FBRI continues to play a key role in state-wide and regional/national public policy discourse.

b) Diversity:

Maine EPSCoR continues to develop strategies for improvement, including a targeted effort to engage the Native American population through the Wabanaki Center's Native Scholar Educational Outreach program. During the 3½ year project, of the total number of individuals directly supported by this project, an average of 37% were female and 3% were from underrepresented groups (see Appendix 4). Of indirectly supported participants, an average of 54% were female and 4% were from underrepresented groups. Diversity partnerships were continued throughout all years and included: the Wabanaki Center Native Student Educational Outreach Program; the National Girls Collaborative Project; Expanding Your Horizons program; the Institute for Broadening Participation; the Northeast Alliance for Graduate Education and the Professoriate; and UMaine's Center for Community Inclusion and Disability Studies.

c) Workforce Development:

Workforce development activities over the grant period resulted in 125 new positions created and supported, and included three new tenure-track faculty and five postdoctoral associate positions. Integrated research and education activities both year-round and in the summer included: 53 graduate student research internships; 86 undergraduate student internships; and 28 high school student internships. Technical assistance workshops on grant writing were supported all three years. Two new graduate courses were developed, and several existing courses incorporated new knowledge from FBRI research. All FBRI graduate students participated in on-site conferences and seminars, presented posters at all Maine EPSCoR State Conferences, took part in training workshops, and support was provided for 30 graduate students to attend national/international conferences. Travel scholarships were provided for 25 state researchers and students to attend conferences and workshops. Maine EPSCoR worked with the Maine STEM Collaborative to initiate a K-12 STEM Career Pathways program for the state.

d) Cyberinfrastructure (CI):

Maine EPSCoR formed a state CI Planning Committee that actively defined statewide needs and created a state strategic CI plan. Active partnerships were formed with other regional stakeholders such as NSF EPSCoR and NIH IDeA programs in Vermont, New Hampshire, Rhode Island, and Delaware, and with Canadian partners. Primary CI objectives included addressing basic connectivity issues for the state, enhancing access to UMaine's supercomputer abilities, and upgrading videoconferencing and distance learning capabilities. A regional NSF EPSCoR RII Track 2 proposal was submitted in January 2009 in a partnership consisting of ME, VT, NH, RI, DE EPSCoR, and a complementary NIH NCRR proposal was submitted in March 2009. Both were awarded and are underway.

e) Outreach and Communication

Outreach and communication activities for the academic and research community included: 1) research and education collaborations with over 24 academic, industry, government, and NGO partners; 2) FBRI sponsored 60 workshops and seminars for over 1,000 participants; 3) 29 FBRI faculty and graduate students presented papers/ posters on FBRI research at 284 regional/national/international conferences; 4) Maine EPSCoR State Conferences 2006, 2008, and 2009 for 558 participants, an EPSCoR/USDA SBIR workshop in 2007 for 175 participants, and a 2006 DEEPSCoR workshop for 50 participants; 5) 92 related scientific journal publications published by FBRI faculty.

Outreach and communication to the general public included several websites: 1) the comprehensive FBRI website that went live in December 2007; 2) the Maine EPSCoR website, which is undergoing major re-development; 3) a Maine STEM website; and 4) several websites showcasing curriculum developed around FBRI research. FBRI faculty and staff participated in dozens of local, state, and regional activities to disseminate information regarding the project. Maine EPSCoR invested in communications equipment and software and hired two New Media students to work on expanded communication activities such as film, digital photography, websites, and print media (newsletters, press releases, brochures, posters, etc.). Six videos were created showcasing Maine EPSCoR activities, and Maine EPSCoR created a presence on social networking sites (Facebook, YouTube, Twitter, etc.). FBRI and Maine EPSCoR exhibited at a dozen local, regional, and national programs and activities.

Outreach to the research and K-12 community included support of multiple outreach strategies to small businesses, K-12 teachers, university and college faculty, pre-service teachers, and students, reaching 6,108 individuals in supported STEM and research activities. Over the 3 ½ year project, 30 educational outreach and research seed funding projects received over \$700,000 (see section B.2.g.). The FBRI NSF REU/RET program also received support. (See section g.) Maine EPSCoR also expanded its statewide STEM leadership role as a partner in the Maine STEM Collaborative.

f) Evaluation and Assessment:

The evaluation and assessment plan for this project encompassed a multi-layered approach and feedback loops that included: 1) AAAS panel on-site assessments in October 2006, August 2007, and October 2008; 2) FBRI Advisory Board evaluation – full board met annually on-site in July 2007, 2008, and 2009, and executive committee met five times inbetween; 3) NSF Reverse Site Visit September 2007, and annual on-site visits by NSF EPSCoR Directors and Program Officers; 4) Maine EPSCoR RII management team oversight; 5) FBRI management team oversight; 6) FBRI theme and thrust leader management; and 7) MIEAB state EPSCoR committee oversight. The Maine EPSCoR and FBRI management teams regularly reviewed progress in achieving milestones. Recommendations from external reviews were incorporated into the management strategy for the remainder of the project.

g) Sustainability:

The FBRI engaged in multiple activities to ensure sustainability. These include:

- **Grants submitted:** during the project timeframe, 92 grant proposals were submitted (\$108M), and 54 awards were received for a total of \$23.8M. Several large-scale awards were secured that will provide on-going funding beyond the NSF EPSCoR project period.
- **Tech Center:** A recent award from the Maine Technology Asset Fund of \$4.8 million is making possible a new Technology Center with 40,000 sq. ft. high-bay space for taking pilot scale work and making it industrially relevant. This FBRI Tech Center has received a \$2 million in kind cost share from industry in the form of a rent-free lease.
- **Research structure:** The FBRI theme and thrust structure has successfully fostered multi-disciplinary research that would otherwise not have taken place, and provided a solid base for 32 core faculty to continue to work together and ensured the post-EPSCoR sustainability of the initiative.
- **Institute status:** At the July 2009 meeting, the FBRI Advisory board reviewed the plan to transition the FBRI into a formal UMaine research center with an institute status that includes on-going staff support and a base budget. The board members endorsed the plan to

the senior administration of the University, and signed on to continue as the founding members of the FBRI Advisory Board.

- **Seed funding:** a seed funding mechanism was utilized to link FBRI research activities to emerging science and small business opportunities, and 10 partner projects were supported.
- **Human Resource Development:** In support of the RII project's Objective #2 to enhance human resource infrastructure, 125 new positions were created (including 3 tenure-track faculty and 5 postdocs), and a total of 263 individuals were directly supported: 37 core faculty, 5 outreach faculty, 9 postdocs, 53 graduate students, 86 undergraduate students, 28 high school students, and 45 technicians/ professional/ administrative staff on the core project and at outreach partners. An additional 6,108 participants were indirectly supported through various outreach and collaborative activities and included: 377 conference & workshop participants, 377 faculty, 167 graduate student, 359 undergraduate students, 398 professional/administrative staff, 605 K-12 teachers/pre-service teachers, 2,354 middle school students, 456 high school students.
- **Leveraging NSF programs:** faculty participation in FBRI allowed the leveraging of an additional \$1.8M in new NSF funding, including the receipt of an NSF REU and RET award, and an NSF MRI award. All were coordinated with the NSF EPSCoR RII project efforts.

h) RII Project Management & Structure:

The FBRI has been under the oversight of NSF EPSCoR Project Director Dr. Michael Eckardt, and Associate Project Director Vicki Nemeth, as well as the Maine Innovation Economy Advisory Board, which serves as the state's EPSCoR governing committee. During the grant period, the FBRI was organized under two FBRI Co-Directors (Pendse and Shaler) and two Associate directors (Wagner and Bilodeau). The structure of the organization grew to three "use-inspired themes" and four "discovery-driven thrusts" with their corresponding leaders. The FBRI support staff now consists of a Project Manager, Administrative Assistant, two Research Scientists, and a part time Communications Coordinator. With the completion of this NSF EPSCoR project, the FBRI program will continue under the oversight of Dr. Michael Eckardt in his role as Vice President of Research. Funding and budgets have been put into place to ensure continuation with Prof. Hemant Pendse as the Institute Director, assisted by three Associate Directors (Wagner, Bilodeau, and Donahue), and the same support staff.

3) Overview of Key Accomplishments:

a. Project highlights:

- The NSF EPSCoR award allowed for the successful formation of the FBRI as a research collaborative, with 32 inter-disciplinary faculty working together towards a single vision, and a the pending conversion into a formal UMaine research institute with a base budget.
- The \$6.9M NSF EPSCoR investment leveraged over \$24M in new external FBRI funding, including a new \$4.8M FBRI Technology Center that will assist in the commercialization of research and innovations through pilot-scale technology validation.
- FBRI successfully formed an industry partnership to commercialize its research technology by building a biorefinery at an existing industry site.
- Human infrastructure development included 125 new positions; direct support of 263 individuals; and 167 students participating in research internships with FBRI faculty.
- Over \$700,000 in seed funding supported ten research partners for emerging projects, and 30 educational outreach partners for discovery-based learning activities (6,108 participants).

b. Intellectual Merit:

The science and engineering pursued by the FBRI researchers a strong integration of existing research interests and capabilities around a common theme, and critical gaps in the University's expertise were fully addressed. All of these efforts focused on the common goal of producing science that will assist in eventually realizing the forest-based biorefinery and boost the regional and national economy. A strength of the FBRI is in aggregating existing functional research programs at UMaine like Pulp and Paper, Engineered Wood Composites (AEWC), Surface Sciences, and the Cooperative Forest Research Unit (CFRU) towards new societal challenges. In addition, smaller, but well-functioning groups in Computational Chemistry and Biological Sciences are included to provide key areas of expertise. Strong integration of existing faculty assets is obvious in the high degree of coordination between the research in Themes 2 and 3 (Extraction and New Products). Likewise, the recognition that resource and societal issues will play a large role in the eventual success of a biorefinery is apparent in the focus provided by Human Dimensions thrust and Theme 1 (Forest Health) researchers.

c. Broader Impacts:

The activities noted above have enabled the FBRI to: broaden its impact on research and technology across the state; advance discovery and understanding while promoting teaching, training, and learning; broaden participation of underrepresented groups; enhance the state infrastructure for research and education through major equipment acquisitions, facilities renovations, and new collaborative partnerships; and provide benefits to society in the form of greater potential for new materials, chemicals, and fuels.

The FBRI research is particularly unique in its direct engagement with forest landowners and forest products industry stakeholders: many examples exist where science and engineering based on resource utilization have not realized success because of conflicts between stakeholder expectations and research directions. The FBRI leadership has maintained communication channels to the many stakeholders in the State and region, and developed a series of meetings to present and discuss the various issues. In addition, UMaine received a \$350,000 I/UCRC grant to join NSF's recently established Center for Advanced Forestry Systems (CAFS), and will now be part an exclusive group of nationally recognized leaders in forest research, including North Carolina State University, Oregon State University, Purdue University and Virginia Tech. Collaborations between FBRI's Theme 1 group and other state stakeholders were instrumental in this success.

4) Actions Taken in Response to Recommendations:

Mid-Project NSF Reverse Site Visit: The RII project team addressed recommendations made by the 2007 NSF Reverse Site Visit panel, including: 1) refining ROI parameters that can be utilized to measure success; 2) working to increase the participation of women, underrepresented groups, and persons with disabilities; 3) expanding outreach activities for pre-college students to address broad STEM participation; 4) taking actions to enhance state cyberinfrastructure and connectivity; 5) communicating the compelling nature and benefits of the science; and 6) pursuing funding from other NSF programs (IGERT, MRI, and STC).

AAAS Assessment: Recommendations from all AAAS panel reviews were included in its FBRI strategies, including Year 3 recommendations to: 1) continue to enhance integration between the three major research theme groups, and in particular build the integration of the Human Dimension thrust into the whole research agenda; 2) finalize University base funding for support

staff and activities; 3) work with University administration to provide incentives for, and reduce barriers to, interdisciplinary research approaches; 4) balance industry interaction with the broader FBRI societal role; 5) ensure that outreach and communication activities are retained post-EPSCoR to strengthen stakeholder engagement.

FBRI Advisory Board Review: The FBRI Advisory Board will continue to guide the FBRI, and their recommendations were incorporated into the FBRI strategic plan, and include: 1) proceeding to secure full Institute status at the University; 2) implementing the planned transition to a single director; 3) supporting key staff positions under a University base budget; and 4) incentivizing the base budget.

Maine NSF EPSCOR EPS-05-54545
“Investing in Maine Research Infrastructure – Sustainable Forest Bioproducts”

B) FINAL REPORT DETAIL

1) RII Project Participants

In support of the RII project’s Objective #2 to enhance human resource development in this focus area for current and future researchers, a total of 263 individuals were directly supported by this 3½ year project: 37 core faculty, 5 outreach faculty, 9 postdocs, 53 graduate students, 86 undergraduate students, 28 high school students, and 45 technicians/ professional/administrative staff on the core project and at outreach partners. An additional 6,108 participants were indirectly supported through various outreach and collaborative activities and included: 1,347 conference & workshop participants, 377 faculty, 167 graduate students, 359 undergraduate students, 398 professional/administrative staff, 605 K-12 teachers/pre-service teachers, 2,354 middle school students, 456 high school students.

2) RII Project Description

a. Research Accomplishments and Plans

The FBRI has become a signature research program for the University of Maine and the state, and continues to engage in activities that are aligned with the project’s Objective #1 to advance cutting-edge science and engineering capabilities for discovery and innovation in order for Maine’s academic, non-profit, and for-profit R&D community to: a) increase research capabilities; b) increase competitiveness & federal funding; c) acquire new technical skills & knowledge; and d) develop new collaborations.

Various forest bioproducts being pursued by Maine’s FBRI include (1) ethanol, (2) butanol, (3) green synthetic diesel/jetfuel, (4) green synthetic gasoline, (5) green heating oil, (6) bio-crude, (7) acetic acid, (8) levulinic acid, (9) oligomeric hemi-celluloses, (10) functional substitutes for dry strength additives used in papermaking or additives used in sheet molding compounds, (11) wood pellets, (12) wood-plastic composites, and (13) cellulosic nano-composites. This bioproducts portfolio is well balanced in utilization of extracted biomass components as well as cellulosic solids. Both biological and thermal conversion platforms are actively being pursued with unique UMaine niches in wood component separation, surface functionalization, and catalyst development areas. Most work on bioproducts also addresses ecological and economic factors in keeping with the project’s holistic approach. We are also addressing socio-cultural attitudes towards bioproducts in order to better inform researchers, the public, and policy-makers about issues likely to arise as we transition toward a bioeconomy.

To support these efforts, FBRI researchers developed seven research clusters that encompass three “use-inspired” themes and four “discovery-driven” thrusts. The management team works with seven theme and thrusts leaders on strategic planning and hands-on management. Theme clusters focus on addressing selected opportunities and overcoming known barriers in (1) promoting forest health for a stable bio-economy through sustainable feedstocks and markets, (2) understanding and separating wood components for effective further processing, and (3) creating and commercializing new bioproducts technologies. Thrust clusters focus on enabling tools and methodologies to support activities of theme clusters, and pushing the envelope by identifying new opportunities and strengthening broad scientific underpinnings. Four thrust clusters are organized as: 1) human dimensions; 2) nanotechnology; 3) biological processing; and 4) thermal

conversion. The thrust activities cut across multiple themes. This type of research cluster organization has fostered cross-disciplinary collaboration resulting in new perspectives and synergy.

Three new FBRI faculty have become a key part of the FBRI core:

- 1) Dr. Peter van Walsum: research includes biological conversion of woody biomass into fuels, chemicals and bioplastics. He has also established several research projects involving integrated biological and thermal conversion technologies for biomass utilization. His research has help broaden FBRI activities into collaborations involving agricultural and marine biomass.
- 2) Dr. Aaron Weiskittel: research is focused on the development and application of quantitative techniques to provide the tools necessary for sound forest management decisions that include biomass harvesting. His research concentrates on multiple spatial scales ranging from the individual needle to the regional landscape and is multidisciplinary in practice, particularly in the combination of statistics and forest physiology.
- 3) Dr. Anthony Halog: has developed a new research Group focused on Industrial Ecology, LCA and Systems Sustainability in conjunction with FBRI mission including relevant technologies in the pursuit of broader agenda of the triple dimensions of sustainability (environment, economy and society). His research projects are being positioned on the recent emphasis of NSF, EPA, USDA and DOE activities on coupling human and natural systems to solve environmental and energy issues involving complex systems such as bioenergy production.

It has become evident from the work of the FBRI and others that several critical areas need to be addressed in order to create a successful bioproduct and bioenergy economy based on woody biomass in the northern forest region, and indeed across the nation. These key areas include:

- What fundamental mechanisms do the forests utilize in affecting growth and yield under complex environmental stimuli, and how do they interact with varying land-ownership patterns? (This is particularly important in the northern forests where natural regeneration dominates in contrast to plantations where trees can be genetically engineered)
- What fundamental chemical and physical forces resist wood fractionation, and why do acid and alkaline treatments impact various hardwood and softwood species so differently?
- What high value products can be derived from wood fractions through selective chemical and biochemical conversions?
- How does ligno-cellulosic biomass behave at the nano scale and how can this be taken advantage of?
- What technologies will have the least carbon footprint, and how will successful research be translated to sustainable businesses in the region, while transferring applicable results outside the region to the world beyond?

These are challenging and diverse questions which are all intimately related. The answers require open and frequent dialogue between research clusters comprising many disciplines. The FBRI leads the state's efforts to address these questions.

Since the inception of the FBRI, understanding the sustainability of emerging biorefinery technologies in the northeastern forest has been identified as a high research priority. Without quantitative knowledge of the sustainability dimensions of bioproduct and bioenergy commercialization, it is not possible to convince the public, political leaders, and policy makers of the true potential of biorefinery technologies in the Northeast. Three key objectives provide

the regional focus for the research led by the Theme 1 group: 1) predicting the quantity, species composition, quality, and sustainability of future woody biomass feedstocks; 2) understanding the environmental impact of emerging biorefinery technologies using life cycle analysis; and 3) identifying important socio-economic, policy, and human dimension implications for an emerging bioproducts/bioenergy economy.

The Theme 1 group, under the leadership of Prof. Wagner, has organized research clusters to work on nine major projects. Four of these projects focused on forest biomass feedstock prediction, harvest systems, & environmental effects. The other five projects addressed business pathways for the forest bioproducts industry and public perceptions of biorefineries. To date, theme 1 has been working in four different research areas: (1) species differences in crown structure (biomass, leaf area, primary branch characteristics); (2) assessing the long-term influence of forest management on growth and yield; (3) development of an individual tree growth and yield model; and (4) addressing potential changes in climate in future growth and yield projections. The overall goal of this work is to understand and forecast what the future forest composition and structure under a range of possible scenarios. LCA work is in alignment with the major areas of protection, according to United Nations Environmental Program (UNEP), which includes human health, natural environment quality, natural resources and man-made environment.

Capital investments and regulatory policies need to be addressed before full scale commercialization of lignocellulosic biorefineries will be feasible in the northeastern forest. FBRI research has already made strides in beginning to understanding the feasibility and the business pathways to forest biorefineries. Ongoing research collaborations in this area with forestland owners and managers of 8 million acres of Maine's forest through the Cooperative Forestry Research Unit (CFRU) ground the research with those directly involved in the forest industry. In addition, ongoing collaborations with University of New Brunswick and Dalhousie University through the Atlantica Bioenergy Task Force are providing key cross-border, regional perspectives. The human dimensions focused projects involving stakeholder attitude analysis have played an important role in the development of the new NSG EPSCoR supported Sustainability Solutions Initiative.

The overarching mission of the FBRI is to generate new value added products from woody biomass in a sustainable manner, whilst preserving the quality and quantity of existing product streams. To enable the creation of new products, underutilized components of the forest resource must be employed. The portion of woody biomass that is most widely used in current forest products is cellulose, the structural element of the plant. Underutilized components therefore include hemicellulose, lignin and organic extractive compounds. Accordingly, the Theme 2 group objectives are:

- Probe the fundamentals of fractionating woody biomass into its primary substituents.
- Optimize or functionalize the extracted substituents to facilitate new product development.

Enzymatic hydrolysis of oligomers offers the potential for reducing capital cost and waste generation compared to traditional acid hydrolysis. Consequently, the Theme 2 group continues to work on fundamentals of enzyme chemistry and kinetics, the utility of enzyme immobilization, enzymatic cleavage of lignin-carbohydrate complexes, and the effects of extraction-derived degradation products on enzyme activity.

Once reduced to monomeric sugars, several options exist for conversion to value added products. Firstly, monosugars may be fermented to ethanol. Fermentation of hemicellulose-

derived sugars is challenging because of the difficulty of identifying or developing organisms that ferment all of the sugars while producing ethanol with high selectivity. This challenge is increased in the presence of inhibitory compounds such as salts, organic acids or biomass degradation products. The FBRI is leading efforts in identification and quantification of bioconversion inhibitors. Additionally, the FBRI is investigating the utility of employing consolidated bioprocessing (CBP), that is, the use of organisms that are capable of carrying out both hydrolysis and fermentation. Prof. Leschine of UMASS, who has identified one such organism, has collaborated with Dr. van Walsum in this area.

An alternative route to producing value added products from hemicellulose is the use of mixed culture acidogenic fermentations. Such fermentations yield a variety of organic acids which may be chemically and/or thermally upgraded to ketones, esters, alcohols and hydrocarbons. Termed the carboxylate platform, this route offers a promising alternative to the sugar and syn gas platforms for production of bio-based fuels and chemicals. Issues of importance for development of this platform include improved fundamental understanding of mixed culture fermentations, suppression of methanogenesis, separations of organic acids from water and chemical upgrading to final products. Prof. van Walsum continues to develop efforts in acidogenic digestion by characterizing the adaptation of microbial ecosystems to variable and biodiverse feedstocks and operating conditions, and optimizing the integration of separation and catalytic upgrading operations into the general process model in collaboration with Prof. Wheeler.

The FBRI nanotechnology group has developed various mechanical methodologies to produce cellulose nanofibers. These low cost methods have the potential to produce large quantities of material. In addition, the FBRI has shown that enzymatic and/or chemical pre-treatment of wood fibers may significantly reduce the mechanical energy input required to produce a given fiber size, and enable processing at greater solids content. Initial studies have demonstrated that incorporation of these nanofibers into latex films results in a significant increase in the elastic modulus, even at very low concentrations. In parallel with these studies, nano-toxicological investigations are ongoing through collaborations with the University of Southern Maine.

The Theme 3 group, under the leadership of Prof. Pendse, is working on 1) integration of advanced enabling technologies into biomass conversion processes, 2) process design and simulation including economic assessments, and 3) process validation at the pilot scale. All three activities are directed toward implementing advances in scientific understanding and technology breakthroughs into bioproducts and processes in a rapid and efficient manner through process simulations and pilot-scale validations. The current focus is on acetic acid recovery from wood extracts using liquid-liquid extraction and fermentation of xylose to ethanol or butanol. This group is working closely with Old Town Fuel & Fiber (OTFF) pulp mill personnel to develop plans for a satellite plant for biorefinery based on mill extraction trials of pre-pulping extraction technology developed by UMaine. UMaine's pre-pulping extraction technology was deployed at the Old Town Fuel & fiber (OTFF) pulp mill in December 2007. OTFF's technology deployment allows one to integrate biofuel production into existing pulp facility infrastructure. Today the Old Town facility continues to be at the forefront of change with a focus on co-production of pulp, fuels and chemicals, with their Biorefinery project that has been selected to receive \$30 million Department of Energy award. In May 2009, a new project began in area of jet fuel production in collaboration with a team led by Logos Technologies of Arlington, VA with funding from DARPA. Another biofuel collaboration involves the

Agenda2020 Technology alliance of American Forest and Paper Association (AF&PA) that includes representatives from several large pulp manufacturers, as well as researchers from the Forest Products Laboratory in Madison, WI and the National Renewable Energy Laboratory (NREL) in Golden, CO.

Theme 3 groups are also actively involved in two other projects focused on producing bioplastics from wood derived sugars. One project is focused on polylactic acid (PLA) and culminated in the Sustainable Bioplastics Council of Maine. The council supports and promotes the use and production of bioplastics from renewable feedstocks consistent with the principles of Green Chemistry with focus on sustainability. The council membership is comprised of potential feedstock providers, technology suppliers, large and small manufacturers, and non-profit organizations. The other project is focused on polyitaconic acid (PIA) involving Itaconix LLC of Dover, NH and Microbia Inc. of Lexington, MA.

The FBRI continued activities in support of the project's Objective #4 to show a positive economic impact for the state by providing a solid scientific platform for the effective transfer of technology in this area from Maine's research institutions to the private sector. This was accomplished through:

- 1) intellectual property and patents
- 2) small business and industry collaborations, where the FBRI has been successfully positioned as a research arm for Maine's forest products industry, and has developed active collaborations to ensure effective technology transfer
- 3) providing a testbed for industry scale-up through an innovative partnership involving UMaine and Red Shield Acquisitions, which resulted in a grant award of \$30 million from the U.S. Department of Energy (DOE) to design, build and operate a small-scale commercial biorefinery in Old Town, Maine. The biorefinery will produce ethanol, acetic acid and other by-products from the wood chips that are also utilized to produce market pulp in Red Shield's mill, and moves the University one step closer in its goal to successfully transfer forest-based cellulosic ethanol and bioproducts research from its labs to commercial mill operations. Construction is expected to begin in 2010 and a fully integrated biorefinery will be in operation by 2012.
- 4) FBRI Technology Center: a new \$4.8M award from the Maine Technology Asset Fund, combined with a \$2M in-kind match from Red Shield Acquisitions, will allow the FBRI to create a new 40,000 sq. ft. high-bay industrial research facility. This facility will assist in the rapid commercialization of research and innovations through pilot-scale technology validation.
- 5) UMaine received a \$350,000 I/UCRC grant to join NSF's Center for Advanced Forestry Systems (CAFS), and will now be a part of an exclusive group of nationally recognized leaders in forest research.
- 6) FBRI is collaborating with Itaconix of Dover, NH and Microbia of Lexington, MA in the area of producing bioplastics from wood derived sugars under a USDA/DOE grant awarded to Itaconix. This new collaboration complements ongoing efforts led by the Sustainable Bioplastics Council of Maine with support from the Maine Technology Institute.

b. Diversity and Broadening Participation

b.1 Broadening Participation:

Over the 3 ½ years of this project, of the total number of individuals directly supported, an average of 37% were female and 3% were from underrepresented groups. Of indirectly

supported participants, an average of 54% were female and 4% were from underrepresented groups. Appendix 4 shows the annual detail, and shows a modest increase each year.

While Maine is the second least diverse state in the nation with minorities consisting of only 3.3% of the population, Maine EPSCoR has a demonstrated track record of being committed to programs and activities that will expand the participation of women and underrepresented groups in STEM fields. Maine EPSCoR continues to develop strategies for improvement, including a targeted effort to engage the Native American population, which is the state's largest minority population. Other diversity partnerships were continued and included:

- 1) Institute for Broadening Participation (IBP): Maine EPSCoR has partnered with the IBP, which is a nonprofit organization located in the state. IBP is committed to supporting future scientists as they make their way through their education and careers, and in particular, focuses on making an education and career in science more accessible to women, people of color, and first generation college students. They are also associated with the NSF IGERT program and the national Alliances for Graduate Education and the Professoriate.
- 2) National Girls Collaborative Project (NGCL): The University of Maine received a grant to participate in the NGCL, which is a national program to foster gender equity in STEM for girls. Maine EPSCoR has financially matched this grant for the three-year period of the project.
- 3) Expanding Your Horizons: Maine EPSCoR is a partner in an annual STEM conference on campus for 600 middle school girls, linking them with women role models who are active in STEM and providing hands-on STEM experiences and career information.
- 4) Wabanaki Native American Center: Maine EPSCoR has an established partnership with the Wabanaki Center and is supporting their Native Scholar Educational Outreach program to engage Maine's five tribal nations in STEM education, research, and careers. Year 2 concentrated on establishing communication networks with the tribal communities and conducting a needs assessment, which then drove an initial implementation phase in Year 3.
- 5) Maine EPSCoR participated in negotiations to hire a Native American faculty member in Environmental Studies, who began January 2009 and also serves as the university's first Director of Native Research. Maine EPSCoR will continue to work with him to develop and initiate STEM mentoring, and educational and career activities for the Native American community.
- 6) The University of Maine also continues participation with the Northeastern Alliance for Graduate Education and the Professoriate (NEAGEP). Maine EPSCoR takes advantage of strategies that have been developed under the university's NSF IGERT and REU programs; and participated in planning for various NSF grant solicitations to encourage the participation of women and underrepresented groups (ADVANCE, LSAMP).
- 7) Maine EPSCoR has recently begun working with UMaine's Center for Community Inclusion and Disability Studies to develop a specific action plan to foster participation by this population, and has begun planning to work with the EAST project at the University of Southern Maine to extend their programs into northern portions of the state.

b.2 Institutional Collaborations

Research and education collaborations were initiated with two research labs at the University of Southern Maine, and Bates, Bowdoin, and Colby colleges (undergraduate institutions). All involved students at the undergraduate and high school levels.

Other research collaborations included: 1) small business partners Tethys Research LLC, Corinth Wood Products, Zeomatrix, Habitat Planning, and Forest Research LLC; 2) industry and organizational partners Red Shield Environmental LLC, Northeastern States Research

Cooperative, New England Green Chemistry Consortium, Pinchot Institute, Huber Resources Corporation, Polymer Science and Engineering at the University of Massachusetts in Amherst, MA, and the Materials Science Program at University of New Hampshire in Durham, NH; 3) national and international partners Rensselaer Polytechnic Institute in Troy, NY; Wood and Paper Science Department at North Carolina State University in Raleigh, NC; Forest Products Lab in Madison, WI; Michigan State University; Forest Products Association of Nova Scotia; Helsinki Technical University, Finland; Mumbai University Institute of Chemical Technology, India; ENERKEM, Canada.

c. Workforce Development

Workforce development activities over the grant period resulted in 125 new positions created and supported, and included three new tenure-track faculty and five postdoctoral associate positions. Integrated research and education activities both year-round and in the summer included: 53 graduate student research internships; 86 undergraduate student internships; and 28 high school student internships. Technical assistance workshops on grant writing were supported all three years. Two new graduate courses were developed, and several existing courses incorporated new knowledge from FBRI research. All FBRI graduate students participated in on-site conferences and seminars, presented posters at all Maine EPSCoR State Conferences, took part in training workshops, and support was provided for 30 graduate students to attend national/international conferences. Maine EPSCoR worked with the Maine STEM Collaborative to initiate a K-12 STEM Career Pathways program for the state. Additional workforce development activities are discussed in section B.2.e. Outreach and Communication, and B.2.g Human Resource Development.

d. Cyberinfrastructure:

Maine EPSCoR sent two University representatives to the Kentucky EPSCoR CI workshop in the fall of 2007 and subsequently formed a state CI Planning Committee that has continued to actively define statewide needs and refine the state action plan. Partnerships have been formed with other regional stakeholders such as NSF EPSCoR and NIH IDeA programs in Vermont, New Hampshire, Rhode Island, and Delaware, and with Canadian partners. Primary objectives include addressing basic connectivity issues for the state, enhancing access to UMaine's excellent supercomputer abilities, and upgrading videoconferencing and distance learning capabilities. To that end, a regional NSF EPSCoR RII Track 2 proposal was submitted in January 2009 (ME, VT, NH, RI, DE EPSCoR), and a complementary NIH NCRN proposal was submitted in March 2009. Both are pending.

e. Outreach and Communication:

Outreach and communication activities for the academic and research community included: 1) research and education collaborations with over 24 academic, industry, government, and NGO partners; 2) FBRI sponsored 60 workshops and seminars for over 1,000 participants (see Appendix 7); 3) 29 FBRI faculty and graduate students presented papers/ posters on FBRI research at 284 national/international conferences (see Appendix 8); 4) Maine EPSCoR State Conferences 2006, 2008, and 2009 for 558 participants, an EPSCoR/USDA SBIR workshop in 2007 for 175 participants, and a 2006 DEEPSCoR workshop for 50 participants; 5) 92 related scientific journal publications published by FBRI faculty (see NSF Fastlane).

Outreach for research and knowledge transfer generated collaborations with: 1) educational partners Maine Center for Toxicology and Environmental Health at the University of Southern Maine, Colby, Bates, and Bowdoin Colleges; 2) small business partners Tethys Research LLC, Corinth Wood Products, Zeomatrix, Habitat Planning, and Forest Research LLC; 3) industry and organizational partners Red Shield Environmental LLC, Northeastern States Research Cooperative, New England Green Chemistry Consortium, Pinchot Institute, Huber Resources Corporation, Polymer Science and Engineering at the University of Massachusetts in Amherst, MA, and the Materials Science Program at University of New Hampshire in Durham, NH; 4) national and international partners Rensselaer Polytechnic Institute in Troy, NY; Wood and Paper Science Department at North Carolina State University in Raleigh, NC; Forest Products Lab in Madison, WI; Michigan State University; Forest Products Association of Nova Scotia; Helsinki Technical University, Finland; Mumbai University Institute of Chemical Technology, India; ENERKEM, Canada.

Outreach and communication to the general public included several websites: 1) the comprehensive FBRI website that went live in December 2007; 2) the Maine EPSCoR website, which is undergoing major re-development; 3) a Maine STEM website; and 4) several websites showcasing curriculum developed around FBRI research; and 5) a new website in 2009 for “A More Vibrant Maine Economy through Bottom-up Innovation” (www.umaine.edu/vme). FBRI faculty and staff participated in dozens of local, state, and regional activities to disseminate information regarding the project. Maine EPSCoR invested in communications equipment and software and hired two New Media students to work on expanded communication activities such as film, digital photography, websites, and print media (newsletters, press releases, brochures, posters, etc.). Six videos were created showcasing Maine EPSCoR activities, and Maine EPSCoR created a presence on social networking sites (Facebook, YouTube, Twitter, etc.). FBRI and Maine EPSCoR exhibited at a dozen local, regional, and national programs and activities.

Outreach to the research and K-12 community included support of multiple outreach strategies to small businesses, K-12 teachers, university and college faculty, pre-service teachers, and students, reaching 6,108 individuals in supported STEM and research activities. Over the 3 ½ year project, 30 educational outreach and research seed funding projects received over \$700,000 (see section B.2.g.). The FBRI NSF REU/RET program also received support. Maine EPSCoR also expanded its statewide STEM leadership role as a partner in the Maine STEM Collaborative, which is a statewide partnership of education, business, government, research, non-profit sectors, and teacher advisory groups who have come together to foster the improvement of STEM education in the state.

f. Evaluation and Assessment:

The evaluation and assessment plan for this project encompassed a multi-layered approach and feedback loops that included: 1) AAAS panel on-site assessments in October 2006, August 2007, and October 2008; 2) FBRI Advisory Board evaluation – full board met annually on-site in July 2007, 2008, and 2009, and executive committee met five times inbetween; 3) NSF Reverse Site Visit September 2007, and annual on-site visits by NSF EPSCoR Directors and Program Officers; 4) Maine EPSCoR RII management team oversight; 5) FBRI management team oversight; 6) FBRI theme and thrust leader management; and 7) MIEAB state EPSCoR committee oversight. The Maine EPSCoR and FBRI management teams regularly reviewed

progress in achieving milestones. Recommendations from external reviews were incorporated into the management strategy for the remainder of the project.

AAAS Assessment: The AAAS panel held its third review of the FBRI project on October 2008, and concluded that “In sum, FBRI has made impressive progress during the past year. As in years past, the review panel was impressed by the sheer number of students, faculty and stakeholders that are incorporated under the FBRI umbrella. It’s clear that FBRI has generated a unique identity within the University of Maine and a presence throughout the state.” Specific panel recommendations included: 1) continue to enhance integration between the three major research theme groups, and in particular build the integration of the Human Dimension thrust into the whole research agenda; 2) finalize University base funding for support staff and activities; 3) work with University administration to provide incentives for, and reduce barriers to, interdisciplinary research approaches; 4) balance industry interaction with the broader FBRI societal role; 5) ensure that outreach and communication activities are retained post-EPSCoR to strengthen stakeholder engagement. The FBRI management incorporated these recommendations in its decision-making and research implementation for the final year. All three AAAS reports were included in the annual NSF reports.

FBRI Advisory Board: The FBRI Advisory Board was formed during Year 1 under the direction of founding chair Del Raymond (retired from Weyerhaeuser), and consists of a mix of regional, national, and international experts in fields of relevance to the FBRI research mission. The Advisory Board was charged with reviewing FBRI’s programs, activities, and progress, and providing feedback and recommendations. Throughout the year, the Advisory Board also acts in a proactive capacity to assist the FBRI in networking and forming new collaborations. The full FBRI Advisory Board met on-site during July 2007, 2008, and 2009, with a full two-day agenda each time that allowed for interactions with FBRI participants and stakeholders. In addition, the Executive Committee also conducted meetings in September 2008, December 2008, and March 2009, and produced a mid-year report in January 2009. All reports have been included in the annual NSF reports.

NSF EPSCoR Site Visits:

The following NSF EPSCoR Directors and Program Officers attended Maine EPSCoR State Conferences and were able to also conduct a site visit of the FBRI project, which included meetings with RII faculty and students, and tours of the facilities at UMaine and at industry partner Red Shield Environmental:

2009 Maine EPSCoR State Conference: John Hall, Denise Barnes – Program Officers

2008 Maine EPSCoR State Conference: Henry Blount, Director

2007 Maine EPSCoR SBIR Conference: Jim Gosz, Interim Director, & Tony Walters

2006 Maine EPSCoR State Conference: Sherry Farwell, Director

Reverse Site Visit: five members from Maine participated in the NSF Reverse Site Visit in September 2007, and responses to the panel’s recommendations were integrated into the management and implementation plans.

g. Sustainability and Project Outputs

The FBRI engaged in multiple steps to ensure sustainability. These include:

- **Grants submitted:** 115 proposals were submitted, and awards of over \$25.2M received. Detail: Year 3+ (April 2009-Sept 2009): 23 grant proposals were submitted for a total of over \$17M; 7 grant awards were received for a total of ~\$3.8M. Year 3: 39 grant proposals

were submitted for a total of over \$60M; 23 grant awards were received for a total of ~\$16M. Year 2: 24 grant proposals were submitted for a total of over \$8M; 15 grant awards were received for a total of ~\$2.8M. Year 1: 29 proposals were submitted for a total of over \$13.6M; 17 grant awards were received for a total of \$2.6M. (See Appendix 5).

- Several large-scale awards were secured for FBRI that will provide on-going funding beyond the NSF EPSCoR project period including: \$1M federal earmark; \$1.9M DOE EPSCoR; \$30M DOE Biorefinery Demonstration Grant in conjunction with the Integrated Forest Biorefinery (FBRI \$3M subcontract); and \$4.8M from the Maine Technology Asset Fund for a pilot-scale research facility.
- **Research structure:** The FBRI theme and thrust structure has been successful in fostering multi-disciplinary research that would otherwise not have taken place, and has provided a solid base to ensure the sustainability of the research initiative beyond NSF EPSCoR funding, with all collaborative research focused on the broad vision and based on cross-disciplinary teams.
- **Institute status:** At the July 2009 meeting, the FBRI Advisory board reviewed the plan to transition the FBRI into a formal UMaine research center with an institute status that includes on-going staff support and a base budget. The board members endorsed the plan to the senior administration of the University, and signed on to continue as the founding members of the FBRI Advisory Board. A recent award from the Maine Technology Asset Fund of \$4.8 million is making possible a new Technology Center with 40,000 sq. ft. high-bay space for taking pilot scale work and making it industrially relevant. This FBRI Tech Center received a \$2 million in kind cost share from industry in the form of a rent-free lease.
- **Collaborations:** FBRI developed dozens of collaborations with small business, industry, organizations, and national/international partners.

g.1 Seed Funding and Emerging Areas: Maine EPSCoR utilized a seed funding mechanism to link the FBRI research activities to emerging science and small business opportunities.

Research partners that received seed funding support included:

- 1) **Tethys Research LLC:** “Environmentally-Friendly Wood Pre-treatment Enzymes Could Revolutionize Wood Processing,” PI - Nancy Kravit.
- 2) **Corinth Wood Pellets:** “The Effects of Lignin, Black Liquor and Wax Emulsion on the Manufacture and Thermal Properties of Wood Pellets,” PI - Jason Stevens.
- 3) **Habitat Planning:** PI - Steve Young. Support provided for forest inventory and computer model development, and forest management plan development and implementation to further sustainable forest management in the Acadian Forest Region of northern Maine.
- 4) **Forest Research, LLC:** PI – Don McKay. Support provided to review the basic types of chemicals, including pharmaceuticals, which can be extracted from trees in Maine, and to examine the market for the major types of these chemicals and pharmaceuticals in terms of price and future demand.
- 5) **“Projected Nutrient Losses from Biomass Harvesting Forest Stands in Maine”:** PIs - Ivan Fernandez and Bob Wagner, University of Maine; Lee Allen, North Carolina State University.
- 6) **“Stakeholder Views towards the Emerging BioProducts Industry in Maine”:** PIs - Robert J. Lilieholm and Jessica Leahy, UMaine School of Forest Resources, and Terry L. Porter, UMaine Business School.

- 7) “**Maine’s Climate Future: An Initial Assessment – Report to Governor Baldacci**”: PIs - Stephen Shaler and Robert J. Lilieholm, (UMaine School of Forest Resources), Peter van Walsum and Michael Bilodeau (UMaine Chemical and Biological Engineering).
- 8) **Atlantica BioEnergy Task Force**: PIs - Hemant Pendse (UMaine Chemical and Biological Engineering), Robert Wagner (UMaine School of Forest Resources), Jonathan Rubin (UMaine School of Economics & Margaret Chase Smith Policy Center).
- 9) **Maine Center for Toxicology & Environmental Health**: Year 2, 3: Two projects provided an educational and research experience for a USM graduate student, five USM undergraduate students, and two Portland High School students. Research was done to help in the use of woody biomass to create new products, by studying the toxicity of cellulose nanoparticles as a first step towards identifying modifications to the nanoparticles that may make them less toxic and safer for human and environmental exposure and consequently commercially more valuable.

g.2 Human Resources Development

In support of the RII project’s Objective #2 to enhance human resource infrastructure in this focus area for current and future researchers, a total of 263 individuals were directly supported during the 3½ year project: 37 core faculty, 5 outreach faculty, 9 postdocs, 53 graduate students, 86 undergraduate students, 28 high school students, and 45 technicians/professional/administrative staff on the core project and at outreach partners. An additional 6,108 participants were indirectly supported through various outreach and collaborative activities and included: 1,347 conference & workshop participants, 377 faculty, 167 graduate student, 359 undergraduate students, 398 professional/administrative staff, 605 K-12 teachers/pre-service teachers, 2,354 middle school students, 456 high school students. (See Appendix 3 & 4.) Ten high school and undergraduate students who participated in research internships continued on to the next level (undergraduate or graduate).

29 FBRI core faculty and graduate students attended/presented at 284 regional, national, and international workshops, conferences, and symposium. Additional support was provided in the form of travel scholarships offered to researchers throughout the state to participate in the following: NSF Regional Grants Conference, Providence, RI, April 2008 (3 UMaine attendees); Vermont EPSCoR State Conference, Burlington, VT, June 2008 (2 UMaine, 1 UMaine Fort Kent, 2 Univ. of Southern Maine attendees); NSF NIST TIP Conference, Boston, MA, July 2008 (3 UMaine attendees); NSF EPSCoR Social-Ecological Systems Workshop, Anchorage, AK, May 2009 (1 UMaine attendee); Vermont EPSCoR Annual State Meeting and Grant Writing Workshop, Burlington, VT, June 2009 (1 UMaine attendee).

Maine EPSCoR supported multiple outreach strategies to K-16 teachers, university and college faculty, pre-service teachers, students, researchers, and small businesses, reaching 6,108 individuals. Over the award period, 30 educational outreach projects received over \$700,000 to engage in discovery-based learning activities for K-16 students and teachers. The FBRI NSF REU/RET program was also supported. Maine EPSCoR also utilized a seed funding mechanism to support these educational outreach programs, which included:

- 1) **University of Southern Maine**: Year 1: Associate Professor of Education Robert Kuech trained pre-service secondary science and elementary teachers how to produce and use podcasts of science activities and concepts related to forest and water ecology in their classrooms.
- 2) **University of Maine at Fort Kent**: Year 1: Kim Borges-Therien, Associate Professor of Environmental Studies, received support for an undergraduate student internship in a

research effort to investigate changes in water quality parameters in a local lake (Cross Lake) during winter. The student measured dissolved oxygen, temperature, and phosphorus through the ice several times during the season in order to draw conclusions about winter stress to fish populations in a lake.

- 3) **University of Maine at Fort Kent:** Year 1: Forest Technology Program Coordinator and Instructor of Forestry Jeff Dubis received an award for a project that supported the promotion of low-impact logging through demonstrations and workshops, which included logging exercises conducted by students during class time as well as demonstrations and workshops presented by faculty, staff, and students for local small woodlot owners. Studies on timber harvesting and its impact on forest biodiversity were also supported.
- 4) **UM Center for Science and Mathematics Education Research:** Year 1, 2, 3, 3+: The Center received support for their project entitled, “Professional Development through Collaborative Networks: An Innovative Partnership to Strengthen K-16 Science and Mathematics Education.” This project included three coordinated programs to link experienced science and mathematics teachers with pre-service teachers and University faculty in these fields, two statewide conferences, two national conferences and summer academies, and the formation of a new Middle School Collaborative which focuses specifically on ways to bring guided-inquiry curricula into middle school mathematics and science classrooms. Support was also provided for the High School Physics Teachers’ Collaborative and the Mathematics Cross-Tier-Teaching Team.
- 5) **University of Maine at Farmington:** Year 1: Matthew McCourt, Assistant Professor of Social Sciences and Business, received support for a Rangeley Lakes-High Peaks partnership for undergraduate research. This project provided an educational experience for undergraduate students to directly contribute to technology-enabled, community-based research focused on 500,000 acres of forestland in western Maine. Over 40 students and two interns acquired the skills necessary to implement the Participatory Geographic Information Systems component of a larger natural resource inventory centered on the Rangeley Lakes/High Peaks region. The project advanced natural resource planning in western Maine while simultaneously preparing a new group of students to meaningfully contribute to bioproducts research and forest management, and participatory planning. The resource inventory project and participatory mapping exercises were the centerpiece of semester-long, linked class projects, designed to explore the substantive issues of land use change in RLHP area, as well as the theory and practice of participatory GIS research. Maps created from the final database enable citizens and resource managers alike to analyze both local priorities and areas of potential conflict. When integrated with other ecological and economic data for the region, the participatory GIS maps can advance future planning discussion about the use of Maine’s forests through a holistic approach that acknowledges all stakeholder concerns.
- 6) **UM Department of Electrical and Computer Engineering:** Year 1: Bruce Segee, Associate Professor, received year one support for the Maine Laptop Initiative for STEM educational outreach. This project sought to refine and test in the K-12 classroom a data visualization method that utilizes individual laptop computers (and a set of shelves) to create a tiled wall-sized display. In particular, the project sought to use available satellite imagery as a mechanism by which students can “fly over” the State of Maine, particularly its forests, without leaving the classroom. This work was tested at Hermon Middle School, at Old Town’s Leonard Middle School, and at Indian Island School. A graduate student with a nominal travel budget to cover trips to the schools was supported.

- 7) **Maine TREE Foundation:** Year 1, 2, 3, 3+: The Foundation held three five-hour workshops in which FBRI scientists presented their research and talked about STEM careers which 36 K-12 science and math teachers attended; four summer forestry tours for teachers that were attended by 69 K-12 teachers and researchers; and three professional development workshops for math and science teachers that drew 30 participants including 14 high school teachers, 6th to 8th grade teachers, and representatives from Maine's Energy Education Office, the Maine Math and Science Alliance, and Maine's Department of Environmental Protection. Funding also supported a high school curriculum development project in collaboration with FBRI faculty and other consultants and curriculum development specialists, as well as the distribution of those lessons. Maine TREE contracted with a student-run media services program to develop a web interface that will allow the lessons to be viewed by and distributed to teachers and educators around the world. This can be found at www.forestbioproductslessons.org.
- 8) **UM Senator George J. Mitchell Center for Environmental and Watershed Research:** Year 1: Research Associate Professor Peter Vaux received an award to create a Maine Woods Website. The website hosts a broad spectrum of multi-disciplinary information and data about Maine's forest lands for use by educators and students from K-12 schools and colleges. Maine forests present an extremely rich educational resource spanning multiple disciplines, including wildlife and plant ecology, landscape ecology and GIS mapping, conservation planning, resource management policy, timber harvest practices, and socio-economics. Although a wealth of information exists about Maine's forest lands, there was no single online resource that provided easy access to this information, and educators needed a fast, user-friendly, and inclusive Web tool to incorporate this information into curricula and classroom and field experiences. The website also provides the ability to access data sets, published information syntheses, comprehensive bibliographies, full-text articles, and curriculum materials.
- 9) **UM Foster Student Innovation Center:** Year 1, 2: The Foster Student Innovation Center received support in the first two years of the Forest Bioproducts Research Initiative to conduct two innovation and commercialization plan contests for student innovators from Maine's colleges and universities. Workshops and individual counseling were provided to help students develop commercialization plans and cash prizes were awarded to finalists to execute those plans.
- 10) **UM Women's Resource Center:** Year 1, 2, 3: Support was provided for the Expanding Your Horizons conference conducted by the Women's Resource Center. Girls participated in hands-on sessions with women role models in STEM fields to encourage interest in STEM curriculum and careers. Each year 600 or more middle school girls from around the state participated.
- 11) **UM Pulp & Paper Foundation:** Year 2, 3: Maine EPSCoR supported the Foundation's Consider Engineering Program for talented math and science students to explore engineering careers as well as the latest developments in technology and research. The first year was attended by 63 high school juniors, the second by 101 with the addition of another week. FBRI faculty and graduate students participated as mentors.
- 12) **FBRI NSF REU & RET program:** Year 2, 3: Two middle school teachers and 30 high school students participated in FBRI's RET and REU programs. RET teachers did research for and developed a forest bioproducts curriculum which was shared, along with student projects, through an RET bioproducts blog. REU students conducted research advancing

their knowledge of sustainable forest bioproducts and gained a detailed understanding of one of the thematic elements of the research effort. At the conclusion of their experience students reported in both oral and written formats in professionally organized seminars open to faculty and the public.

- 13) **UM Wabanaki Center:** Year 2, 3: Maine EPSCoR is supporting the Wabanaki Center's Native Scholar Educational Outreach project to create a solid foundation for STEM recruitment and retention activities by renewing and strengthening connections with Native communities, students, and alumni in Maine. The project began with needs assessment and community mapping activities, identification of University of Maine Native American alumni who might serve as mentors to current or potential students, planning for participation in Maine Indian Education Career Fairs, and an overnight campus visit for tribal high school students. Other activities include a Mentor Dinner event, a Student Weekend event, purchasing of resource materials to develop a STEM resource center for Native American students, and updating their website with STEM resources.
- 14) **Orono High School:** Year 2, 3: FBRI faculty member Dr. Barbara Cole, working with Orono High School and FBRI faculty, created a research program that brought 36 high school students (14 girls) to campus to work with FBRI faculty and graduate students. The students worked side by side in the labs and in the field, assisting researchers and presenting the results of their collaborations in both reports and public seminar presentations.
- 15) **Maine Association of Conservation Districts:** Year 2, 3: The Center received funding for "Reaching More Maine High Schools through Envirothon to Promote Environmental Awareness and Hands-on Environmental Problem-Solving," a project that covered all Maine school districts to encourage participation in the national Envirothon program, with face-to-face interactions with over 1,000 students and advisors. The project also sought to collaborate with existing teacher workshops (e.g., Project Learning Tree) as a means of outreach to raise participation in Envirothon.
- 16) **UM Department of Earth Sciences/Climate Change Institute:** Year 2: This project built the capacity of middle and high school science and mathematics teachers to apply technology skills to answer environmental questions of interest and relevance to them and their students through workshops, a speaker series, and a conference. One professor and one graduate student were supported, 25 in-service and pre-service teachers participated, and up to 400 students, teachers, and other participants benefited indirectly.
- 17) **UM Center for Research on Sustainable Forests:** Year 2: The CRSF, working as part of Forests for Maine's Future, planned a day-long program of teaching and interactive workshop events for Maine youth at an April 2008 public expo held in Portland, Maine. Approximately 800 attendees participated.
- 18) **UM Upward Bound Program:** Year 2, 3, 3+: Maine EPSCoR supported the Upward Bound summer program for high school graduates preparing to enter postsecondary education. The students participate in a 6-week program in which they do individual and group research, presentations, and prepare articles. Students were able to do research alongside FBRI researchers from graduate students and postdocs to technicians and faculty. Across three summers, 113 students were supported.
- 19) **Maine Energy Education Program (MEEP):** Year 2: FBRI supported MEEP and the University of Maine to initiate curriculum development by an undergraduate REU student working with MEEP staff. The REU student created visual information in the form of power point slides, overheads, and written information about how energy from forest bioproducts

will be integrated into existing alternative fuels development. After attending a Maine TREE Foundation workshop (another FBRI outreach grant partner) MEEP staff followed-up with on-site classroom presentations that demonstrated the creation of cellulosic ethanol.

- 20) **Troy Howard Middle School:** Year 2, 3: Support was provided for a summer laboratory school, a year-round environmental club, to construct and equip an outdoor classroom facility, and to develop trails with informational stations. Four classroom teachers plus a garden manager/teacher worked with 31 students in the environmental club, while 155 students at the school have benefited from the additions.
- 21) **Washington Academy:** Year 2: Washington Academy received funding for their portable biodiesel processor project which allowed them to acquire a 50 gallon biodiesel processor that will minimize the handling and exposure of chemicals that can pose a risk in large volumes. The entire biodiesel production system was made portable to allow for community outreach in alternative fuel energies and biofuel technologies, and WA students and faculty are able to conduct workshops and training programs for area middle and high schools, higher education programs and institutions, seasonal festivals, and other interested parties.
- 22) **UM Department of Mathematics & Statistics:** Year 3: Professor Tod Shockey sought to recruit Native American students at the middle school and undergraduate level into the STEM fields through dissemination of the work of the SPEED Lab (Spatial Population Ecological and Epidemiological Dynamics) at the University of Maine. Two middle school teachers were trained in the work of the SPEED Lab in order to provide unique mathematics activities to their (22) 7th and 8th grade students at the Beatrice Rafferty School in Pleasant Point which serves the Passamaquoddy People. This project also reached approximately 40 Native American undergraduates the University of Maine who have not declared a major through a presentation on the SPEED Lab at a dinner hosted by the Wabanaki Center.
- 23) **UM College of Engineering:** Year 3: The College of Engineering hosted 65 high school-aged 4-H girls and Girl Scouts from four counties at the University of Maine where they toured the campus, were introduced to engineering programs available, and participated in hands-on projects with different engineering departments, including those involved in the FBRI project.
- 24) **UM Technical Writing Lab and Consultation Center:** Year 3: Support was provided for the creation of a computer lab and consultation space for training technical communication students to work with scientists and engineers on documents that support research and development.
- 25) **Institute for Broadening Participation:** Year 3: Support was provided to build and maintain a web-based interface providing up-to-date resources for students, parents, educators, research, businesspeople, and policymakers on STEM education and career opportunities that are particularly relevant to Maine citizens.
- 26) **UM National Girls Collaborative Project:** Year 3+: As part of a match from Maine EPSCoR, the Maine Girls Collaborative Project (MGCP) was able to provide four mini-grant applicants with full funding for their projects. The collaborating partners selected for funding are Hardy Girls Healthy Women and Girls Scouts of Maine, the Lower Penobscot Watershed Coalition and UMaine Upward Bound, and Girl Scouts of Maine and the Challenger Learning Center of Maine. Hardy Girls Healthy Women and the Girls Scouts of Maine were chosen for a second mini-grant in order to expand on their collaborative effort. These four projects are targeting girls ranging from ages 6 to 18 and exposing them to real-world STEM activities.

g.3 Leveraging NSF Programs

Faculty participation in FBRI allowed the leveraging of an additional \$1.8M in new NSF funding. FBRI received an NSF Research Experience for Undergraduates (REU) award to fund “Explore It! Building the Next Generation of Sustainable Energy Researchers,” along with an accompanying RET award. FBRI researchers also received an NSF MRI to develop specialized major equipment. The FBRI management team applied for an NSF STC, and continues to develop proposals for additional large center-like program opportunities at NSF and other federal agencies. All FBRI programs were coordinated with the NSF EPSCoR RII project efforts.

h. Management Structure

EPSCoR Governing Committee: The Maine Innovation Economy Advisory Board serves as the EPSCoR governing committee for the state, and is under the state’s Office of Innovation (see Appendix 1), which has developed the state’s Science and Technology Action Plan. The MIEAB meets quarterly and reviews EPSCoR progress, and oversees the selection process for RII proposals.

EPSCoR Management Team: The Maine EPSCoR Office at the University of Maine is under the direction of Maine NSF EPSCoR Project Director Dr. Michael Eckardt (UMaine Vice President for Research) and Associate Project Director Vicki Nemeth (UMaine Director of Research Administration & Maine EPSCoR). Both have served in these capacities for over 5 years. The office is responsible for all project oversight and management, and in addition to the Director, has a staff of two program assistants and two undergraduate students. The research focus was under the direction of the FBRI Management Team, which consisted of two Research Project Co-Directors and two Associate Directors. This team meet regularly (at least monthly) and was responsible for the coordination and implementation of the research activities; integrating research and educational initiatives; recruiting and mentoring faculty, staff, and students; working with the FBRI Advisory Board; establishing effective collaborations; engaging in technology transfer; and ensuring sustainability. Other research program staff included a newly hired Project Coordinator, an Administrative Assistant, and a part-time Communications Coordinator. The FBRI has applied to become an Organized Research Unit of UMaine, and as such will continue to report to Dr. Eckardt after the NSF EPSCoR funding period has ended.

FBRI researchers participated in seven research clusters – three ‘use-inspired themes’ and four ‘discovery-driven thrusts’. The themes focus on addressing selected opportunities and overcoming known barriers in: 1) promoting forest health for a stable bio-economy through sustainable feedstocks and markets; 2) understanding and separating wood components for effective further processing; and 3) creating and commercializing new bioproducts technologies. The thrusts focus on enabling tools and methodologies to support activities in the themes, cut across multiple themes, and are organized as: (H) Human Dimensions, (N) Nanotechnology, (B) Biological processing, and (T) Thermal conversion. This type of focused research cluster organization has fostered cross-disciplinary collaboration resulting in new perspectives and renewed synergy directed at FBRI. The FBRI management team met monthly with the theme and thrust leaders, who then had regular team meetings with their researchers.

Committees: a list of the MIEAB members and affiliations can be found in Appendix 1, and the FBRI external Advisory Committee members and affiliations are in Appendix 10.

Outside Technical Assistance: four major conferences were presented during the award timeframe, all of which involved NSF representatives as well as representatives from other federal agencies and regional/national experts:

2006 Maine EPSCoR State Conference: representatives from NSF, EPA EPSCoR, NIH IDeA, and AAAS gave presentations (150 participants).

2007 EPSCoR/USDA SBIR Workshop: over 50 presenters participated in panels on various SBIR-related topics (175 participants from around the region & nation).

2008 Maine EPSCoR State Conference: nine NSF program officers and representatives gave presentations on their respective directorates and met one-on-one with researchers (190 participants). An NSF Grant-writing workshop was given on the second day, led by another NSF program officer (70 participants).

2009 Maine EPSCoR State Conference: provided researchers and students around the state/region with information and networking opportunities for EPSCoR/IDeA programs, information and connections to help increase R&D capacity and competitiveness, networking opportunities for research and educational outreach collaborations, and a showcase for research being done in the region (148 participants from government, industry, and academia).

In addition, FBRI utilized outside consultants to develop plans for the Technology Center, provide assistance in several research areas, and to develop the FBRI website. Maine EPSCoR utilized a graphic and web-design consultant to develop marketing materials and to begin the upgrade process for the Maine EPSCoR website.

i. Jurisdictional and Other Support:

Resources available to the RII project include: 1) MIEAB member expertise and guidance; 2) office space and staffing for Maine EPSCoR; 3) space for the FBRI office, graduate students, postdocs, technicians, new faculty, and equipment; 4) media services such as film, photography, design, etc.; 5) access to additional state-of-the-art research facilities at the University of Maine; 6) access to additional state-of-the-art equipment at the University of Maine and partner institutions; 7) access to other faculty expertise as needed throughout the state; 8) support of collaborative partners for research and education; 9) support of outreach partners for research and education.

j. Unobligated Funds:

All of the original and supplemental NSF funds for this project have been fully expensed in accordance with the project scope and intent. The University of Maine provided over \$3.5 in additional support for this project during the award period.

3) Jurisdiction Specific Terms and Conditions

Specific RII contract terms included:

- 1) Women and underrepresented groups - see Diversity section B.2.b and Appendix 3 &4
- 2) Linkages to other NSF- see section B.2.g.3
- 3) Budget: see section B.2.j

4) Experimental/Computational Facilities

In support of the project's Objective #3 to improve the state's physical infrastructure in this focus area through the acquisition of new equipment and new research capabilities, over \$3.35M was invested in this area. Additionally, \$146,729 was expended on accompanying facilities renovation/expansion in order to accommodate the new equipment. The 52 pieces of new equipment are maintained and operated by the FBRI project's two full-time technicians, and

are available for use at no charge by any of the 32 core faculty. A complete detailed list of major equipment purchased during the project can be found in Appendix 6.

Three laboratories for chemical, thermal and microscopy-based analysis, and an additional one for biocatalysis and fermentation are now fully renovated, equipped, and operational. This provides the necessary instrumentation for analysis of liquid extracts as well as solids encountered in woody biomass processing and conversion into bioproducts. A fifth pilot-scale biomass processing laboratory has been developed as a custom-designed pre-treatment and extraction facility capable of handling wood chips, wood strands, and steam-exploded biomass at elevated temperatures and pressures under computer control. In addition, a new work area for the FBRI graduate students and postdocs was created, and additional offices for the Maine NSF EPSCoR Office were obtained and renovated.

5) Publications and Patents

Publications: FBRI faculty published 92 related scientific journal publications and 62 books and other one-time publications. Five websites were produced, including a comprehensive FBRI website that went live in December 2007. (Details are in NSF Fastlane.)

Patents: FBRI researchers filed 9 related patents, 5 of which have been licensed so far, 3 are pending, and one was abandoned.

| Date: | Type: | Faculty: | Description | Status: |
|-----------|--------------------------------|-------------------|--|---------------------|
| 5/9/2006 | Provisional Patent Application | Neivandt, David | US Utility & Foreign Equivalents: Filed 09 May 2007, Converted from Provisional: Filed 09 May 2006, Gramlich, Oporto, Gardner Neivandt 'A procedure to improve the adhesive bonding between resin and wood plastic composites' | converted - pending |
| 11/8/2006 | Provisional Patent Application | Bilodeau, Michael | "A Method of Producing a Composition Useful as a Dry Strength Additive and/or a Retention Aid" | licensed |
| 11/8/2006 | Provisional Patent Application | Bilodeau, Michael | "A Method of Producing a High Yield Pulp Useful in the Manufacture of Paper, Board and Composite Materials" | # yet to be issued |
| 11/8/2006 | Provisional Patent Application | Bilodeau, Michael | "A Process to Convert Lignocellulosics into a Plurality of Products with a High Overall Yield and Efficiency" | # yet to be issued |
| 2007 | Provisional Patent Application | Bilodeau, Michael | "Novel method to improve wood pellet manufacturing process and quality" | 60/998,006 |
| 1/1/2007 | Provisional Patent Application | Neivandt, David | US Provisional: Filed 08 January 2007, Jabar, Bilodeau, Neivandt, Spender, Jabar 'Aqueous Adhesive Composition' | abandoned |

| | | | | |
|-----------|--------------------------------|------------------------|---|--|
| 10/7/2008 | Provisional Patent Application | Van Heiningen, Adriaan | Van Heiningen. Recovery of Acetic acid from Wood Extracts. | licensed |
| 12/9/2008 | foreign patent filed | van Walsum , G. Peter | Van Heiningen, Afriaan, Sixta, Herbert, Byung-Hwan Um, van Walsum, Peter. 2009. Recovery of Acetic acid from Wood Extracts. | International publication Number WO 2009/059228 A2 |
| 2009 | Provisional Patent Application | Shaler, Stephen | Multifunctional reinforcement system for wood composite panels | US Patent 7,547,470 B2 (issued June 16, 2009) |

6) Honors and Awards

Thirteen FBRI faculty and students received special awards and recognitions related to their FBRI research. These are detailed in Appendix 9.

C) Highlights

Three research and education highlights follow.

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

Research and Education Highlight #1

Maine EPSCoR at University of Maine

5717 Corbett Hall, Room 444,
Orono, ME 04469-5717
Phone: (207)-581-2285
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www.umaine.edu/epscor



Prof. Hemant Pendse and Keith Hodgins showing
FBRI wood extraction facility to industry representatives.

FBRI Wood Extracts Attract National Attention

Under an NSF EPSCoR RII award, researchers at the Forest Bioproducts Research Initiative (FBRI) at the University of Maine have been working on the utilization of wood extracts to produce biofuels like ethanol, butanol, and jet fuel at integrated commercial forest biorefineries. This has resulted in the development of two wood-extraction technologies that can be integrated with existing manufacturing facilities for pulp or orientated strand board/lumber (OSB/OSL), and the ability to scale-up technologies so that commercial partners can get design data at an industrially relevant scale of operation.

Under the NSF EPSCoR award, UMaine's pre-pulping extraction technology has already been deployed at the nearby Old Town Fuel & Fiber (OTFF) mill, and with a recent Department of Energy award for a biorefinery demonstration project, the Old Town facility will continue to be at the forefront of change. The project is proceeding with the active involvement of five FBRI faculty, who are focusing on co-production of pulp, fuels and chemicals. In addition, UMaine's pre-OSB/OSL extraction technology also got a boost with a grant from the Maine Technology Institute for a project involving the FBRI, the University's Advanced Structures and Composites Center, and the Louisiana Pacific Corporation (L-P).

This innovative extraction activity has received national attention, with project leaders from Logos Technologies of Arlington, VA visiting UMaine in connection with their 'BioJet' project funded by a prime contract from the Defense Advanced Research Projects Agency (DARPA) to produce jet fuel from cellulosic biomass. The Logos team was accompanied by DARPA representatives from the biofuels program that focuses on alternative feedstocks that do not compete with food sources. The DARPA/Logos team is looking into wood extracts that can be converted into jet fuel.

In addition, The Agenda2020 Technology alliance of American Forest and Paper Association (AF&PA) held their 'Value Prior to Pulping (VPP)' program review meeting at UMaine. AF&PA guests included representatives from several large pulp manufacturers, as well as researchers from the Forest Products Laboratory in Madison, WI and the National Renewable Energy Laboratory (NREL) in Golden, CO. The VPP team is focusing on the use of wood extracts for ethanol production at pulp mills, and UMaine's Process Development Center, with its pilot scale wood extraction facility, was a major highlight for these visitors. Wood from Maine's forests is a certified sustainable renewable year-round resource, and wood extracts from existing forest product facilities are particularly attractive early candidates for biorefineries.

**Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts**

Research and Education Highlight #2

Maine EPSCoR at University of Maine

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**Two New Bioplastics Projects Put FBRI
at the Forefront of Industry**

Prof. Hemant Pendse demonstrating UMaine pre-extraction technologies for wood chips going to pulp, and wood strands going to orientated strand board/lumber (OSB/OSL)

Begun under an NSF EPSCoR RII award, the Forest Bioproducts Research Initiative (FBRI) at the University of Maine is now active in two Sustainable Bioplastics projects in collaboration with a consortium of private companies and academic collaborators. Joint research and development activities will lead to the production of sustainable bioplastics using renewable resources from the New England region, and represents a new strategic direction and opportunity for FBRI to utilize biomass wood for polymers in leading consumer products.

Lab-scale fermentation studies have shown the potential to produce these key bioplastics from a range of potential sugar feedstocks. Therefore, several industrial sites in the region with significant existing commercial infrastructure (such as on-site electricity, steam generation, fresh/waste water treatment capacity, and railway transportation access) have been evaluated for the potential to host fermentation and/or bioplastics polymerization operations. In addition, a market survey of potential bioplastic users was conducted and used to estimate the current market size and the potential growth rate for substituting bioplastics for petrochemical-based plastics.

One of the projects, supported by the Maine Technology Institute, has focused on demonstrating the economic viability of producing polylactic acid (PLA) for fiber and foam markets using potato waste and forest biomass as feed. The Sustainable Bioplastics Council of Maine supports and promotes the use and production of bioplastics from renewable feedstocks consistent with the principles of Green Chemistry, with a focus on sustainability, and is coordinating the PLA project with a total budget of \$1 million. The council membership is comprised of potential feedstock providers, technology suppliers, large and small manufacturers, and non-profit organizations. UMaine's Process Development Center is coordinating FBRI involvement in this project.

The other project, supported by a \$1.8 million grant to Itaconix LLC from the U.S. Departments of Agriculture (USDA) and Energy (DOE) is focused on utilizing woody biomass in the production of polyitaconic acid (PIA) for super absorbent and dispersant markets. The PIA project is a tri-state partnership involving Itaconix LLC of Dover, NH; Microbia Inc. of Lexington, MA; and UMaine's FBRI.

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

Research and Education Highlight #3

Maine EPSCoR at University of Maine

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**Maine STEM Collaborative Leads
Statewide Education Efforts**

Maine Governor John Baldacci signs into law LD 1101: 'Resolve, to Understand and Assist in Efforts to Promote STEM Education'

Maine's rural economy is increasingly dependent on innovation and global competitiveness, with 40% of its industries projected to gain jobs in STEM-related fields over the next five years. It is therefore critical for the state to have a workforce prepared with a strong background in science, technology, engineering, and mathematics (STEM).

In recognition of this, the Maine STEM Collaborative was formed as a partnership of education, research, business, government, non-profit sectors, and teacher advisory groups who have come together to foster the improvement of STEM education in the state. Maine EPSCoR is a founding member, and played a lead role in the development of a statewide STEM strategic plan.

The strategic plan calls for an increase in Maine's P-20 student STEM participation by 10% by 2014 through a strong, coherent, consistent, and integrated STEM education system. This will be accomplished by focusing on the following main objectives:

- Foster innovation in schools through the vertical alignment of STEM education from pre-K through graduate education, and the horizontal alignment across all disciplines.
- Support the state's human network for leadership development, professional development, and workforce development.
- Integrate, coordinate, and refine existing STEM efforts in the state for greater program effectiveness and impact.
- Integrate a STEM career pathways initiative into all areas of P-20 STEM education in order to generate greater awareness and interest.
- Make a strong case for STEM for current and future Maine economic development.
- Develop new systems and processes for gathering, monitoring, and analyzing baseline and on-going data on STEM education in the state.
- Work towards greater financial support for STEM education efforts in Maine.

Maine EPSCoR aligns its NSF EPSCoR RII education efforts with those of the Collaborative, and also supports the group's annual Maine STEM Summit, a new STEM Schools and STEM Partners programs, and the development of a state STEM website and other communication tools. In response to recent Maine STEM legislation, Maine EPSCoR will also support a key landscape study on STEM levels and efforts in Maine.

**Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts**

**APPENDIX 1: State EPSCoR Committee Members
Maine Innovation Economy Advisory Board**

| Name: | Association: |
|------------------------------|--|
| James Atwell | Sevee & Maher Engineers, Inc. |
| Dr. Ken Ault | Maine Medical Center Research Institute |
| Dr. Pam Baker | Bates College |
| Bruce Bornstein | Isaacson Lumber Co. |
| John Burns | Small Enterprise Growth Fund |
| Dr. Jacque Carter | University of New England |
| Dr. H.J. Dagher P.E. | Advanced Engineered Wood Composites Center, University of Maine |
| Dr. Michael Eckardt | Vice President for Research, University of Maine |
| Karin Gregory | Furman, Gregory, Hahn |
| Dr. Patricia Hand | MDI Biological Laboratory |
| Dr. William Harris | Marical Inc. |
| Rita Helms, JD | University of Southern Maine School of Law |
| Dr. Janet Hock | Maine Institute for Human Genetics and Health |
| Dr. Jack Kartez | University of Southern Maine |
| Whitney King | Colby College |
| Robert Lad | Dept. of Physics and Astronomy, University of Maine |
| Peter Merrill | WahicoMetroflex, Inc. |
| Peter Murray | Quantrix |
| Captain Robert Peacock | R.J. Peacock Canning Co. |
| Dr. Hemant Pendse | Dept. of Chemical & Biological Engineering, University of Maine, Orono |
| Dr. Don Perkins | Gulf of Maine Aquarium |
| Jane Sheehan | Foundation for Blood Research |
| Dr. Michael Sieracki | Bigelow Laboratory for Ocean Sciences |
| Dr. Dale Syphers | Bowdoin College |
| Dr. Barbara Tennent | The Jackson Laboratory |
| Miles Theeman | Affiliated Healthcare System |
| Stephen Von Vogt | Maine Marine Composites |
| Dr. John Wise, Sr | University of Southern Maine |
| Dr. John Wright | University of Southern Maine |
| <i>Dr. Catherine Renault</i> | <i>ex officio member Office of Innovation, DECD</i> |
| <i>Dr. Betsey Biemann</i> | <i>ex officio member, Maine Technology Institute</i> |

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

APPENDIX 2: Project Goals and Objectives

OVERALL PROJECT GOAL: provide strategic programs and opportunities that will solidify and strengthen Maine’s R&D capacity and competitiveness in the area of forest bioproducts research.

| PROJECT OBJECTIVES: (in the theme area) | ACTIVITIES: | EVIDENCE: | OVERALL OUTCOMES: |
|--|--|---|--|
| <p>Advance cutting-edge science and engineering capabilities for discovery and innovation in this focus area in order for Maine’s academic, non-profit, and for-profit R&D community to:</p> <ul style="list-style-type: none"> a) increase research capabilities b) increase competitiveness & federal funding c) acquire new technical skills & knowledge d) develop new collaborations | <ul style="list-style-type: none"> • create the Forest Bioproducts Research Initiative (FBRI) at the University of Maine, bringing together statewide researchers from up to 13 different disciplines to address the focus area. • examine at least three scientific theme areas: 1) forest bioproducts sustainability, 2) extraction and residual solids control, and 3) separation and conversion to new products. • utilize additional cross-focus areas such as bioprocessing, surfaces and nanotechnology, computational chemistry, and resource modeling in the R&D focus | <ul style="list-style-type: none"> • # grant submissions, awards, and funding levels • multi-departmental/ multi-disciplinary/ multi-institutional research • involvement of undergraduate institutions in corollary research • quality and results of research • # cited works, peer-reviewed publications • national visibility and participation (review panels, boards, etc.) • awards, prizes, recognitions, etc. • hosted events (conferences, workshops, etc.) • # & level of federal awards funded | <ul style="list-style-type: none"> • Provide the basic research to create the next generation of industrial and consumer products that will efficiently utilize our forest resources and lessen our dependence on petroleum resources (i.e. by finding functional substitutes for products that are currently made from oil, such as containers, adhesives, coatings, etc.). • Create opportunities to help transform the state’s current forest-based industry into globally competitive biorefineries that can utilize forest-based products in a more efficient, higher value manner that is also environmentally cleaner (saving and creating jobs). • Maximize the efficient and wise use of forest acreage in the state through a holistic approach that takes all stakeholder concerns into consideration. |

| PROJECT OBJECTIVES: (in the theme area) | ACTIVITIES: | EVIDENCE: | OVERALL OUTCOMES: |
|--|---|---|--|
| <p>Enhance human resource development in this focus area:</p> <ul style="list-style-type: none"> a) for current researchers b) for future researchers | <ul style="list-style-type: none"> • support 47 new hires (faculty, staff, postdocs, technicians, professionals, graduate and undergraduate students) • support a minimum of 25 current faculty at Maine’s educational institutions • provide researcher development programs (funding & training opportunities) • provide research, training, & education opportunities for graduate and undergraduate students • provide opportunities for Maine high school, undergraduate, and graduate students to participate in a diverse selection of research and educational experiences • provide opportunities for related K-12 teacher & student STEM activities • increase the participation of women & underrepresented groups in STEM activities | <ul style="list-style-type: none"> • High school student participation in related STEM activities • undergraduate student participation in related STEM activities • graduate student assistantships & participation in related STEM activities • # related undergraduate and graduate courses • # post-doctoral personnel hired/involved • # new faculty/professionals hired/involved • diversity levels (women & underrepresented groups) • K-12 teacher training & involvement • K-12 student involvement | <ul style="list-style-type: none"> • Provide training and opportunities to support the efforts of current researchers to increase their capabilities and competitiveness • Provide training and opportunities that will foster the next generation of leaders and researchers in this field. |

| PROJECT OBJECTIVES: (in the theme area) | ACTIVITIES: | EVIDENCE: | OVERALL OUTCOMES: |
|---|---|--|--|
| <p>Improve the state’s physical infrastructure in this focus area</p> | <ul style="list-style-type: none"> • provide \$3.35M in new major equipment to support the FBRI research • provide small equipment funding for researchers, high schools, small businesses, and undergraduate institutions | <ul style="list-style-type: none"> • new research capabilities • facilities (square footage) renovated or expanded • new or enhanced capital equipment • new levels of small equipment | <ul style="list-style-type: none"> • enable all of the proposed activities and outcomes to occur |
| PROJECT OBJECTIVES: (in the theme area) | ACTIVITIES: | EVIDENCE: | OVERALL OUTCOMES: |
| <p>Show a positive economic impact for the state by providing a solid scientific platform for the effective transfer of technology in this focus area from Maine’s research institutions to the private sector</p> | <ul style="list-style-type: none"> • Engage in meaningful partnership activities with state, regional, national, and international research and educational institutions, small businesses, and industry • Provide small business development programs in this focus area • Convey scientific progress & information to the science and industry communities • Convey scientific progress & information to the public, legislators, government entities, & other stakeholders | <ul style="list-style-type: none"> • level of private industry investment, collaboration, and development • # jobs created • # intellectual property licenses, patent disclosures, applications, awards, etc. • new spin-off companies & development of emerging companies • # STIR, SBIR, GOALI submissions and awards for the State | <ul style="list-style-type: none"> • Help to provide statewide opportunities for additional private capital investments in this area. • Create linkages throughout the state, region, nation, and world that will put Maine’s forest bioproducts research in a position to help solve the problem of over-reliance on petroleum resources. |

**Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts**

**APPENDIX 3: Project Personnel
(financially supported directly & indirectly through outreach)**

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|------------|------------|-----------|---------------------------|-----|------|------|-------|
| Consultant | Haibo | Mao | Chem & Bio Engineering | | | | x |
| Consultant | Greg | Norris | Sylvatica | x | x | | |
| Consultant | Del | Raymond | Retired | x | x | x | x |
| Faculty | Kathleen | Bell | Resource Economics | x | x | x | |
| Faculty | Jeff | Benjamin | Forest Resources | x | x | x | x |
| Faculty | George | Bernhardt | DOE | | x | x | x |
| Faculty | Michael | Bilodeau | Chemical Engineering | x | x | x | x |
| Faculty | Douglas | Bousfield | Chem & Bio Engineering | x | x | x | x |
| Faculty | Michael | Call | DOE | | x | | x |
| Faculty | Barbara | Cole | Chemistry | x | x | x | x |
| Faculty | William | DeSisto | Chem & Bio Engineering | | x | x | x |
| Faculty | Darrell | Donahue | Chem & Bio Engineering | x | x | x | x |
| Faculty | Raymond | Fort | Chemistry | x | x | x | x |
| Faculty | David | Frankel | Chem & Bio Engineering | | | | x |
| Faculty | Brian | Frederick | Chem & Bio Engineering | | x | x | x |
| Faculty | Douglas | Gardner | Forest Resources | x | x | x | x |
| Faculty | Joseph | Genco | Chem & Bio Engineering | x | x | x | x |
| Faculty | Anthony | Halog | Forest Resources | | x | x | x |
| Faculty | Jody | Jellison | Molecular Plant Pathology | x | x | x | x |
| Faculty | Nancy | Kravit | Chem & Bio Engineering | x | x | x | x |
| Faculty | Jessica | Leahy | Forest Resources | x | x | x | x |
| Faculty | Robert | Liliehalm | Forest Resources | x | x | x | |
| Faculty | Michael | Mason | Chem & Bio Engineering | x | x | | |
| Faculty | Paul | Millard | Chem & Bio Engineering | x | x | x | |
| Faculty | David | Neivandt | Chem & Bio | x | x | x | x |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|--------------|------------|---------------|------------------------------|-----|------|------|-------|
| | | | Engineering | | | | |
| Faculty | Yanghao | Ni | FBRI – Theme 2 | | x | | |
| Faculty | Hemant | Pendse | Chem & Bio Engineering | x | x | x | x |
| Faculty | Terry | Porter | Business | x | x | x | |
| Faculty | Jonathan | Rubin | Resource Economics | x | x | x | x |
| Faculty | Douglas | Ruthven | Chem & Bio Engineering | x | x | x | |
| Faculty | Catherine | Schmitt | Mitchell Ctr for Env Studies | x | | x | |
| Faculty | Stephen | Shaler | Forest Resources/AEWC | x | x | x | x |
| Faculty | Carl | Tripp | DOE | | x | | x |
| Faculty | Adriaan | van Heiningen | Chem & Bio Engineering | x | x | x | x |
| Faculty | Peter | van Walsum | Chem & Bio Engineering | | x | x | x |
| Faculty | Peter | Vaux | Mitchell Ctr for Env Studies | x | | x | |
| Faculty | Robert | Wagner | Forest Resources | x | x | x | x |
| Faculty | Aaron | Weiskittel | Forest Resources | | x | x | x |
| Faculty | Clayton | Wheeler | Chem & Bio Engineering | | x | x | x |
| Faculty | Jeremy | Wilson | Forest Resources | x | x | x | |
| Grad Student | Aymn | Abdulrahman | Chem & Bio Engineering | | | x | x |
| Grad Student | Madieh | Aghazadeh | Forest Bioproducts | | | | x |
| Grad Student | Rakhi | Baddam | Chem & Bio Engineering | | x | x | x |
| Grad Student | James | Beaupre | Chem & Bio Engineering | x | x | | |
| Grad Student | Mohit | Bhatia | Forest Bioproducts | | | x | x |
| Grad Student | Roger | Blanchette | Computer Engineering | x | | | |
| Grad Student | Kate | Brevin | Forest Resources | | | | x |
| Grad Student | Julia | Briedis | Forest Resources | | x | x | |
| Grad Student | Rongkai | Chen | Forest Bioproducts | | | | x |
| Grad Student | Xiaowen | Chen | Chemical Engineering | x | x | x | |
| Grad Student | Charles | Coup | Forest Resources | | x | x | |
| Grad Student | Sagar | Deshpande | Chem & Bio Engineering | x | x | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|--------------|------------|---------------|---------------------------|-----|------|------|-------|
| Grad Student | Victor | Gaetemartinez | Forest Resources | | x | | |
| Grad Student | Isaac | Ghampson | Chem & Bio Engineering | | x | x | x |
| Grad Student | Benjamin | Goundie | Physics | | | | x |
| Grad Student | LeRae | Graham | Chemistry | x | x | x | |
| Grad Student | Gretchen | Heldmann | Forest Resources | x | x | | |
| Grad Student | Caitlin | Howell | Molecular Plant Pathology | x | x | x | |
| Grad Student | Rory | Jara | Chem & Bio Engineering | | x | x | x |
| Grad Student | Ashoka | Karunarathne | Forest Bioproducts | | | | x |
| Grad Student | Heini | Lehtonen | Chem & Bio Engineering | | | x | |
| Grad Student | Lei | Li | Chem & Bio Engineering | x | x | x | x |
| Grad Student | Haibo | Mao | Chem & Bio Engineering | x | x | | x |
| Grad Student | James | Marciano | Forest Resources | | x | x | |
| Grad Student | Peter | McBride | Forest Resources | x | x | | |
| Grad Student | Wilfred | Mercier | Forest Resources | x | x | | x |
| Grad Student | Ryan | Mills | Forest Resources | x | x | x | |
| Grad Student | Saikrisha | Mukkamala | Forest Bioproducts | | | x | x |
| Grad Student | Bhupendra | Nagpure | Physics | | x | x | |
| Grad Student | Richard | Nelson | Chem & Bio Engineering | | | x | |
| Grad Student | Binod | Neupane | Forest Resources | | | x | x |
| Grad Student | Gloria | Oporto | Forest Resources | x | x | x | x |
| Grad Student | Maryam | Panahiazar | FBRI | | x | | |
| Grad Student | Juan | Paredes | AEWC | x | x | x | |
| Grad Student | Joseph | Pekol | Forest Resources | | | | x |
| Grad Student | Boyan | Peshlov | Chem & Bio Engineering | x | | | |
| Grad Student | Rachel | Pollock | Chemistry | | | x | x |
| Grad Student | Rikard | Rigdal | Forest Bioproducts | | | x | |
| Grad Student | Baburam | Rijal | Forest Resources | | | x | x |
| Grad Student | Robert | Rioux | Chemical Engineering | x | x | | |
| Grad Student | Pamela | Ruiz | Forest Bioproducts | | | x | x |
| Grad Student | Matthew | Russell | Forest Resources | | | | x |
| Grad Student | Roger | Ryder | Chem & Bio | | | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|--------------|------------|------------|--------------------------|-----|------|------|-------|
| | | | Engineering | | | | |
| Grad Student | Nazia | Siddiqui | Chem & Bio Engineering | x | x | x | |
| Grad Student | Margaret | Southworth | Chem & Bio Engineering | x | | | |
| Grad Student | Timothy | Thibodeau | Chemistry | | | x | x |
| Grad Student | Mehmet | Tunc | Chem & Bio Engineering | x | x | x | |
| Grad Student | Sara | Walton | Chem & Bio Engineering | x | x | x | x |
| Grad Student | Julian | Wiggins | Forest Resources | x | x | | |
| Grad Student | Joshua | Wright | Physics | | | | x |
| Grad Student | Ana | Zivanovic | Forest Resources | | x | x | |
| H.S. Student | Hosain | Aghamoosa | Orono High School intern | | x | | |
| H.S. Student | Tionna | Baldwin | Orono High School intern | | x | x | |
| H.S. Student | Norah | Bird | Orono High School intern | | | | x |
| H.S. Student | Jenna | Borden | Orono High School intern | | | | x |
| H.S. Student | Meghan | Curtis | Orono High School intern | | | | x |
| H.S. Student | Nathan | Curtis | Orono High School intern | | x | x | |
| H.S. Student | Anne | Davison | Orono High School intern | | | x | |
| H.S. Student | Jordan | Dudley | Orono High School intern | | x | | |
| H.S. Student | Sorel | Edes | Orono High School intern | | | x | x |
| H.S. Student | Lee | Hecker | Orono High School intern | | | x | x |
| H.S. Student | Ashley | Husson | Orono High School intern | | x | | |
| H.S. Student | Kelsey | Johnson | Orono High School intern | | | x | |
| H.S. Student | Sean | Kilpatrick | Orono High School intern | | | x | x |
| H.S. Student | Karl | Koehler | Orono High School intern | | | | x |
| H.S. Student | Daniel | Lesser | Orono High School intern | | | | x |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|---------------------|------------|------------|-----------------------------------|-----|------|------|-------|
| H.S. Student | Amy | Mares | Orono High School intern | | | x | |
| H.S. Student | Ruth | Mares | Orono High School intern | | | | x |
| H.S. Student | Andrew | Michaud | Orono High School intern | | x | | |
| H.S. Student | Paul | Ohno | Orono High School intern | | | x | |
| H.S. Student | Brian | Park | Orono High School intern | | | x | x |
| H.S. Student | Anthony | Raymond | Orono High School intern | | x | | |
| H.S. Student | Nikolai | Renedo | Orono High School intern | | | | x |
| H.S. Student | Benjamin | Richards | Orono High School intern | | x | | |
| H.S. Student | Devon | Riley | Orono High School intern | | | x | |
| H.S. Student | Jessica | Riley | Orono High School intern | | | | x |
| H.S. Student | Mark | Rowe | Orono High School intern | | | | x |
| H.S. Student | Lauren | Wheeler | Orono High School intern | | x | | |
| H.S. Student | Max | Winter | Orono High School intern | | x | x | |
| Outreach Consultant | Katherine | Schmidt | Tethys Research LLC | | x | | |
| Outreach Faculty | Andrew | Barton | University of Maine at Farmington | x | | | |
| Outreach Faculty | David | Correia | University of Maine at Farmington | x | | | |
| Outreach Faculty | Tandy | Delvecchio | Mathematics & Statistics | | | x | |
| Outreach Faculty | Stephen | Engle | University of Maine at Farmington | x | | | |
| Outreach Faculty | William | Hillary | Eastern Maine Community College | | | x | |
| Outreach Faculty | Matthew | McCourt | University of Maine at | x | | | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|------------------------|------------|----------------|--|-----|------|------|-------|
| | | | Farmington | | | | |
| Outreach Faculty | Jonathan | Moyer | Husson University | | | x | |
| Outreach Faculty | Molly | Schauffler | Earth Science/Climate Change Institute | | x | | |
| Outreach Faculty | Tod | Shockey | Mathematics & Statistics | | | x | |
| Outreach Faculty | John | Wise | University of Southern Maine | x | x | x | |
| Outreach Undergraduate | Drew | Janoch | Habitat Planning | | | x | |
| Outreach Faculty | Hong | Xie | University of Southern Maine | | x | x | |
| Outreach Grad Student | Andrea | Burke | OPSE | | | x | |
| Outreach Grad Student | Roger | Feeley | Physics Education Research | | | x | |
| Outreach Grad Student | Maria | Girouard | Wabanaki Center | | x | | |
| Outreach Grad Student | Mindi | Kvaal Anderson | Physics | | | x | |
| Outreach Grad Student | Carolyne | LaCerte | University of Southern Maine | | x | x | |
| Outreach Grad Student | Matthew | Leland | Mechanical Engineering | | | x | |
| Outreach Grad Student | Nitisha | Mitchell | Physics & Astronomy | | | x | |
| Outreach Grad Student | Casey | Murphy | School of Biology & Ecology | | | x | |
| Outreach Grad Student | Lisa | Schultz | Physics & Mathematics | | | x | |
| Outreach Grad Student | Joel | Van Deventer | Physics & Mathematics | | | x | |
| Outreach Grad Student | Sara | Willett | Wabanaki Center | | | x | |
| Outreach H.S. Student | Jenny | Huang | Cheverus High School | | x | x | |
| Outreach H.S. Student | Catherine | Wise | Cheverus High School | | x | x | |
| Outreach K-12 Teacher | Brett | Achorn | Calais High School | | | x | |
| Outreach K-12 Teacher | Fred | Almquist | Bucksport Middle School | | | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|-----------------------|------------|----------------|-------------------------------------|-----|------|------|-------|
| Outreach K-12 Teacher | Keri | Ballard | Central High School | | | x | |
| Outreach K-12 Teacher | Shane | Barker | Troy Howard Middle School | | | x | |
| Outreach K-12 Teacher | Karen | Beckler | Gardner Middle School | | | x | |
| Outreach K-12 Teacher | Patricia | Bernhardt | James F. Doughty Middle School | | | x | |
| Outreach K-12 Teacher | Annette | Brickley | Challenger Learning Center of Maine | | | x | |
| Outreach K-12 Teacher | Will | Brooks | Waldo County Tech Center | | | x | |
| Outreach K-12 Teacher | Scott | Burgess | John Bapst Memorial High School | | | x | |
| Outreach K-12 Teacher | Kevin | Coombs | Troy Howard Middle School | | | x | |
| Outreach K-12 Teacher | Linda | Davis | Troy Howard Middle School | | | x | |
| Outreach K-12 Teacher | Terry | Duffy | Katahdin High School | | | x | |
| Outreach K-12 Teacher | Laura | Farrington | SeDoMoCha Middle School | | | x | |
| Outreach K-12 Teacher | Steve | Gabel-Richards | Connors Emerson School | | | x | |
| Outreach K-12 Teacher | Susan | Gramlich | John Bapst Memorial High School | | | x | |
| Outreach K-12 Teacher | John | Guidi | Sumner High School | | | x | |
| Outreach K-12 Teacher | Ravin | Gustafson | Beatrice Rafferty School | | | x | |
| Outreach K-12 Teacher | Elizabeth | Haynes | Troy Howard Middle School | | | x | |
| Outreach K-12 Teacher | Dan | Hodgins | Wagner Middle School | | | x | |
| Outreach K-12 Teacher | Lindsay | Howe | SeDoMoCha Middle School | | | x | |
| Outreach K-12 Teacher | Will Tad | Johnston | William Cohen Middle School | | | x | |
| Outreach K-12 Teacher | Lisa | Kelley | Nokomis High School | | | x | |
| Outreach K-12 Teacher | Robin | Kennedy | Challenger | | | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|-----------------------|------------|-----------------|---------------------------------|-----|------|------|-------|
| Teacher | | | Learning Center of Maine | | | | |
| Outreach K-12 Teacher | Kathi | King | Messalonskee High School | | | x | |
| Outreach K-12 Teacher | Beverly | Koelbl | Troy Howard Middle School | | | x | |
| Outreach K-12 Teacher | Victor | Laprade | Nokomis High School | | | x | |
| Outreach K-12 Teacher | Jean | Lawlir | Searsport District High School | | | x | |
| Outreach K-12 Teacher | Edward | Lindsey | Old Town High School | | | x | |
| Outreach K-12 Teacher | Kelley | Littlefield | Troy Howard Middle School | | | x | |
| Outreach K-12 Teacher | Jamee | Luce | Messalonskee High School | | | x | |
| Outreach K-12 Teacher | Jeanne | Lysobey | Gardner Middle School | | | x | |
| Outreach K-12 Teacher | John | Mannette | Bucksport High School | | | x | |
| Outreach K-12 Teacher | Kate | McKann | Bangor High School | | | x | |
| Outreach K-12 Teacher | Joanna | Meyer | Hermon High School | | | x | |
| Outreach K-12 Teacher | Cynthia | Moran | Wagner Middle School | | | x | |
| Outreach K-12 Teacher | Brenda | Murphy | John Bapst Memorial High School | | | x | |
| Outreach K-12 Teacher | Michael | Murphy | John Bapst Memorial High School | | | x | |
| Outreach K-12 Teacher | Jeff | Owen | Orono High School | | | x | |
| Outreach K-12 Teacher | William | Palmer | MSAD #5, Adult Ed | | | x | |
| Outreach K-12 Teacher | Jennifer | Parkhurst-Skala | Bucksport Middle School | | | x | |
| Outreach K-12 Teacher | Ellen | Payne | Nokomis High School | | | x | |
| Outreach K-12 Teacher | Jonathan | Pratt | Dover-Foxcroft Academy | | | x | |
| Outreach K-12 Teacher | Sharon | Provost | Margaret Chase Smith School | | | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|-----------------------|------------|-------------|--|-----|------|------|-------|
| Outreach K-12 Teacher | Ellen | Small | Greenville Middle School | | | x | |
| Outreach K-12 Teacher | Karen | Snyder | Nokomis High School | | | x | |
| Outreach K-12 Teacher | Don | Sprangers | Washington Academy | | | x | |
| Outreach K-12 Teacher | Rhonda | Stevens | Beatrice Rafferty School | | | x | |
| Outreach K-12 Teacher | Jane | Stork | Nokomis High School | | | x | |
| Outreach K-12 Teacher | James | Tyson | Maine Central Institute | | | x | |
| Outreach K-12 Teacher | Robert | Volenoti | Bucksport Middle School | | | x | |
| Outreach K-12 Teacher | Michael | Waters | Messalonskee High School | | | x | |
| Outreach Postdoc | Warren | Christensen | Physics Education | | | x | |
| Outreach Staff | Julie | Agri | Maine Tree Foundation | | x | x | |
| Outreach Staff | Summer | Allen | Center for Research on Sustainable Forests | | x | | |
| Outreach Staff | Tish | Carr | Maine Association of Conservation Districts | | x | x | |
| Outreach Staff | Liv | Detrick | Institute for Broadening Participation | | | x | |
| Outreach Staff | Amie | Gellen | Center for Science & Math Education Research | | x | x | |
| Outreach Staff | Sherry | Huber | Maine Tree Foundation | | x | x | |
| Outreach Staff | Abbe | Jacobs | Foster Student Innovation Ctr | | x | | |
| Outreach Staff | Renee | Kelly | Foster Student Innovation Ctr | | x | | |
| Outreach Staff | Donald | MacKay | Forest Research LLC | | | x | |
| Outreach Staff | Susan | MacKay | Forest Research LLC | | | x | |
| Outreach Staff | Patricia | Maloney | Maine Tree Foundation | | x | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|--------------------|------------|--------------|--|-----|------|------|-------|
| Outreach Staff | Deborah | Neuman | Target Technology Center | | x | | |
| Outreach Staff | Dana | Saywell | Institute for Broadening Participation | | | x | |
| Outreach Staff | Alan | Stenstrup | Maine TREE Foundation | | | x | |
| Outreach Staff | Tanya | Swain | Western Mountains Alliance | x | | | |
| Outreach Staff | Doreen | Vaillancourt | College of Engineering | | | x | |
| Outreach Staff | Susie | Valaitis | Institute for Broadening Participation | | | x | |
| Outreach Staff | Steve | Young | Habitat Planning | | x | x | |
| Outreach Undergrad | Kathleen | Barron | Eastern Maine Community College | | | x | |
| Outreach Undergrad | Matthew | Braun | University of Southern Maine | | | x | |
| Outreach Undergrad | Timothy | Brown | University of Maine | | | x | |
| Outreach Undergrad | Charles | Drew | College of Engineering | | | x | |
| Outreach Undergrad | Gesie | Gelin | Eastern Maine Community College | | | x | |
| Outreach Undergrad | Jamie | Juntura | Mathematics & Statistics | | | x | |
| Outreach Undergrad | Stacey | Kendall | Secondary Education/Mathematics | | | x | |
| Outreach Undergrad | Nicole | Meirimo | Eastern Maine Community College | | | x | |
| Outreach Undergrad | Andrea | Morrill | Mathematics & Statistics | | | x | |
| Outreach Undergrad | Mark | Okeny | University of Southern Maine | | x | | |
| Outreach Undergrad | Sherrie | Pederson | Eastern Maine Community College | | | x | |
| Outreach Undergrad | Sherry | Phillips | Eastern Maine Community | | | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|-----------------------|------------|-------------|--|-----|------|------|-------|
| | | | College | | | | |
| Outreach Undergrad | Rhonda | Rideout | Eastern Maine Community College | | | x | |
| Outreach Undergrad | Hamida | Suja | University of Southern Maine | | x | x | |
| Outreach Undergrad | Jeremy | Todd | University of Maine | | | x | |
| Outreach Undergrad | Jacob | Williams | Mathematics & Statistics | | | x | |
| Outreach Undergrad | James | Wise | University of Southern Maine | | x | x | |
| Outreach Youth Leader | Delfino | Almeida | Maine 4-H | | | x | |
| Outreach Youth Leader | Wendy | Almeida | Maine 4-H | | | x | |
| Outreach Youth Leader | James | Braley | Maine 4-H | | | x | |
| Outreach Youth Leader | Karen | Dyer | Maine 4-H | | | x | |
| Outreach Youth Leader | Christy | Fitzpatrick | Maine 4-H/Houlton High School | | | x | |
| Outreach Youth Leader | Penny | Kern | Maine 4-H | | | x | |
| Outreach Youth Leader | Sarah | LeBlanc | Maine 4-H/UMaine Cooperative Extension | | | x | |
| Outreach Youth Leader | Reva | Merrill | Maine 4-H | | | x | |
| Outreach Youth Leader | Roxanne | Smith | Maine 4-H | | | x | |
| Postdoc | Gurbakhash | Bhander | FBRI – Theme 1 | | x | x | |
| Postdoc | Abigail | Engelberth | Chem & Bio Engineering | | | | x |
| Postdoc | Joerg | Fick | FBRI – Theme 2 | x | | | |
| Postdoc | Keith | Hurley | DOE | | | x | x |
| Postdoc | Laura | Leitas | Forest Resources | | | | x |
| Postdoc | Rongxia | Li | FBRI – Theme 2 | | x | x | x |
| Postdoc | Mehmet | Tunc | Chem & Bio Engineering | | | | x |
| Postdoc | Byung-Hwan | Um | FBRI – Theme 3 | | x | x | x |
| Postdoc | Han-Seung | Yang | FBRI – nano thrust | | x | x | x |
| RET | Katy | MacDonal | University of | | | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|------|------------|---------------|---|-----|------|------|-------|
| | | d | Maine | | | | |
| RET | Timothy | Surette | James F. Doughty Middle School | | x | | |
| RET | Tracy | Vassailiev | James F. Doughty/William S. Cohen Middle School | | x | x | |
| REU | Gracson | Andrews | University of Colorado | | x | | |
| REU | Lucas | Andrusyk | Iowa State University | | | x | |
| REU | Christian | Barclay | Miami University | | | x | |
| REU | Rachel | Bowman | MIT | | | | x |
| REU | Alexander | Canney | Pensacola Christian College | | x | | |
| REU | Jesse | Capecelatro | SUNY, Binghamton | | | x | |
| REU | Stewart | Gramlich | University of Maine | | x | | |
| REU | James | Grudy | Harvard University | | | x | |
| REU | Abigail | Hamilton | University of Maine | | | x | |
| REU | Peter | Jacobson | West Virginia University | | | x | |
| REU | Jacob | Kavkewitz | University of Tennessee | | x | | |
| REU | Tatyana | Khamatnur ova | University of Texas | | | x | |
| REU | Andrew | Knox | Whitman College | | | x | |
| REU | Ryan | Lena | Tufts University | | x | | |
| REU | Andrew | O'Farrell | University of Colorado | x | x | | |
| REU | Brittany | Oetter | University of Colorado | | x | | |
| REU | Nimesh | Patel | University of Connecticut | | x | | |
| REU | Melody | Rhine | Emory University | | | x | |
| REU | Kelsey | Rush | University of Maine | | x | | |
| REU | Marcienne | Scofield | University of Maine | | | x | |
| REU | Ian | Stone | Louisiana State University | | | x | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|-------|------------|------------|-----------------------------------|-----|------|------|-------|
| REU | Nathaniel | Vacanti | University of Connecticut | | x | | |
| Staff | Wendy | Barclay | EPSCoR | | | x | |
| Staff | Sedat | Beis | Chem & Bio Engineering | | | x | x |
| Staff | Proserfina | Bennett | Chem & Bio Engineering | | | x | x |
| Staff | Vicky | Blanchette | FBRI- Communications | | | x | |
| Staff | Robert | Bryan | Theme I – Independent Contractor | | x | | |
| Staff | Thomas | Drake | Consultant | x | x | | x |
| Staff | Jennifer | Dunham | EPSCoR Office – Admin Asst | x | x | x | x |
| Staff | Michael | Eckardt | Project Director/VP Research | x | x | x | x |
| Staff | Wendy | Eckert | EPSCoR | x | x | x | |
| Staff | Russell | Edgar | Consultant | | x | | x |
| Staff | Lucas | Ellis | Chem & Bio Engineering | | x | | |
| Staff | Gerard | Gagnon | Chem & Bio Engineering | | x | x | x |
| Staff | James | Gosz | Independent Contractor | | | x | |
| Staff | Cynthia | Grove | EPSCoR Office – Admin Asst | x | x | x | x |
| Staff | Scott | Higgins | Chem & Bio Engineering | | | x | |
| Staff | Jonathan | Hill | Forest Bioproducts | | | x | x |
| Staff | Roberta | Laverty | AEWC – temporary Commun | x | | | |
| Staff | Sandra | Neily | EPSCoR Office – Commun & Outreach | x | x | | |
| Staff | Vicki | Nemeth | EPSCoR Office – Director | x | x | x | x |
| Staff | Dhake | Parag | Chem & Bio Engineering | | | x | |
| Staff | Sheila | Pendse | FBRI – Communications | | | | x |
| Staff | Judith | Rose | EPSCoR | x | x | x | |
| Staff | Lynne | Slusarz | FBRI – Admin. Asst. | | | | x |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|---------------|------------|-------------|------------------------------------|-----|------|------|-------|
| Staff | Jonathan | Spender | Theme 3 | | | x | x |
| Staff | Megan | Wolters | EPSCoR | | | x | x |
| Staff | Haixuan | Zou | Chem & Bio Engineering | x | | | |
| Technician | Amos | Cline | Chem & Bio Engineering | | x | | |
| Technician | Justin | Crouse | FBRI | | x | x | x |
| Technician | Catherine | Dickerson | Resource Economics | | x | x | |
| Technician | Nathan | Hill | Chemical Engineering | | x | x | x |
| Technician | Jennifer | Hubbard | FBRI | | x | | |
| Technician | Dwane | Hutto | Chemical Engineering | x | | x | x |
| Technician | Donna | Johnson | FBRI | x | | | |
| Technician | Dale | Kohlmetz | FBRI | | x | | |
| Technician | Heok | Kwon | FBRI | x | | | |
| Technician | Martin | Lawoko | FBRI | x | x | x | x |
| Technician | Wing | Luu | FBRI | x | | | |
| Technician | Erik | Nash | Cooperative Forestry Research Unit | x | | | |
| Technician | Seongkyung | Park | Chem & Bio Engineering | | | x | |
| Technician | Thomas | Perry | Forest Resources | | | x | x |
| Technician | Erin | Simons | Cooperative Forestry Research Unit | | | x | |
| Technician | Dongcheng | Zhang | FBRI | x | | | |
| Undergraduate | Tionna | Baldwin | Chem & Bio Engin | | | x | |
| Undergraduate | Brendon | Beote | Forest Bioproducts | | | | x |
| Undergraduate | Matthew | Blodgett | FBRI | | x | | |
| Undergraduate | Brittany | Boser | Nanotech | | | x | |
| Undergraduate | Justin | Bousfield | Chem & Bio Engineering | | | x | |
| Undergraduate | Carl | Boyd | DOE | | | x | |
| Undergraduate | Emily | Buchsmann | Theme 2 | | | x | |
| Undergraduate | Nora | Cadwallader | FBRI | | | x | |
| Undergraduate | Alexander | Canney | DOE | | x | x | |
| Undergraduate | Paige | Case | Forest Bioproducts | | | | x |
| Undergraduate | Kersi | Contractor | Forest Resources | x | | | |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|---------------|------------|--------------|---------------------------|-----|------|------|-------|
| Undergraduate | Nathan | Curtis | FBRI | | | x | |
| Undergraduate | Nikki | D'Alessandro | Resource Economics | x | x | | |
| Undergraduate | Anne | Davison | FBRI | | | x | |
| Undergraduate | Ryan | Dawes | Theme 2 | | | x | |
| Undergraduate | Sophia | DeMaio | FBRI | | x | | |
| Undergraduate | Shashi | Dhungel | Forest Resources | | | x | x |
| Undergraduate | Monica | Doing | FBRI | | x | | |
| Undergraduate | Jesse | Duplin | Forest Resources | x | x | | |
| Undergraduate | James | Ecker | Thermo Conversion | | | x | |
| Undergraduate | Matthew | Edwards | FBRI | | | x | |
| Undergraduate | Sarah | Enman | Chem & Bio Engineering | x | x | | |
| Undergraduate | Matthew | Fields | Resource Economics | x | x | | |
| Undergraduate | Meaghann | Fisher | FBRI | | | x | x |
| Undergraduate | Amy | Foley | Chem & Bio Engineering | | | | x |
| Undergraduate | Jeffrey | Galle | FBRI Theme 3 | | | x | |
| Undergraduate | Nicholas | Gosz | FBRI | | x | | |
| Undergraduate | William | Gramlich | FBRI | x | x | x | |
| Undergraduate | Kerry | Hafford | FBRI | | | x | |
| Undergraduate | Abigail | Hamilton | FBRI | | x | | |
| Undergraduate | Ian | Hamilton | FBRI | | x | x | |
| Undergraduate | James | Hessler | Forest Bioproducts | | | | x |
| Undergraduate | Jacob | Hicks | Forest Resources | | x | | |
| Undergraduate | Paul | Holyoke | Thermo Conversion | | | | x |
| Undergraduate | Ashley | Hoskins | Forest Resources | | x | | |
| Undergraduate | Benjamin | Jones | Forest Resources | | x | | |
| Undergraduate | Tara | Kierstad | Forest Resources | | x | | |
| Undergraduate | Jonathan | Lilly | FBRO | | x | | |
| Undergraduate | Ryan | Lockhart | Forest Resources | | x | | |
| Undergraduate | Jarrett | Lukas | Forest Bioproducts | | | | x |
| Undergraduate | Jamie | MacNeil | FBRI | | x | | |
| Undergraduate | Evan | Manley | FBRI | | | x | x |
| Undergraduate | Timothy | McGuire | Thermo Conversion | | | | x |
| Undergraduate | Daniel | Moberg | FBRI | | x | x | x |
| Undergraduate | Dylan | Montgomery | Molecular Plant Pathology | x | x | | |
| Undergraduate | Zachary | Montgomery | Forest Resources | | x | | |
| Undergraduate | Sara | Muzzy | FBRI Theme 2 | | | x | |
| Undergraduate | Chanrasmey | Neang | FBRI | | | x | x |

| Type | First Name | Last Name | UMaine Dept or Other | YR1 | YR 2 | YR 3 | YR 3+ |
|---------------|------------|------------|---------------------------|-----|------|------|-------|
| Undergraduate | Tim | O'Brien | Forest Resources | x | x | | |
| Undergraduate | Elisabeth | Polling | FBRI Theme 2 | | | x | x |
| Undergraduate | Jenna | Ramos | EPSCoR | | | x | |
| Undergraduate | Danielle | Reider | FBRI Theme 2 | | | x | |
| Undergraduate | Thomas | Schwartz | FBRI | x | x | x | x |
| Undergraduate | Megan | Soderberg | EPSCoR Office - Assistant | x | | x | x |
| Undergraduate | Amy | St. Peter | Chem & Bio Engineering | x | x | x | |
| Undergraduate | Charles | Therriault | Forest Resources | | x | | |
| Undergraduate | Nikolas | Tokas | Chem & Bio Engineering | | | x | |
| Undergraduate | Julie | Trudel | Forest Resources | x | | | |
| Undergraduate | Amanda | Turcotte | Biological Sciences | x | x | x | |
| Undergraduate | Katherine | Wallick | Forest Bioproducts | | | | x |
| Undergraduate | Brenna | Walsh | FBRI | | x | x | x |
| Undergraduate | Benjamin | Walz | FBRI | | x | x | |
| Undergraduate | Amber | Wetmore | FBRI | | x | | |
| Undergraduate | Lauren | Wheeler | FBRI | | | x | x |
| Undergraduate | Megan | Wolters | EPSCoR Office - assistant | x | x | | |
| | | | TOTALS: | 88 | 160 | 261 | 111 |

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

APPENDIX 4: Project Personnel Diversity

| Directly Supported Participants: | YR1 Benchmarks | | | YR2 Benchmarks | | | YR3 Benchmarks | | | YR3+ Benchmarks | | |
|---|----------------|-----|-----|----------------|------|-----|----------------|------|-----|-----------------|-----|-----|
| | Total | Fem | Div | Total | Fem | Div | Total | Fem | Div | Total | Fem | Div |
| Core faculty | 26 | 7 | 0 | 34 | 6 | 0 | 33 | 7 | 0 | 27 | 4 | 0 |
| Collaborative faculty | 5 | 0 | 0 | 3 | 2 | 0 | 3 | 1 | 0 | 0 | 0 | 0 |
| Postdocs | 1 | 0 | 0 | 4 | 1 | 0 | 5 | 1 | 0 | 7 | 3 | 0 |
| Graduate students | 21 | 8 | 2 | 28 | 10 | 4 | 32 | 10 | 6 | 26 | 6 | 4 |
| Undergraduate students | 18 | 8 | 0 | 46 | 16 | 0 | 48 | 22 | 0 | 22 | 11 | 0 |
| High school students | 0 | 0 | 0 | 10 | 3 | 0 | 12 | 5 | 0 | 13 | 6 | 0 |
| Professional/ Administrative staff | 19 | 8 | 1 | 23 | 9 | 1 | 28 | 13 | 1 | 21 | 7 | 1 |
| TOTALS: | 90 | 31 | 3 | 148 | 47 | 5 | 161 | 59 | 7 | 116 | 37 | 5 |
| Direct Overall %: | | 34% | 3% | | 32% | 3% | | 37% | 4% | | 32% | 4% |
| Indirectly Supported Participants: | YR1 Benchmarks | | | YR2 Benchmarks | | | YR3 Benchmarks | | | YR3+ Benchmarks | | |
| | Total | Fem | Div | Total | Fem | Div | Total | Fem | Div | Total | Fem | Div |
| Conference & workshop participants | 100 | 30 | 9 | 815 | 252 | 43 | 400 | 130 | 19 | 32 | 19 | 0 |
| Faculty | 19 | 6 | 0 | 130 | 82 | 6 | 140 | 79 | 9 | 88 | 32 | 4 |
| Graduate students | 27 | 20 | 3 | 65 | 39 | 2 | 70 | 39 | 2 | 50 | 15 | 3 |
| Undergrad students | 65 | 28 | 5 | 70 | 39 | 5 | 220 | 101 | 9 | 4 | 0 | 0 |
| Professional/ Administrative staff | 27 | 11 | 1 | 210 | 135 | 9 | 67 | 53 | 2 | 94 | 15 | 6 |
| K-12 teachers & pre-service teachers | 115 | 65 | 2 | 284 | 178 | 10 | 107 | 72 | 6 | 99 | 66 | 4 |
| Middle school students | 530 | 212 | 15 | 802 | 648 | 27 | 1022 | 729 | 41 | 0 | 0 | 0 |
| High school students | 23 | 9 | 3 | 212 | 100 | 9 | 194 | 104 | 7 | 27 | 15 | 0 |
| TOTALS: | 906 | 381 | 38 | 2588 | 1473 | 111 | 2220 | 1307 | 95 | 394 | 162 | 17 |
| Indirect Overall % | | 42% | 4% | | 57% | 4% | | 59% | 4% | | 41% | 4% |

*Previously reported numbers included Asians/Asian Americans & have been corrected (not considered underrepresented by NSF)

**Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts**

APPENDIX 5: FBRI Grant Proposals

YR3+ FBRI Grant Proposals Submitted & Awarded

| Submit | Name | Title | Sponsor | Sponsor request | Award |
|---------------|--|--|--|------------------------|--------------|
| 4/14/09 | DeSisto, William | EFRI HyBi: Collaborative: Hydrocarbon Production From Modified Biomass | National Science Foundation | \$272,067 | Pending |
| 4/16/09 | Gardner, Douglas | Bio-Based Hybrid Composites Made From Modified Natural And Synthetic Polymers | US Dept of Agriculture | \$499,928 | Rejected |
| 5/15/09 | Rubin, Jonathan, Leahy, J | Modeling Consumer Acceptance of Biofuels | US Dept of Agriculture | \$328,169 | Pending |
| 5/20/09 | Cole, Barbara J, Shaler, S; Jellison, J; Gardner, D | Wood Utilization Research 2009 | US Dept of Agriculture | \$475,612 | \$475,612 |
| 5/21/09 | Gardner, Douglas | Cellulose Nanocomposites for Blast Protection and Structural Applications | US Dept of Defense | \$1,925,000 | \$1,925,000 |
| 5/27/09 | Pendse, Hemant | Thermochemical Conversion of Woody Biomass to Fuels and Chemicals | US Dept of Energy | \$750,000 | \$750,000 |
| 6/8/09 | Pendse, Hemant | Polyitaconic Acid from Northeast Hardwood Biomass | US Dept of Agriculture through Itaconix, LLC | \$400,000 | Pending |
| 6/9/09 | Pendse, Hemant; Neivandt, David; Rubin, Jonathan; Bilodeau, Michael; Donahue, Darrell; Fort, | Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts +\$ | National Science Foundation | \$575,000 | \$575,000 |

| | | | | | |
|---------|---|---|------------------------------------|-----------|----------|
| | Raymond; Gardner, Douglas; Jellison, Jody;Bousfield, Douglas; Cole, Barbara; Shaler, Stephen | | | | |
| 6/15/09 | Shaler, Stephen | Integrated Assessment of Extraction in OSL Manufacture | Maine Technology Institute | \$84,808 | \$84,808 |
| 6/19/09 | Weiskittel, Aaron | Using Pioneering Growth and Yield Studies to Inform Management and Modeling | US Dept of Agriculture | \$40,509 | \$40,509 |
| 6/24/09 | Weiskittel, Aaron | REU Supplement: UMaine Proposal for Joining the NSF Ctr Advanced Forestry Sys | National Science Foundation | \$7,350 | \$7,350 |
| 10/2/09 | Gardner, D; Donahue, D; Neivandt, D. | REU: Explore It! Building the Next Generation of Sustainable Energy Researchers | National Science Foundation | \$544,327 | Pending |
| 8/31/09 | Weiskittel, Aaron | ARRA: Development of an Applied Mathematical Model and Computer Interface | US Dept of Energy | \$756,319 | Pending |
| 8/17/09 | Weiskittel, Aaron | Do Silvicultural Outcomes Vary in Response to Climatic Gradient | US Dept of Agriculture | \$25,500 | Pending |
| 4/15/09 | Benjamin, J | Early Commercial Thinning Harvest Systems: A Silvicultural and Operational Assessment | Cooperative Forestry Research Unit | \$55,760 | Rejected |
| 9/17/09 | Halog, A | Exergetic Life Cycle Assessment Tools for Building Components | National Science Foundation | \$299,129 | Pending |
| 9/01/09 | Halog, A | ARRA: Life Cycle Sustainability Assessment Tool | US Dept of Energy | \$828,730 | Pending |

| | | | | | |
|---------|--|--|--|---------------------|--------------------|
| | | for Bioenergy Production | | | |
| 7/07/09 | Halog, A | Modeling the Potential Impacts of Forest Biorefinery on Land Use | National Science Foundation | \$303,180 | Pending |
| 7/07/09 | Bilodeau, M., Bousfield, D | Biobased Binder for Coatings, Paints, and Adhesives | US Dept of Agriculture | \$485,584 | Pending |
| 8/10/09 | Neivandt, D., Garnder, D. | ARRA-Acquisition of Equipment for the Advanced Nanocomposites | National Science Foundation | \$5,999,441 | Pending |
| 7/01/09 | Neivandt, D., Garnder, D. | Development of Low Cost Carbon Nanofiber Enhanced Photovoltaic Fabrics | US Dept of Defense through Tex Tech Industries | \$697,006 | Rejected |
| 8/24/09 | Jellison, J | Renovation of a Suite of Shared-Use Ecology Research Facilities at the Universit | Nationl Science Foundation | \$1,056,500 | Pending |
| 7/13/09 | DeSisto, William; Frederick, Brian; Wheeler, M. Clayton | ARRA: Standards for Characterization of Biomass Fast Pyrolysis Processes | US Dept of Commerce | \$1,440,785 | Pending |
| | Total Submitted: 23 | Total Awarded: 7 | | \$17,850,704 | \$3,858,279 |

YR3 FBRI Grant Proposals Submitted & Awarded

| Name | Title | Sponsor | Sponsor Request | Award |
|---------------------------|---|--------------------------------|-----------------|-------------|
| Benjamin, J. | Fuel Conservation Best Management Practices for Forest Operations | Wood Supply Research Institute | \$67,239 | Rejected |
| Bilodeau, M; Pendse, H | Forest Ag Bioproducts Research, Development, & Commercialization | Maine Technology Institute | \$4,800,000 | \$4,800,000 |
| Gardner, D | Advanced Nanocomposites for the Renewable Energy Industry | Maine Technology Institute | \$4,999,460 | \$4,999,460 |
| Shaler, S; | Acquisition of a Steam | Maine Technology | \$3,825,000 | Rejected |

| | | | | |
|--|---|---------------------------------------|-------------|-----------|
| Gardner, D | Injection Press | Institute | | |
| Bell, K; Wilson, J; Wagner, R; Weiskittel, A | Forecasting & Assessing the Future & Status of Maine's Forests Using LiDar | Maine Technology Institute | \$2,098,924 | Rejected |
| Wilson, J. | Support for Long-Term Research on the Penobscot Experimental Forest 2009 | US Dept of Agriculture | \$10,000 | \$10,000 |
| Wagner, R | Does Forest Harvesting Alter Soil Carbon and Nutrient Status? | US Dept of Agriculture | \$146,630 | Pending |
| Weiskittel, A | Reginement of the FVS-NE Predictions of Individual Tree growth Response | US Dept of Agriculture | \$84,194 | \$84,194 |
| Wagner, R; Wilson, J; Weiskittel, A | Predicting Biomass Productivity and Availability from Maine's Forest | US Dept of Agriculture | \$55,824 | Rejected |
| Bell, K | Public Preferences for Protecting Forested Landscapes | US Dept of Agriculture | \$36,340 | Pending |
| Wagner, R | Management of Data from Long-Term Silvicultural Research | US Dept of Agriculture | \$18,500 | \$18,500 |
| Bilodeau, M; Pendse, H | University of Maine Integrated Forest Biorefinery Research | US Dept of Energy | \$956,000 | \$956,000 |
| Bilodeau, M; Bousfield, D | Biobased Polymer Binders | US Dept of Agriculture | \$634,483 | Rejected |
| van Walsum, P; Wheeler, C | Production of Higher Alcohol Liquid Biofuels via Acidogenic Digestion | US Dept of Agriculture | \$712,736 | \$712,736 |
| Leahy, J | Enhancing Prosperity for Maine's Family Forests Through Diversification | US Dept of Agriculture | \$458,047 | Pending |
| Weiskittel, A | Estimating and Mapping Regional Forest Potential Productivity | US Dept of Agriculture | \$28,477 | \$28,477 |
| Bell, K | Improving Economic Analysis of Forest Change | US Dept of Agriculture | \$24,996 | \$24,996 |
| Bilodeau, M; Pendse, H | Summer Institute in Pulp and Paper Technology | National Science Foundation | \$29,856 | \$29,856 |
| Rubin, J | Comprehensive Review and Consumer Survey Analysis of New England Transportation | New England Transportation Consortium | \$149,553 | Pending |
| Weiskittel, A | Estimating and Mapping Regional Forest Potential Productivity | US Dept of Agriculture | \$80,084 | \$80,084 |
| Bilodeau, M; Pendse, H; van Heiningen, A | VPP Consortium Mixed Hardwood Study | US Dept of Agriculture | \$60,000 | \$60,000 |

| | | | | |
|--|---|-----------------------------|--------------|-----------|
| Weiskittel, A | Development of an Acadian Variant of FVS | US Dept of Agriculture | \$81,993 | \$81,993 |
| Leahy, J | Estimating Willingness to Accept Recreation Access Policies Incentives, & Comp | US Dept of Agriculture | \$43,532 | \$43,532 |
| Bilodeau, M; Pendse, H; Neivandt, D; Wagner, R | Regional Science & Technology Center for Forest Bioproducts Research | National Science Foundation | \$25,000,000 | Rejected |
| Jellison, J | Role of Fungi in Biotransformation of Wood and Base Cation Cycling in the Forest | US Dept of Agriculture | \$5,000 | \$5,000 |
| Gardner, D; Neivandt, D; Leahy, J; Lilieholm, R | IGERT: Sustainable Forest Bioproducts | National Science Foundation | \$3,200,000 | Pending |
| Wagner, R | Predicting the Effects of Traditional and Emerging Forestry Practices | US Dept of Agriculture | \$336,703 | \$336,703 |
| Halog, A; Weiskittel, A | EFRI: HyBi Hybrid Biological-Thermal Conversion of Biodiverse Feedstocks | National Science Foundation | \$2,449,969 | Pending |
| Halog, A | ICT: Enabled Sustainability Framework for Developing Value Clains of Forest Based | AT&T Corporate | \$25,000 | Pending |
| Wilson, J; Weiskittel, A | Influence of Partial Harvesting Intensity and Technology on Northern Forests | US Dept of Agriculture | \$37,250 | \$37,250 |
| Gardner, D | Nanoparticle-filled Wood Plastic Composites: The Next Generation | Maine Technology Institute | \$496,746 | Pending |
| Shaler, S; Gardner, D | Acquisition of a Unique Press System for Advanced Research, Development, and Com | Maine Technology Institute | \$3,800,000 | Pending |
| Pendse, H; Bilodeau, M | Forest & Ag Bioproducts Research, Development, and Commercialization Facility | Maine Technology Institute | \$4,800,000 | Pending |
| Rubin, J | Development of a Standardized Biomass Assessment Methodology for Northeast | US Dept of Transportation | \$12,500 | Pending |
| Gardner, D | Development of a Green Technology for Biocomposites using Nature-derived Raw Mat | US Dept of Transportation | \$150,000 | Pending |
| Fort, R; Genco, J; | Investigations of Enzymatic | US Dept of | \$150,000 | Pending |

| | | | | |
|----------------------------|--|---------------------------|---------------------|---------------------|
| Cole, B | Methods for Processing of Hemicelluloses | Transportation | | |
| Fort, R; Genco, J; Cole, B | Lignin Feedstock for Use in Carbon Fibers | US Dept of Transportation | \$150,000 | Pending |
| Kravit, N; Millard, P | New Enzymes to Separate Xylan from Lignin | US Dept of Transportation | \$147,393 | Pending |
| Halog, A | Development of a Dynamic Systems Model for Life Cycle Sustainability Analysis of | Cornell University | \$146,991 | Pending |
| Benjamin, J | Optimal Logging Residue Characteristics for Storage and Delivery of Energy Wood | US Dept of Transportation | \$128,714 | Pending |
| Total Submitted: 39 | Total Awarded: 17 | TOTALS: | \$60,438,134 | \$12,308,781 |

FBI Grant Proposals Submitted YR2 - Awarded YR3

| Name | Title | Sponsor | Sponsor Request | Award |
|--|---|-----------------------------|--------------------|--------------------|
| Genco, J; Pendse, H. | Demonstration of Integrated Biorefinery at Old Town, ME | US Dept of Energy | \$3,000,000 | \$3,000,000 |
| van Walsum, P. | Identification & Quantification of Cellulase & Microbial Inhibitors | US Dept of Agriculture | \$146,092 | \$146,092 |
| van Walsum, P. | Characterization of Accumulation Trends for Carbohydrate | US Dept of Agriculture | \$16,829 | \$16,829 |
| Rubin, J. | Marketing New England Biofuels to Ensure Energy Security | US Dept of Transportation | \$101,218 | \$101,218 |
| Donahue, D; Neivandt, D; Gardner, D. | REU: Explore It! Building the Next Generation of Sustainable Energy Researchers | National Science Foundation | \$10,000 | \$10,000 |
| Cole, B; Jellison, J; Gardner, D; Shaler, S. | Wood Utilization Research 2008 | US Dept of Agriculture | \$526,460 | \$526,460 |
| | | TOTALS: | \$3,800,599 | \$3,800,599 |

YR2 FBI Grant Proposals Submitted & Awarded

| Name | Title | Sponsor | Sponsor Request | Award |
|--------------|---|------------------------|-----------------|----------|
| Benjamin, J. | Biomass Harvesting Guidelines for the Acadian | US Dept of Agriculture | \$21,813 | \$21,813 |

| | | | | |
|--|---|-----------------------------|-------------|-----------|
| | Forest | | | |
| Benjamin, J.; Leahy, J.; Wagner, R.; Wilson, J. | Conservation Landowners in the Northern Forest: An Interdisciplinary Land Mgmt. | US Dept of Agriculture | \$53,990 | Pending |
| Benjamin, J.; Wagner, R.; Wilson, J. | Harvest Levels & Characteristics of Biomass Feedstock from Maine's Forest | US Dept of Agriculture | \$887,044 | pending |
| Bilodeau, M.; Pendse, H.; van Heiningen, A. | VPP Consortium Mixed Hardwood Study | US Dept of Agriculture | \$140,000 | \$140,000 |
| Cole, B.; Fort, R. | Extracting Valuable Chemicals from Lignin Prior to Hydrolysis of Wood | US Dept of Agriculture | \$113,240 | \$113,240 |
| Collins, S.; DeSisto, W.; Frederick, B.; Lad, R.; Pendse, H.; van Heiningen, A.; Wheeler, C. | Thermochemical Conversion of Woody Biomass to Fuels & Chemicals | US Dept of Energy | \$500,000 | \$500,000 |
| Eckardt, M.; Nemeth, V. | Enhancing Linkages Between Universities & Small Business in EPSCoR Areas | National Science Foundation | \$99,896 | \$99,896 |
| Gardner, D. | Nanometer Scale Cellulose Fibers Derived from Woody Biomass | US Dept of Agriculture | \$0 | Rejected |
| Gardner, D.; Donahue, D.; Neivandt, D. | Explore It! Building the Next Generation of Sustainable Energy Researchers | National Science Foundation | \$20,000 | \$20,000 |
| Gardner, D.; Leahy, J.; Lilieholm, R.; Neivandt, D. | IGERT in Sustainable Forest Bioproducts | National Science Foundation | \$0 | Rejected |
| Gardner, D.; van Heiningen, A. | Integrated Forest Product Refinery #5 | US Dept of Energy | \$78,768 | \$78,768 |
| Genco, J.; Pendse, H. | Demonstration of Integrated Biorefinery at Old Town, ME | US Dept of Energy | \$3,000,000 | Pending |
| Kravit, N. | Improving Woody Biomass Separation by Enzymatic Means | US Dept of Transportation | \$90,581 | \$90,581 |
| Lilieholm, R. | Forest Dependency & | US Dept of | \$15,000 | \$15,000 |

| | | | | |
|--|--|------------------------------------|--------------------|--------------------|
| | Community Transition in Southeast Alaska | Agriculture | | |
| Millard, P. | EFRI-CBE: Axonal Responses to Microengineered Environments | National Science Foundation | \$1,962,558 | Rejected |
| Millard, P.; Shaler, S.; van Heiningen, A. | An Integrated Forest Biorefinery: Fuel Production from Woody Biomass | US Dept of Transportation | \$265,000 | Pending |
| Neivandt, D. | REU Site: Visualize it! | National Science Foundation | \$249,265 | Rejected |
| Pendse, H. | KVCC Summer Institute | Kennebec Valley Community College | \$29,999 | \$29,999 |
| Rubin, J. | Economic Impact of CEI on Capital Management Investments | Coastal Enterprises Inc. | \$38,384 | Pending |
| Rubin, J. | Informing Consumers About Wood-Based Biofuels: Impacts on New England's Energy | US Dept of Transportation | \$371,020 | Pending |
| Tripp, Carl | New England Green Chemistry Consortium | US Environmental Protection Agency | \$110,000 | \$110,000 |
| van Walsum, P. | Characterization of Accumulation Trends for Carbohydrate | US Dept of Agriculture | \$16,829 | Pending |
| van Walsum, P. | Identification & Quantification of Cellulase & Microbial Inhibitors | US Dept of Agriculture | \$146,092 | Pending |
| van Walsum, P. | Development of a Microarray Diagnostic Tool | US Dept of Agriculture | \$299,870 | Pending |
| Total Submitted: 24 | Total Awarded: 11 | | \$8,509,349 | \$1,219,297 |

F BRI Grant Proposals Submitted YR1 - Awarded YR2

| Name | Title | Sponsor | Sponsor Request | Award |
|--|---|------------------------------------|-----------------|-----------|
| Leahy, J., Wilson, J., Bell, Kathleen | Sustainable Lake Management in Maine's Changing Landscape | US Environmental Protection Agency | \$299,249 | \$299,249 |
| Pendse, H., van Heiningen, A., Wheeler, C., DeSisto, W., Frederick, B., Collins, S., Lad, R. | DOE EPSCoR: Thermochemical Conversion of Woody Biomass to Fuels & Chemicals | US Dept of Energy | \$500,000 | \$500,000 |
| Neivandt, D., Mason, M., etc. | MRI: Development of a Hybrid Scanning Fluorescence & Sum Frequency | National Science Foundation | \$728,102 | \$728,102 |

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|---------------|---|----------------------------|--------------------|--------------------|
| | Spectroscope | | | |
| Bousfield, D. | Fundamental Understanding of Rheology of High-Solids Biomass Slurries | Midwest Research Institute | \$137,422 | \$137,422 |
| | | TOTALS: | \$1,664,773 | \$1,664,773 |

YR1 FBRI Grant Proposals Submitted & Awarded





| Name | Title | Sponsor | Sponsor request | Award |
|---|--|------------------------------------|-----------------|-----------|
| Millard, P | SENSORS: Detecting Microbial Pathogens with Novel Surface Acoustic Wave Devices in Liquid Environments | National Science Foundation | \$6,000 | \$6,000 |
| Gardner, D. Shaler, S., Jellison, J., Fort, R., Cole, B., Genco, J., etc. | New England Wood Utilization Research: 2006-2009 | U.S. Dept of Agriculture | \$728,545 | \$728,545 |
| Leahy, J., Wilson, J., Bell, Kathleen | Sustainable Lake Management in Maine's Changing Landscape | US Environmental Protection Agency | \$299,249 | Pending |
| Wheeler, C. | SST: Intergrated Fluorocarbon Microsensor System Utilizing Catalytic Modification | National Science Foundation | \$7,500 | \$7,500 |
| Jellison, J | Role of Fungi in Biotransformation of Wood & Base Cation Cycling in the Forest Ecosystem | US Dept of Agriculture | \$9000 | \$9,000 |
| Leahy, J. | Bulding Demand for Maine's Certified Wood & Paper Products: Public Opinion | ME Dept. of Conservation | \$14,733 | \$14,733 |
| Millard, P. | Automated System for Liquid Phase Detection of Toxic Compounds | U.S. Dept of Defense | \$5,330,291 | \$170,400 |
| Wagner, R. | LTREB: Integrating Spatially Explicit Methods & Models into a Long-Term Forest | National Science Foundation | \$412,727 | Rejected |
| Wheeler, C | CAREER: Mechanistic Studies Using Microhotplate Gas Sensors | National Science Foundation | \$496,991 | Rejected |
| Neivandt, D. | Determination of the Role of the Plasma Membrane in Non-Classical Protein Trans | National Science Foundation | \$610,293 | Rejected |






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|--|--|--------------------------------|-----------|-----------|
| Donahue, D., Neivandt D., Gardner D. | REU: Explore It! Building the Next Generation of Sustainable Energy Researchers | National Science Foundation | \$90,235 | \$90,235 |
| Pendse, H. | KVCC Summer Institute | National Science Foundation | \$16,812 | \$16,812 |
| Bell, Kathleen, Wilson, J. | Characterizing the Effects of the Plum Creek Concept Plan | ME Dept. of Conservation | \$31,029 | \$31,029 |
| Dagher, H., Gardner, D., Shaler, S., etc. | Structural Use WPC's in Tranportation | U.S. Dept. Trans | \$976,022 | \$976,022 |
| Wagner, R. | Protocols for Assessing the Silvicultural Aspects of Timber Harvests in Maine | ME Dept. of Conservation | \$75,946 | \$75,946 |
| Pendse, H., van Heiningen, A., Wheeler, C., DeSisto, W., Frederick, B., Collins, S., Lad, R. | DOE EPSCoR: Thermochemical Conversion of Woody Biomass to Fuels & Chemicals | US Dept of Energy | \$500,000 | Pending |
| Jellison, J. | Tetraploid Seedling Generation in Support of Varietal Development | U.S. Dept of Agriculture | \$50,000 | \$50,000 |
| Jellison, J. | Novel Processes to Prepare & Utilize Carbon Nanofibers & Nanotubes | US Dept of Defense | \$499,872 | Pending |
| Rubin, J. | The Regional Greenhouse Gas Initiative: A Prime for Maine | Environmental Defense Fund | \$2,500 | Pending |
| Gardner, D., van Heiningen, A. | Integrated Forest Product Refinery #4 | U.S. Dept. of Energy | \$496,584 | \$39,000 |
| Jellison, J. | Process to Produce MultiWalled Carbon Nanotubes from Natural Cellulosic 2006-07 | U.S. Dept of Defense | \$50,490 | \$50,490 |
| Wagner, R. | Current & Emerging Silvicultural Practices on Forest Productivity 2006-2007 | US Dept of Agriculture | \$46,700 | \$46,700 |
| Pendse, H., van Heiningen, A., Genco, J. | Hemicellulose Extract from Woody Biomass as Low Cost Feedstock | US Dept of Energy | \$600,000 | Pending |
| van Heiningen, A., Shaler, S., Millard, P. | Ethanol as Co-product from Wood Hemicelluloses via Hydrogenation of Acetic Acid | US Dept. of Agriculture | \$500,000 | Rejected |
| Neivandt, D., Mason, M., etc. | MRI: Development of a Hybird Scanning Fluorescence & Sum Frequency Spectroscope | National Science Foundation | \$728,102 | Pending |
| Pendse, H. | Technologically Advanced | National Science | \$160,000 | \$242,663 |

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| | Workforce for Pulp & Paper Industry | Foundation | | |
| Bousfield, D. | Fundamental Understanding of Rheology of High-Solids Biomass Slurries | Midwest Research Institute | \$137,422 | Pending |
| Jellison, J. | Developing Novel Processes to Produce Carbon Nanotubes & Nanofibers | National Science Foundation | \$307,375 | Rejected |
| Gardner, D., van Heiningen, A. | Integrated Forest Product Refinery #5 | U.S. Dept of Energy | \$496,584 | \$79,769 |
| Total Submitted: 29 | Total Awarded: 17 | TOTALS: | \$13,681,002 | \$2,634,844 |






**Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts**






APPENDIX 6: FBRI Equipment Purchased






| FBRI Equipment List | | |
|---|-------------------|---|
| Equipment Name: | <i>Technician</i> | Purchased: |
| GC with Headspace | <i>Martin</i> | 7/11/2006 |
|  | | <p>The Headspace Gas Chromatograph is used for the analysis of volatiles. The interactions of these gaseous analytes with the walls of the column (coated by different stationary phases) causes different compounds to elute at different times called retention time. The comparison of these retention times is the analytical power of GC. It is being used by the FBRI for the analysis of alcohols, Organic acids (C2-C7 acids) and derivatized monosugars (as alditol acetates).</p> <p>Specifications Manufacturer: <i>Shimadzu Scientific</i> Model: <i>GC-2010/AOC 5000</i> Details: <i>Autosampler; standard vacuum system; enhanced data station w/ GCMS solution software; AOCAOi QP system kit; copper tubing; gas regulators</i></p> |
| GC-MS | <i>Martin</i> | 7/11/2006 |
|  | | <p>Gas chromatography-mass spectrometry (GC-MS) is a method that combines the features of gas-liquid chromatography and mass spectrometry to identify different substances within a test sample. It is ideal for many applications, including low molar mass component identification, and product impurity identification.</p> <p>Specifications Manufacturer: <i>Shimadzu Scientific</i> Model: <i>QP-2010S</i> Details: <i>patented constant linear velocity of carrier gas; 20 temperature ramps; inert source; standard vacuum system; GCMS solution software.</i></p> |
| Gradient HPLC System | <i>Justin</i> | 7/11/2006 |
|  | | <p>The HPLC is used to separate, identify, and quantify a variety of compounds. HPLC is now a commonly used technique for monitoring the progress of the fermentation in the ethanol production laboratory. FBRI is using this HPLC to analyze sugar, ethanol concentrations in biomass fermentation and organic acids (C2-C7).</p> <p>Specifications: Manufacturer: <i>Shimadzu Scientific</i> Model: <i>LC-20AD</i> Details: <i>Autosampler, UV/VIS detection, and refractive index detector (RID)</i></p> |
| TOC Combustion/Nitrogen Analyzer | <i>Martin</i> | 7/11/2006 |
|  | | <p>TOC is a highly sensitive, non-specific measurement of all organics present in a sample. FBRI researchers use it to determine the quality of fermentation and filtration feed stocks and products. It may be a critical tool in determining mass balances.</p> <p>Specifications: Manufacturer: <i>Shimadzu Scientific</i> Model: <i>TOC-VCPH</i> Details: <i>auto-aqueous TOC analyzer w/ 40mL vials; total nitrogen option; gas and oxygen regulator</i></p> |






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| Inverse Gas Chromatogram (iGC) | <i>Justin</i> | 10/06/2006 |
|  | | <p>The Inverse Gas Chromatograph is an advanced instrument for the characterization of particulates, fibers and thin-films. FBRI research has looked at acid-base characteristics of wood-plastic composites in order to improve its intermolecular bonding properties.</p> <p>Specifications Manufacturer: <i>Surface Measurement Systems</i> Model: <i>IGC-2000</i> Details: <i>Full Humidity Control. In-Situ Sample Preconditioning; up to 10 Different probe gas molecules.</i></p> |
| GC-MS | <i>Cole</i> | 2/7/07 |
|  | | <p>Gas chromatography-mass spectrometry (GC-MS) is a method that combines the features of gas-liquid chromatography and mass spectrometry to identify different substances within a test sample. It is ideal for many applications, including component identification, and product impurity identification.</p> <p>Specifications Manufacturer: <i>Agilent Technology Inc.</i> Model: <i>6850 GC/ 59755B MSD</i> Details: <i>Self-aligning Automatic Liquid Sampler. Intelligent GC pneumatics. Modular Analyzer assembly. Optional Ion Gauge. Scan rates up to 10,000 u/sec. Electron impact ionization. Vacuum system.</i></p> |
| ICP | <i>Martin</i> | 10/1/06 |
|  | | <p>Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES), is an analytical technique used for the detection of trace metals. It is a type of emission spectroscopy that uses the inductively coupled plasma to produce excited atoms and ions that emit electromagnetic radiation at wavelengths characteristic of a particular element. This ICP is highly sensitive and offers the ability to analyze sulfur as well as rare elements such as titanium, both of which are of interest in FBRI research.</p> <p>Specifications Manufacturer: <i>Thermo Electron Corp.</i> Model: <i>iCAP 6300</i> Details: <i>3 Channel, Radial torch. Solid state, free running 37MHz RF generator. ICP data station. iTEVA ICP-OES PC software.</i></p> |
| UV-Vis Spectrophotometer | <i>Martin</i> | 10/1/06 |
|  | | <p>The UV-VIS can be used in both simple quantification studies and more complex kinetic studies, where wavelength may be monitored as a variable. FBRI uses it for lignin quantification, spectral analysis and determination of phenolic content</p> <p>Specifications Manufacturer: <i>Thermo Electron Corp.</i> Model: <i>Evolution 100</i> Details: <i>Wavelength Range, nm :190 to 1100 ±0.5 nm. Wavelength Reproducibility, nm : ±0.1 nm. Bandwidth: 2 nm. Optical System: Double-beam, quartz-coated optics. Display Range: -3A to 6A Photometric Accuracy: ±0.0013A. Photometric Reproducibility : ±0.001A</i></p> |
| Ion Chromatograph | <i>Martin</i> | 8/8/06 |
|  | | <p>The Ion Chromatograph is used to separate, isolate and identify the components of chemical mixtures. Inorganic ions, e.g. sodium, sulfate that are present in extraction solvent systems can be monitored</p> <p>Specifications Manufacturer: <i>Dionex Corp</i> Model: <i>ICS 3000</i> Details: <i>system for analysis of anions and cations.</i></p> |







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| <p>Atomic Force Microscope</p>  | Justin | <p>12/27/06</p> <p>The AFM is used to take measurements of wood, fiber and wood polymer surface properties from micron scale down to nano-scale including long z-scan range above 25 microns to account for the microscopic roughness of wood cellular structure.</p> <p>Specifications Manufacturer: <i>Asylum Research</i> Model: <i>MFP-3D-SA</i> Details: <i>Flexured scanner. Extended head. MFP-3D base. All-Digital Controller and Software.</i></p> |
| <p>Quantum Chemistry Workstation</p>  | Fort | <p>10/1/06</p> <p>This equipment uses computer modeling to understand and enable the separation of biopolymers found in wood; specifically the removal of lignin bound to hemicelluloses.</p> <p>Specifications Manufacturer: <i>Parallel Quantum Solutions</i> Model: <i>QS8-2200C-064</i> Details: <i>8 processor 64 bit. Opteron Quantum Cube with master node and 3 slave nodes with gigabit Ethernet throughout, all PQS software and full range of Linux utilities</i></p> |
| <p>Mini DeBEE Processing System</p>  | Justin | <p>12/4/06</p> <p>The Mini DeBEE Processing System is an electro-hydraulically operated bench-top laboratory high-pressure homogenizer. This machine allows a researcher to break down particles to sizes below one micron thus effecting homogenization.</p> <p>Specifications Manufacturer: <i>Bee International Inc.</i> Model: Details: <i>PLC electronic control and monitoring system. Constant Processing pressure. Continuous flow up to 250 ml/min. Full control of processing energy.</i></p> |
| <p>Autosampler for HPLC</p>  | Justin | <p>9/1/06</p> <p>The autosampler for HPLC automatically takes samples, which allows many more samples to be analyzed in a day or overnight. The HPLC is used to measure concentrations of sugars and ethanol during fermentation.</p> <p>Specifications Manufacturer: <i>Shimadzu Scientific</i> Model: <i>SIL-20AC</i> Details: <i>Sample cooler w/ built-in dehumidifier. Fixed temperature control. Reduced Cycle times. High Speed/ Throughput. Precise sample injection. Near-Zero Carryover.</i></p> |
| <p>Autosampler for HPLC</p>  | Justin | <p>07/11/06</p> <p>The autosampler for HPLC automatically takes samples, which allows many more samples to be analyzed in a day or overnight. The HPLC is used to measure concentrations of sugars and ethanol during fermentation.</p> <p>Specifications Manufacturer: <i>Shimadzu Scientific</i> Model: <i>SIL-20A</i> Details: <i>High-speed injection. High through-put. Carryover Elimination.</i></p> |


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| <p>AccuSpin Model 400 Centrifuge</p>  | <p><i>Justin</i></p> | <p>11/10/06</p> <p>This instrument uses centrifugal force to separate mixtures of solids and liquids. It may be used to purify wood extracts by pelletizing unwanted suspended particles.</p> <p>Specifications Manufacturer: <i>Fisher Scientific</i> Model: <i>Accuspin 400</i> Details: <i>Variable microprocessor-based speed control. Adjustable timer and quick-spin feature. Touch keypad with intuitive controls and digital display for speed, time, and braking.</i></p> |
| <p>CO2 and O2 exhaust gas analyzer</p>  | <p><i>Justin</i></p> | <p>10/16/06</p> <p>This sensor accurately measures concentrations of oxygen and carbon dioxide gases in any gas stream. It detects small changes in metabolic activity often missed by other systems and will allow for feeding based on the metabolic activity of incubated cells.</p> <p>Specifications Manufacturer: <i>Biomedical Resources Intl.</i> Model: <i>A3 Duet</i> Details: <i>Temperature compensation. Local display of O2, CO2, and temperature.</i></p> |
| <p>O.D. probe and absorbance monitor</p>  | <p><i>Justin</i></p> | <p>12/1/06</p> <p>The Model 950 is microprocessor based and used with a Model BT65 online sensor to measure cell density in bacterial fermentation and cell culture applications</p> <p>Specifications Manufacturer: <i>Wedgewood Analytical Inc.</i> Model: <i>950</i> Details: <i>Features proprietary bubble reject algorithm. Measures absorbance up to 5 AU/OD units. Built-in diagnostics. Baseline and baseline shift functions. Advanced log amp.</i></p> |
| <p>Automated Reactor Sampling System</p>  | <p><i>Justin</i></p> | <p>8/18/06</p> <p>After an auto sampler draws samples from up to four bioreactors at specified times, the samples are sent to a fraction collector for storage until they can be analyzed. Fermentation experiments can last many days, and this system allows samples to be taken over the course of the entire reaction.</p> <p>Specifications Manufacturer: <i>Groton Biosystems</i> Model: <i>ARS 400</i> Details: <i>Automated precision sampling. Modular flexible design. Sanitary interface to the bioreactor. Automated sample prep Options. Online Analysis Options and Sample Collection. Fraction Collector.</i></p> |
| <p>Fermentation Systems (1 to 7 L)</p>  | <p><i>Justin</i></p> | <p>05/30/2007</p> <p>The fermentation system is important in optimizing the production of ethanol and other desirable products. With it, we are able to compare many reactor conditions such as pH, temperature, aeration, agitation, substrate, and fermentation organism.</p> <p>Specifications Manufacturer: <i>New Brunswick Scientific</i> Model: <i>Bioflo 110</i> Details: <i>Grow virtually any cell type. Interchangeable control modules, impeller, motor drives and vessels. Autoclavable glass vessels. Pre-programmed control ranges.</i></p> |



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| Accelerated Solvent Extractor | <i>Martin</i> | 5/30/2007 |
|  | <p>The ASE is used to extract hemicellulose from woodchips using a patented solvent extraction system.</p> <p>Specifications Manufacturer: <i>Dionex</i> Model: <i>ASE-300</i> Details: <i>Automated extraction. Dramatic solvent reduction. Large sample extractions. Reduced exposure to solvents.</i></p> | |
| Superspeed Centrifuge | <i>Justin</i> | 2/26/07 |
|  | <p>This centrifuge, capable of speeds up to 22,000 RPM, separates particles (sometimes as small as individual molecules) based on their size and relative density in a centrifugal field.</p> <p>Specifications Manufacturer: <i>Thermo Electron</i> Model: <i>Sorvall RC-6Plus</i> Details: <i>SLC-4000, F-13S, SS-34 & SH 3000 rotors. RPM/RCF control. GMP/GLP-compatible data management. Programmability. Controlled Access. Step-mode Runs. Real Time Control. Pre-cool function.</i></p> | |
| FT-NIR Spectrometer | <i>Justin</i> | 02/08/2007 |
|  | <p>Near Infrared Spectroscopy is often used in particle sizing in a range of different fields, including studying pharmaceutical and agricultural powders. The FT-NIR spectrometer is specially designed for economical, dedicated Near-IR analysis.</p> <p>Specifications Manufacturer: <i>Buchi Corp.</i> Model: <i>N500</i> Details: <i>The polarization interferometer is insensitive to mechanical disturbances. Comprehensive set of components allow for interchangeable sensors. Traceable procedures and data. Automatic measurements.</i></p> | |
| Empower 30-110 Laser System | <i>Neivandt</i> | 8/21/07 |
|  | <p>Pump laser for the UMaine femtosecond broadband Sum Frequency Spectrometer which provides molecular level orientation and conformational information of interfacial species.</p> <p>Specifications Manufacturer: <i>Spectra Solutions</i> Model: <i>Empower 30-110</i> Details: <i>High power CW diode, 1-10KHz, ND:YLF</i></p> | |
| Low Pressure Chromatography System | <i>Justin</i> | 3/22/07 |
|  | <p>The BioLogic LP low-pressure chromatography system is ideal for molecule purification.</p> <p>Specifications Manufacturer: <i>Biorad</i> Model: <i>Biologic LP</i> Details: <i>Gradient Mixer. MV-6 manual inject valve. BioLogic LP optics module. Conductivity flow cell in conductivity holder. BioLogic rack. Automated fraction collector.</i></p> | |


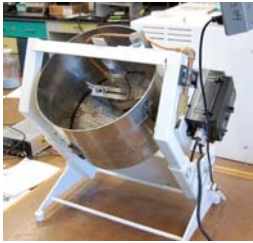

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| <p>Microplate Reader</p>  | <p>Justin</p> | <p>3/21/07</p> <p>The microplate reader quantifies small scale reactions in microplate wells with visible and ultra-violet light</p> <p>Specifications Manufacturer: <i>BioTek Instruments Inc.</i> Model: <i>SLFPTAD synergy 2</i> Details: <i>Fluorescence polarization. Luminescence UV-Visible absorbance. Quadruple grating system. Deep blocking filter and dichroic mirrors.</i></p> |
| <p>Mid-IR Spectrometer</p>  | <p>Justin</p> | <p>3/2007</p> <p>General purpose mid infrared spectrometer with accessories for transmission, reflectance and attenuated total reflection sampling geometries.</p> <p>Specifications Manufacturer: <i>ABB Inc.</i> Model: <i>FTIR FTLA2000-104</i> Details: <i>Insensitive to moisture. Uses only non-hygroscopic optics. Second integrated optical path.</i></p> |
| <p>High Pressure Catalyst Characterization Instrument</p>  | <p>Frederick</p> | <p>6/25/07</p> <p>The AMI-200 performs the following dynamic procedures in order to quantify the adsorption and desorption of gas molecules for a catalyst surface: temperature programmed desorption (TPD); - Temperature programmed reduction/oxidation (TPR/O); -Temperature programmed reaction (TPRx); - Pulse chemisorptions; - Catalyst treatment; - Flow BET surface area; - Pulse calibration</p> <p>Specifications Manufacturer: <i>Altamira Instruments</i> Model: <i>AMI-200</i> Details: <i>Switchable gas streams. Controllable gas flow rates. Blendable gases. Controlled temperature and temperature ramps. Collectable desorption data. Movable clamshell furnace. Automatic air cooling speeds. Single internal temperature-controlled zone.</i></p> |
| <p>Shaker Incubator</p>  | <p>Justin</p> | <p>6/11/2007</p> <p>This shaker/incubator is used for fungal and bacterial cell culturing.</p> <p>Specifications Manufacturer: <i>New Brunswick Scientific</i> Model: <i>I-24</i> Details: <i>Shaker, Orbital. Benchtop model. Circular shaking motion of 3/4in diameter or 13/4in. Programmable timer. Large-capacity blower ensures uniform temperature throughout the chamber. Keypad control of speed. RS-232 port. 120V 50/60Hz.</i></p> |
| <p>Anaerobic chamber</p>  | <p>Justin</p> | <p>6/28/07</p> <p>This versatile unit can be used as a controlled atmosphere or anaerobic chamber.</p> <p>Specifications Manufacturer: <i>Plas Labs</i> Model: <i>855-AC</i> Details: <i>Rigid acrylic glove box with transfer compartment. Two pressure/vacuum diaphragm pumps. Catalyst heater/oxygen remover. Desiccant train. System of purge valves for adjusting interior atmosphere.</i></p> |

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| <p>YSI 7100 Bioanalytical System</p>  | <p>Justin</p> | <p>12/12/2007</p> <p>Capable of measuring six distinct parameters simultaneously, the system can be customized with up to three sensor modules—each containing up to two chemistry sensors. Existing chemistries include the following: Glucose—Sucrose—Lactate—Glutamate—Glutamine—Ethanol—Methanol—Ammonium—Potassium—Galactose</p> <p>Specifications Manufacturer: <i>YSI Life Sciences</i> Model: <i>7100 MS</i> Details: <i>Rigid acrylic glove box with transfer compartment. Two pressure/vacuum diaphragm pumps. Catalyst heater/oxygen remover. Desiccant train. System of purge valves for adjusting interior atmosphere.</i></p> |
| <p>Sartorius Shaker Incubators</p>  | <p>Justin</p> | <p>2008</p> <p>These stackable shaker/incubators are used for fungal and bacterial cell culturing.</p> <p>Specifications Manufacturer: <i>Sartorius Stedim Biotech</i> Model: <i>Certomat BS-1</i> Details: <i>Stacks 3 units high with full speed shaking. Choice of 25 and 50 mm shaking orbits. Shaking speed 40-400 rpm. Optional integrated cooling. Fully programmable. Analogue output for data recording. Accepts up to 6 x 5 L flasks.</i></p> |
| <p>Hodgins Biomass Extractor</p>  | <p>Justin</p> | <p>2007-2008</p> <p>FBRI's Extractor is a custom designed and built system created to extract chemicals from wood biomass. An innovative collaboration between the Cianbro Corporation, Fitch Company, and Honeywell, the extractor was designed by UMaine engineer Keith Hodgins and staff and faculty at UM's Department of Chemical and Biological Engineering. This system is a completely unique system engineered to advance state of the art wood extraction science developed here at UM. Wood chips and additives are heated in a series of rotating vessels that encourage even mixing and heat distribution. After processing, spent woods chips are removed (and may be used for fuel or in wood composites) and the wood extractives (hemicellulose, for example) can be further treated to produce fuels (ethanol) and other bioproducts.</p> <p>Specifications: <i>Maximum pressure 195psig at 400°F.</i></p> |
| <p>Virtis Lyophilizer</p>  | <p>Justin</p> | <p>2007</p> <p>The lyophilizer dehydrates samples by freezing them under a vacuum. In chemical synthesis, products are often lyophilized to make them more stable, or easier to dissolve in water for subsequent use. In bioseparations, freeze drying can also be used as a late-stage purification procedure, because it can effectively remove solvents. Furthermore, it is capable of concentrating substances with low molecular weights that are too small to be removed by a filtration membrane.</p> <p>Specifications Manufacturer: <i>SP Industries</i> Model: <i>FM35EL-85</i> Details: <i>CFC-free refrigeration system offering condensing temperatures to -85°C. Wide variety of manifolds and freeze-drying chambers. -75°C shell bath for pre-freezing samples.</i></p> |
| <p>Das Gip Bioreactor system</p>  | <p>Justin</p> | <p>2008</p> <p>The fermentation system is important in optimizing the production of ethanol and other desirable products. Small working volumes allow high experimental throughput with minimal input. Precision and comprehensive process control result in highly scalable and reproducible output.</p> <p>Specifications Manufacturer: <i>DasGip Biotools</i> Model: <i>TC4SC4</i> Details: <i>Temperature and Agitation Control. pH, pO2 and Level Control. Substrate Feed. Aeration and Gas Supply. Mass flow controlled data of 4 independent gas flows</i></p> |

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| GC Sulphur | <i>Martin</i> | 2008 |
|  | | <p>The 7090S Sulfur GC Detector delivers equimolar response for all sulfur containing compounds. Chemiluminescence is the clean, fast, interference-free method for determining all bound sulfur in a variety of matrices. It may be used in the analysis of fuels or fuel feedstocks.</p> <p>Specifications Manufacturer: <i>Shimadzu/Antek</i> Model: <i>GC-2010/7090S</i> Details: <i>Third-generation Advanced Flow Control (AFC) supports high-speed analysis at a maximum pressure of 970 kPa and 1200 mL/minute maximum flow rate. High-power oven enables cooling from 450° C to 50° C in less than six minutes. Rapid detector data sampling rate ensures sharp, accurate peaks.</i></p> |
| Parr Reactor (1.8L) | <i>Justin</i> | 2008 |
|  | | <p>High pressure reactor system for the modification of acids derived from fermentation or thermochemical processes.</p> <p>Specifications Manufacturer: <i>Parr Instrument Co.</i> Model: <i>4578</i> Details: <i>1.8L capacity. Max temp = 500 C. Max pres.=5000 psi.</i></p> |
| Parr Reactor (300mL) | <i>Justin</i> | 2008 |
|  | | <p>Mini benchtop high pressure reactor system for the modification of acids derived from fermentation or thermochemical processes.</p> <p>Specifications Manufacturer: <i>Parr Instrument Co.</i> Model: <i>4566</i> Details: <i>300mL capacity. Max temp = 350 C. Max pres.=3000 psi.</i></p> |
| KF Titrande Titration System | <i>Justin</i> | 2008 |
|  | | <p>Karl Fischer titration is a classic titration method in analytical chemistry that uses coulometric or volumetric titration to determine trace amounts of water in a sample.</p> <p>Specifications Manufacturer: <i>Metrohm</i> Model: <i>841 Titrande</i> Details: <i>Intelligent dosing elements. Karl Fischer titration and SET titration. Parallel titration with tiamo. Sample processor control. Automatic reagent exchange with the unique Dosino</i></p> |
| Fluidized sand bath | <i>Justin</i> | 2008 |
|  | | <p>This sand bath, or fluidized bed, is capable of maintaining temperatures of 600 C without bearing the hazards associated with a hot oil bath. It is used to incubate small high temperature reactions (such as pyrolysis) contained in steel "bombs" suspended in the fluidized sand mass.</p> <p>Specifications Manufacturer: <i>Techne</i> Model: <i>SBL-2D</i> Details: <i>Max temp.=600C. Alundum sand material. Usable depth =35 cm PID temp. control.</i></p> |
| BD Flow Cytometer | <i>Justin</i> | 3/15/08 |
|  | | <p>Flow cytometry measures cellular characteristics by scanning cultures with discrete laser wavelengths and then analyzing light scatter or absorption patterns. Often a fluorescent marker is present to positively identify cell types. The cytometer may be used to select certain bacterial strains especially suited to produce valueable fermentation products in inhibitive environments.</p> <p>Specifications Manufacturer: <i>BD Biosciences</i> Model: <i>BD FACSCalibur</i> Details: <i>Three- or four-color fluorescence capability. BD FACStation™ System Data Management System. Modular for future upgrades</i></p> |

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| X-Ray Profilometer | <i>Edgar</i> |  <p>The QDP X-ray profiler is a vertical density profiling system for manufactured panel products (OSB, particleboard, MDF). The density profiler scans 2" square samples positioned in a cassette holder.</p> <p>Specifications Manufacturer: <i>Quintek Measurement Systems Inc.</i> Model: <i>QDP-01X</i> Details: <i>Automatic sample indexing. Automatic sample data entry. Profile step resolution of 0.002". Five user set analysis zones, min. density, avg. density, max. density, and density ratios for each zone.</i></p> |
| Fisher Incubator | <i>Justin</i> | <p>2007</p> <p>This stationary incubator is used for fungal and bacterial cell culturing.</p> <p>Specifications Manufacturer: <i>Fisher Scientific</i> Model: <i>Isotemp 650D</i> Details: <i>Temp range: 30 to 75C. Air changes 3 cuft/hr. Stackable. Microprocessor PID control with safety backup. Digital set and readout. Inside size: 18"W x 18"FB x 26"H.</i></p> |
| GE SEPA Filtration System | <i>Justin</i> | <p>2008 UMaine Tag # 001900</p> <p>The GE SEPA filtration system utilizes pressures in the range of 600 to 900 psig to recirculate liquids through filters of various scales – from reverse osmosis to micron pore sizes.</p> |
| Novasep Ceramic Filtration System | <i>Justin</i> | <p>4/2009 UMaine Tag # NO TAG – assembled in-house with purchased components</p> <p>The Novasep Ceramic Filtration System is capable of circulating liquids past a tangential flow ceramic filter membrane at up to 13 gallons per minute. The system was designed and constructed by FBRI staff, and houses filter membranes from 1 kD to 0.8 micron in pore size</p> |
| Sanyo -80° Freezer | | <p>2007 UMaine Tag # 001676</p> |
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| Analytical balances | <i>Justin</i> | |
|  | | <p>Pictured here is one example of the several scales FBRI researchers have to meet their research needs. Precision to 0.0001 g and range to 40 kg is available.</p> |
| Mercury Porosimeter | <i>Justin</i> | UMaine Tag # 002004 |
|  | | <p>Porosimetry is an analytical technique used to determine various quantifiable aspects of a material's porous nature, such as pore diameter, total pore volume, surface area, and bulk and absolute densities. The technique involves the intrusion of mercury at high pressure into a material through the use of a porosimeter. The pore size can be determined based on the external pressure needed to force the liquid into a pore against the opposing force of the liquid's surface tension.</p> |
| FlowCytoPrep | <i>Justin</i> | AWAITING INSTALLATION (8/2009) |
| CEPA Continuous Centrifuge | <i>Justin</i> | 7/2009 |
| | | <p>Laboratory centrifuge for continuous separation of two liquids, clarifying of liquids from solids, emulsifying of several liquids, fraction of plasma protein, concentration and extraction of viruses and bacteria as well as further fields of application.</p> <p>CEPA centrifuges are characterized by their ability to process many times the volume of their tubular bowl. Fluid mixtures are fed into the bottom of the rapidly rotating separation chamber. Solids are retained,</p> |

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|  | <p>while liquid components are expelled from the top of the chamber through a collection tray. For liquid-liquid separations, two collection trays are used. The retained solids cake is dry and densely packed by the high G-forces of the CEPA centrifuge.</p> |
| <p>Miser Pelletizer <i>Nick</i></p> | |
|  | <p>The "Agglo-Miser" laboratory pelletizer, a multi-depth, bench-scale unit, is ideal for a wide range of batch and/or continuous tests for powder and dust pelletizing. Designed with three adjustable pan depths, a selection of pan speeds and a variety of pan angle variations, the Agglo-Miser can be operated either as a shallow disc or a deep drum, producing either micropellets, granules or large balls.</p> |
| <p>Dual Source Thermal Evaporator <i>Nick</i></p> | |
|  | <p>The Thermal Evaporation System is a high vacuum thin film vacuum evaporator with a clean stainless steel vacuum chamber construction. It is ideally suited for research, laboratory, electron microscopy or even small production applications. The system uses compact metal evaporation sources which accommodate filaments, baskets or boats of either 1.875" or 3" length and can be configured for either upwards or downwards evaporation. The LT 300 power supply is a dual source power supply for light thin film metal evaporation with two KF40 feedthroughs with integrated vacuum safety interlock switches.</p> |

**Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts**

APPENDIX 7: YR3 FBRI On-site Workshops, Seminars, Presentations

| FBRI On-site Workshops, Seminars, Presentations | | | | |
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| DATE | FBRI EVENT | PRESENTER | Title | Affiliation |
| 8/13/2009 | Student Presentations | REU Students | | |
| 8/6/2009 | Environmental Aesthetics: Does it Matter When it Comes to Forest Biomass Harvesting? | Jessica Leahy | Faculty | UM |
| 7/30/2009 | Value Added Products from Lignin | David Neivandt | Faculty | UM |
| 7/23/2009 | Life Cycle Analysis | Anthony Halog | Faculty | UM |
| 7/16/2009 | Cellulose Nanofibril Production and Utilization | Douglas Bousfield | Faculty | UM |
| 7/7/2009 | Exploring the Chemistry of Hemicelluloses | Raymond Fort | Faculty | UM |
| 7/2/2009 | Processing Options for Production of Fuels and Chemicals from Lignocellulosic Biomass | G. Peter van Walsum | Faculty | UM |
| 6/25/2009 | The Role of Forest Operations to the Forest Bioproducts Industry | Jeffrey Benjamin | Faculty | UM |
| 6/18/2009 | What is Graduate School and Why Go? | Dan Sandweiss & Scott Delcourt | Graduate School Dean & Associate Dean | UM |
| 6/11/2009 | Overview of Sustainable Forest Bioproducts | Hemant Pendse | FBRI Research Director | UM |
| 2/24/2009 | FBRI press conference | John Baldacci | Governor | State of Maine |
| 2/13/2009 | Anaerobic Fermentation of Hemicellulose Present in Green Liquor and Hot Water Extracts to Carboxylic Acids | Baddam, Rakhi | Graduate Student | UM |
| 2/13/2009 | Fast Pyrolysis of Biomass: Fuels and Chemicals Virginia Polytechnic Institute and State University. | Beis, Sedat | Post Doc | UM |
| 2/5/2009 | Wood Science & Technology Seminar: Influence of hot water extraction on cell wall mechanics | Juan J. Paredes | Grad Student | UM |
| 1/26/2009 | Hydrolysis of Near Neutral Hemicellulose Extracts Catalyzed by Sulfur Dioxide | Rory Jara | Grad Student | UM |

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| 12/15/2008 | Printeast Bioenergy Market: a Large Landowner Perspective | Steve Robe | | Plum Creek |
| 12/8/2008 | Pre-Hydrolysis of Phenyl Glycosidic Bond in a Model Compound | Sagar Deshpande | Grad Student | UM |
| 11/17/2008 | Overview of Liquid Fuels from Biomass by Thermochemical Conversion | Douglas Elliott | Staff Scientist | Pacific Northwest National Laboratory |
| 10/14/2008 | Characterization of Mechanically and Enzymatically Produced Nanometer Scale Cellulose Fibers from Wood Pulp | Nazia Siddiqui | Grad Student | UM |
| 10/31/2008 | Development of High-Throughput Screening Technique for Screening Catalyst of Bio-Oil Upgrade | Richard Nelson | Grad Student | UM |
| 10/31/2008 | Synthesis and characterization of cobalt catalysts in silica supports with variable pore size | Isaac Tyrone Ghampson | Grad Student | UM |
| 10/27/2008 | Life Cycle Assessment of Bio-ethanol from Forest Resources (Hemicellulose) | Gurbakahash Bhandar | Grad Student | UM |
| 10/9/2008 | It's Time to Celebrate Everything FBRI – fall meeting | FBRI | | |
| 10/6/2008 | Designing the Forest Biorefinery | Virginie Chambost | Research Fellow | Ecole Polytechnique (Montreal, Canada) |
| | | Paul Stuart | NSERC Environmental Design Engineering Chair | Ecole Polytechnique (Montreal, Canada) |
| 9/29/2008 | Heterogeneous Catalytic Reduction of Perchlorate in Water | Keith Hurley | Post Doctoral Candidate | University of Illinois, Champaign |
| 9/19/2008 | I'm Away: Thoughts from an American Association for the Advancement of Science Fellow | Darrell Donahue | Professor | UM |
| 8/15/2008 | Acetic Acid Removal from Pre-Pulping Wood Extract | Aymn Abdulrahman | Grad Student | UM |
| 8/7/2008 | REU Participant Presentations | FBRI | undergraduate students | |
| 7/31/2008 | Environmental Aesthetics: Does it Matter When it Comes to Forest Biomass Harvesting | Jessica Leahy | Assistant Professor | UM |
| 7/28/2008 | Assembling Materials from Nanoscale Building Blocks | Richard Siegel | | Rennselaer Nanotechnology Center/Rennselaer |

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| | | | | Polytechnic Institute |
| 7/24/2008 | The Role of Forest Operations to the Forest Bioproducts Industry | Jeff Benjamin | Professor | UM |
| 7/17/2008 | Forest Biorefineries Producing Pulp, Biofuels, Chemicals and Polymers | Adriaan van Heiningen | Ober Chair & Professor | UM |
| 7/10/2008 | What is Graduate School and Why Go? | Dan Sandweiss & Scott Delcourt | REU presentation | UM |
| 7/17/2008 | Hemicellulose Extraction of Mixed Southern Hardwoods | Mehmet Sefik Tunc | Grad Student | UM |
| 7/3/2008 | Thermal Conversion of Biomass to Fuels and Chemicals | Clay Wheeler | Professor | UM |
| 6/26/2008 | Formation of Soot Precursors during the Pyrolysis of a Biomass Model Compound | Shiju Thomas | interviewee | Louisiana State University |
| 6/26/2008 | Sustaining Maine's Forest Resources - Past Experiences and Future Outlooks | Ken Laustsen | REU presentation | Maine Forest Service |
| 6/19/2008 | Exploring the Chemistry of Hemicellulose | Ray Fort | Professor | UM |
| 6/12/2008 | Processing Options for Production of Fuels and Chemicals from Lignocellulosic Biomass | Peter van Walsum | Professor | UM |
| 6/11/2008 | Forest Biorefineries in the United States: Where are we? Where are we going? | Stephen S. Kelley | Dept. Head (Wood and Paper Science) | North Carolina State University |
| 6/5/2008 | Introduction to Forest Bioproducts Research Initiative | Hemant Pendse | FBRI Research Director | UM |
| 5/28/2008 | Biomass as the New Carbon. Conversion of Renewable Feedstocks into Chemicals and Materials | Joseph J. Bozell | Prof, Biomass Chemistry | University of Tennessee |
| 5/8/2008 | A Forest Resources Perspective on Bioproducts | FBRI Spring Meeting | | |
| 4/22/2008 | FBRI press conference @ Buchanan Alumni House | FBRI | | |
| 4/21/2008 | High Throughput Technologies for Biomass Characterization | Nicole Labbe | Guest Speaker | University of Tennessee |
| 4/20/2008 | Prehydrolysis of Phenyl Glycosidic Bonds in Wood Chips | Sagar Deshpande | Grad Student | UM |
| 4/11/2008 | Anaerobic Fermentation of Hemicellulose Present in Green Liquor and Hot Water Extracts to Carboxylic Acids | Rakhi Baddam | Grad Student | UM |

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| 4/3/2008 | International Biofuels Trade and the U.S. Market Potential | Ning Lu | Grad Student | UM |
| | Presentation of findings for "Potatoes to Plastics" report, given to team members. | Kate Dickerson | Research Assistant | UM |
| 4/1/2008 | Catalyst Development for Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", B. G. Frederick, Dept. of Physics, Univ. of Maine. | Brian Frederick | Faculty | UM |
| | Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", Brian G. Frederick, Chemistry Dept faculty research presentation. | Brian Frederick | Faculty | UM |
| 3/21/2007 | Cellulose Nanofillers Based Nanocomposites"(Formerly of KTH Fibre and Polymer Technology, Division of Biocomposites, Suecia) | My Ahmed Said Azizi Samir | | Morocco |
| 2/6/2007 | Commercialization of Forest Bio-products (Wood Composites), FBRP Commercialization Workshop | Douglas Gardner | Faculty | UM |

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545

Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

APPENDIX 8: FBRI Conference Presentations

| FBRI Conference Presentations | | |
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| Name | Scope | Description |
| Benjamin, Jeffrey | Other/Special | Effects of Biomass Harvesting on Forest Ecosystems. Presented in Truro N.S. Canada at a meeting entitled Intensive Forest Management in the Acadian Forest sponsored by the Forest Products Association of Nova Scotia. Meeting summary published in Atlantic Forestry Review May 2007 pg 48-49. |
| Benjamin, Jeffrey | Regional | Biomass Harvesting: More Questions Than Answers. Invited presentation for Wagner Forest Management Ltd.'s Annual Forester Training. Saddleback Mountain, Maine May 6, 2008 |
| Benjamin, Jeffrey | Local | A Forest Operations Perspective on Biomass. Invited presentation for the Forest Bioproducts Research Initiative Spring Workshop. Orono, Maine. May 8, 2008 |
| Benjamin, Jeffrey | State | Biomass Harvesting: How much is enough? Invited presentation to the Maine Division of the Society of American Foresters Field Tour entitled "Biomass Harvesting - Enhancing or Depleting our Forest Resource?". Penobscot, Maine. May 30, 2008 |
| Benjamin, Jeffrey | National | The Role of Forest Operations in the Bioindustry. Forest Bioproducts Research Initiative REU Seminar Series. University of Maine. July 24. |
| Benjamin, Jeffrey | Regional | Guiding Principles of Biomass Harvesting in Maine. Invited Presentation for The Northern Forest Alliance 2008 Annual Meeting. Crawford Notch, New Hampshire. October 22, 2008. |
| Benjamin, Jeffrey | Regional | State of the Logging Industry in the Northeast. New England Council on Forest Engineering Annual Meeting: The Northeast Forest Products Industry: From Surviving to Thriving. University of Maine, Orono ME. March 9. |
| Benjamin, Jeffrey | Regional | Development of Sawing Patterns and Lumber Recovery Estimates Using Spreadsheets. Eastern CANUSA Forest Science Conference. University of Maine October 17-18. |
| Benjamin, Jeffrey | State | Biomass Harvest Guidelines in the Acadian Forest. Invited presentation to the Maine Wood Energy Policy Forum organized jointly by the Forest Resources Association and Maine Forest Products Council. Augusta, Maine. |
| Benjamin, Jeffrey | National | Lumber Grade Recovery Improvement Potential. Presented at the Wood Quality and Utilization Workshop of the Canadian Tree Improvement Association Meeting in Charlottetown P.E.I. Canada. |
| Bilodeau, Michael | National | National Epescor Conference, Portland, ME October 16, 2007 Regional Collaboration Session "The New England Green Chemistry Consortium" |
| Bilodeau, Michael | State | "Innovations in Forestry - Biofuels " presented at GrowSmart Maine Conference in Augusta, ME October 19,2007 |
| Bilodeau, Michael | State | Growing Maine's Green Economy, University of Southern Maine, Portland, ME October 26, 2007 "Cluster Enhancement: Potatoes to Plastic" |
| Bilodeau, Michael | Regional | University of Maine Pulp and Paper Foundation Membership Committee Meeting, Nov 15 2007. New Page Mill Rumford, ME "What's New at the Process Development Center" |
| Bozell, Joseph | Regional | 5/28/2008 Biomass as the New Carbon. Conversion of Renewable Feedstocks |

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| J. | | into Chemicals and Materials University of Tennessee |
| Chambost, Virginia | International | 10/6/2008 Designing the Forest Biorefinery Ecole Polytechnique (Montreal, Canada) |
| Cole, Barbara J | National | "Exploring the Chemistry of Hemicelluloses." Presented by R.C. Fort at the USDA Forest Products Laboratory, Madison, WI, September, 2007. |
| Cole, Barbara J | National | "Exploring the Chemistry of Hemicelluloses." Presented by R.C. Fort at the University of Tennessee Forest Products Center, Knoxville, TN, November, 2008. |
| Cole, Barbara J | National | "Comparison of acid and enzymatic hydrolysis of hardwood hemicelluloses for the development of an integrated forest biorefinery." Presented by L.B. Graham at the American Chemical Society National Meeting, New Orleans, LA, April 6-10, 2008. |
| Cole, Barbara J | National | "Characterization of mechanically and enzymatically produced nanofibrillated cellulose (NFC) from wood pulp." Presented by N. Siddiqui at the American Chemical Society National Meeting, New Orleans, April 6-10, 2008. |
| Cole, Barbara J | National | "Computer Docking of Lignin-Carbohydrate Model Complexes and Small Lignin Fragments to the Laccase from <i>T. versicolor</i> ." Proceedings of the International Conference on Biotechnology in the Pulp and Paper Industry, Madison, WI, June 10-14, 2007; p.142, Abstract presented.sww |
| Cole, Barbara J | International | "Comparison of Acidic and Enzymatic Hydrolysis of Birch Xylan", Poster presented at the International Conference on Biotechnology in the Pulp and Paper Industry; Madison, WI, June 10-14, 2007. |
| Cole, Barbara J | International | "Oxidation of Lignin-Carbohydrate Models. I. Oxidation of Aryl Glucosides by the Laccase from <i>Trametes versicolor</i> ", Presentation at the International Symposium on Wood, Fiber, and Pulping Chemistry, June 14-18, 2009, Oslo, Norway. |
| Cole, Barbara J | International | "Bark and Foliage Extracts as Antioxidants and Other High Value Materials", Presentation at the International Symposium on Wood, Fiber, and Pulping Chemistry, June 14-18, 2009, Oslo, Norway. |
| Cole, Barbara J | International | "Oxidation of Lignin-Carbohydrate Models. I. Oxidation of Aryl Glucosides by the Laccase from <i>Trametes versicolor</i> ", Presentation at the Gordon Conference, June 21-26, 2009, Plymouth, NH. |
| Dickerson, Kate | State | Presentation of findings for "Potatoes to Plastics" report, given to Maine Potato Board. |
| Donahue, Darrell | National | 2007.Bits and Pieces at the University of Maine: A Research Perspective. Presentation for the Forest Products Center, University of Tennessee-Knoxville, 14-17 March, Knoxville, TN. |
| Elliott, Douglas | National | 11/17/2008 Overview of Liquid Fuels from Biomass by Thermochemical Conversion Pacific Northwest National Laboratory |
| Fort, Ray | Regional | "Exploring the Chemistry of Hemicelluloses", invited presentation, University of New Hampshire, Department of Chemistry, February 2008. |
| Frederick, Brian | National | "Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", H. P. Pendse, M. C. Wheeler, W. J. DeSisto, B. G. Frederick, A. van Heiningen, DOE EPSCoR Annual Program Review and Workshop 2008, Oak Ridge National Laboratory. |
| Frederick, Brian | National | "Infrastructure development for the thermal conversion of woody biomass to fuels and chemicals", I. T. Ghampson, B. Walsh, M. C. Wheeler, W. J. DeSisto, B. G. Frederick, A. van Heiningen, Nanoporous Materials Gordon Research |

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| | | Conference, Colby College, Waterville, ME. |
| Frederick, Brian | Regional | "Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", H. P. Pendse, M. C. Wheeler, W. J. DeSisto, B. G. Frederick, A. van Heiningen, First Annual Conference on Cellulosic Biofuels, TIMBER, Univ. of Massachusetts Amherst. |
| Frederick, Brian | Local | "Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", H. P. Pendse, M. C. Wheeler, W. J. DeSisto, B. G. Frederick, A. van Heiningen, Maine EPSCOR conference. |
| Frederick, Brian | National | "DoE Implementation Award: Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", Hemant P. Pendse, M. Clayton Wheeler, William J. DeSisto, Brian G. Frederick, and Adriaan van Heiningen, National DOE/NSF EPSCOR Conference, National Renewable Energy Laboratory (NREL), Golden CO. |
| Frederick, Brian | Local | Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", Brian G. Frederick, Chemistry Dept faculty research presentation. |
| Frederick, Brian | Local | "Catalyst Development for Thermochemical Conversion of Woody Biomass to Fuels and Chemicals", Brian G. Frederick, LASST research seminar |
| Frederick, Brian | Other/Special | Visit to Johns Hopkins Applied Physics Laboratory to discuss joint research interests. |
| Gardner, Doug | International | March 21, 2007 Dr. My Ahmed Said Azizi Samir (Morocco) Cellulose Nanofillers Based Nanocomposites"(Formerly of KTH Fibre and Polymer Technology, Division of Biocomposites, Suecia)12:00-1:00 pmAEWC, 2nd Floor Conference Room |
| Gardner, Doug | National | October 9, 2007 Forest Bioproducts Research Initiative at the University of Maine. Seminar at the NSF Nanoscale Science and Engineering Center, Rensselaer Polytechnic Institute. Troy, New York. |
| Gardner, Doug | International | Atomic force microscopy and applications to nanofibrillated cellulose. Seminar at the University of Chile, October 19, 2007, Santiago, Chile. |
| Gardner, Doug | International | Wood Plastic Composites Technology Trends. 1st International Symposium of Wood Plastic Composites: Development and Prospects, November 10-11, 2007, Xi An, China. |
| Gardner, Doug | International | Forest Bioproducts Research Initiative at the University of Maine. Seminar at the University of Copenhagen, December 7, 2007, Copenhagen, Denmark. |
| Gardner, Doug | State | Ligament formation of wood resin-adhesives. Fall 2007 WBC Advisory Board Meeting, October 3-4, 2007, Bangor, ME. |
| Gardner, Doug | International | Dyanmic mechanical properties of extruded nylon-wood composites. 9th International Conference on Wood & Biofiber Plastic Composites, May 21-23, 2007, Madison, WI. |
| Gardner, Doug | International | Manufacture of extruded wood-nylon composites: Processing and Properties. 9th International Conference on Wood & Biofiber Plastic Composites, May 21-23, 2007, Madison, WI. |
| Gardner, Doug | International | Oporto, G., W. Gramlich, D. Neivandt, and D. J. Gardner. 2007. Characterizing the mechanism of improved adhesion on modified WPC surfaces. 9th International Conference on Wood & Biofiber Plastic Composites, May 21-23, 2007, Madison, WI. |
| Gardner, Douglas | National | Shaler, S., H. Pendse, and D. J. Gardner. 2006. Integrated Forest Bioproducts Research for Northeastern Species. 49th Annual Convention of the Society of Wood Science and Technology, Newport Beach, California. |

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| Gardner, Douglas | National | Gardner, D. J. 2006. Standards, Procedures and Guidelines for Accrediting Educational Programs Leading to a Professional Degree in Wood Science and Technology or Forest Products. Elvin T. Choong Memorial Lecture Series, May 16, 2006, Louisiana State University, Baton Rouge, LA. |
| Gardner, Douglas | National | Gardner, D. J. 2006. Graduate Certificate in Advanced Engineered Wood Composites. Elvin T. Choong Memorial Lecture Series, May 16, 2006, Louisiana State University, Baton Rouge, LA. |
| Gardner, Douglas | International | Gardner, D. J. 2006. Synthetic Fiber Reinforcement Strategies for Glulam and Oriented Strandboard. Forest Products Society- Eastern Canadian & U.S. Northeast Section Meeting, June 1, 2006, Fredericton, New Brunswick, Canada. |
| Gardner, Douglas | International | D. J. Gardner, S. Shaler, and H. Pendse. 2006. Integrated Forest Bioproducts Research at the University of Maine. First Latin American Congress on Biorefineries. , Nov. 21, 2006, Concepcion, Chile. |
| Gardner, Douglas | State | Gardner, D. J. 2007. Integrated Forest Bioproducts Research at the University of Maine. Refining Trees, Project Learning Tree-FBRP, K-8 workshop, Feb. 2, 2007, Houlton, ME. |
| Gardner, Douglas | Local | Gardner, D. J. 2007. Commercialization of Forest Bio-products (Wood Composites), FBRP Commercialization Workshop Feb. 6, 2007, Orono, Maine. |
| Gardner, Douglas | International | Characterization of Wood Plastic Composite (WPC) Z-section Sheet Pile Properties, D. Alvarez, H.J. Dagher, D.J. Gardner, R. Lopez-Anido, W. G. Davids, 4th International Conference on Advanced Engineered Wood & Hybrid Composites, Bar Harbor, ME July 2008 |
| Gardner, Douglas | International | Mechanical Properties of Thermoplastic Composite filled with Microcrystalline Cellulose, A. Kiziltas, D. Gardner, Y. Han, C. West, 4th International Conference on Advanced Engineered Wood & Hybrid Composites, Bar Harbor, ME July 2008 |
| Gardner, Douglas | International | Adhesion Properties of Wood Plastic Composite (WPC) Surfaces Using Atomic Force Microscopy, G. Oporto and D. J. Gardner, Sixth International Symposium on Contact Angle, Wettability and Adhesion, Orono, Maine July 2008 |
| Gardner, Douglas | International | Yang, H. And D. J. Gardner. 2009. Dispersion study of MCC/nano fibrillated cellulose filled polypropylene composites using thermogravimetric analysis. Cellulose Nanocomposite Symposium. Madison, WI. May 13, 2009. |
| Gardner, Douglas | International | Zhang, X., D.J. Gardner and L. Muszynski. 2007. Ultrasonic atomization of wood resin-adhesives. IUFRO 2007 All Division 5 Conference, October 27- November 2, 2007, Taipei, Taiwan. |
| Gardner, Douglas | International | Gardner, D. J. 2007. Wood Plastic Composites Technology Trends. 1st International Symposium of Wood Plastic Composites: Development and Prospects, November 10-11, 2007, Xi An, China. |
| Gardner, Douglas | International | Andrusuk, L. G. Oporto, D. Gardner, and D. Neivandt. 2008. Production and Testing of Wood Plastic Composites Manufactured from Hot Water Extracted Wood. Society of Wood Science and Technology 51st Annual Convention, November 10-12, 2008, Concepcion, Chile. |
| Gardner, Douglas | International | Gardner, D. J. and N. Stark. 2006. Understanding the durability of wood plastic composites – an update. Durability in Wood Plastic & Natural Fiber Composites 2006: A catalyst for widespread market acceptance. December 4-5, 2006, San Antonio, Texas. |

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| Gardner, Douglas | International | Gardner, D. J. and J. Chen. 2006. Dynamic mechanical thermal analysis of extruded nylon-wood composites. Durability in Wood Plastic & Natural Fiber Composites 2006: A catalyst for widespread market acceptance. December 4-5, 2006, San Antonio, Texas. |
| Gardner, Douglas | State | Gardner, D. J. 2006. New Opportunities for Low Quality Wood Fiber Utilization. NER.COFE Workshop, March 13-14, 2006, Orono, ME. |
| Gardner, Douglas | International | Gardner, D. J. and Y. Han. 2009. Wood-Plastic Composite Technology Trends: Fundamental & Applied R&D. 10th International Conference on Wood & Biofiber Plastic Composites. Madison, WI. May 11-12, 2009. |
| Gardner, Douglas | International | Han, Y., C. West, S. Michalik, and D. J. Gardner. 2009. Foamed styrene-based Wood-Plastic Composite Created using a Physical Blowing Agent Created During Reactive Extrusion. 10th International Conference on Wood & Biofiber Plastic Composites. Madison, WI. May 11-12, 2009. |
| Gardner, Douglas | International | Kiziltas, A., D. J. Gardner, Y. Han, H. Yang and C. West. 2009. Structure, morphology, mechanical and thermal properties of composites based on microcrystalline cellulose and polyamide 6. 10th International Conference on Wood & Biofiber Plastic Composites. Madison, WI. May 11-12, 2009. |
| Gardner, Douglas | International | Kiziltas, A., D. J. Gardner, Y. Han, H. Yang and C. West. 2009. Effects of microcrystalline cellulose particle size on mechanical, thermal, and rheological properties of polystyrene composites. 10th International Conference on Wood & Biofiber Plastic Composites. Madison, WI. May 11-12, 2009. |
| Gardner, Douglas | International | Stevens, J. and D. J. Gardner. 2009. Material properties of wood ash-filled polypropylene wood-plastic composites (WPCs). 10th International Conference on Wood & Biofiber Plastic Composites. Madison, WI. May 11-12, 2009. |
| Gardner, Douglas | International | Oporto, G. D. J. Gardner, L. Andrusyk, and D. J. Neivandt. 2009. Wood-plastic composites manufactured from hot water extracted wood. 10th International Conference on Wood & Biofiber Plastic Composites. Madison, WI. May 11-12, 2009. |
| Gardner, Douglas | International | Gardner, D. J., G. Oporto, and D. J. Neivandt. 2009 Adhesion phenomena in wood-plastic composites. 10th International Conference on Wood & Biofiber Plastic Composites. Madison, WI. May 11-12, 2009. |
| Gardner, Douglas | International | Oporto, G. and D. J. Gardner. 2008. Application of corona discharge treatment on hybrid wood plastic composite (WPC)-fiber reinforced plastic (FRP). International Conference on Progress in Biofibre Plastic Composites, May 12-13, 2008, Toronto, Canada. |
| Gardner, Douglas | International | Stevens, J. and D. J. Gardner. 2008. Material properties of Wollastonite-filled polypropylene wood plastic composites. International Conference on Progress in Biofibre Plastic Composites, May 12-13, 2008, Toronto, Canada. |
| Gardner, Douglas | International | Kiziltas, A., D. J. Gardner, Y. Han and C. West. 2008. Mechanical properties of polymer composites from microcrystalline cellulose (MMC) and polyethylene terephthalate (PET) International Conference on Progress in Biofibre Plastic Composites, May 12-13, 2008, Toronto, Canada. |

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| Gardner, Douglas | International | Alvarez Valencia, D., H. J. Dagher, D. J. Gardner, R. Lopez-Anido, and W. Davids. 2008. Characterization of wood plastic composite (WPC) Z-section sheet pile properties. International Conference on Progress in Biofibre Plastic Composites, May 12-13, 2008, Toronto, Canada. |
| Gardner, Douglas | National | Perry, S. A., Shaler, S. M., Gardner, D. J., and Halteman, W. A. The Effect of Waxes and Adhesives on the Static Coefficient of Friction of Wood Strands. Poster presented at: WBC Center Spring 2009 Industry Advisory Board Meeting and Technical Forum; 2009 June 11-12; Blacksburg, VA. |
| Ghampson, Isaac Tyrone | Local | 10/31/2008 Synthesis and characterization of cobalt catalysts in silica supports with variable pore size UM |
| Halog, Anthony | Local | November 29, 2007 FBRI Speaker's Bureau presents a Life Cycle Assessment seminar |
| Hurley, Keith | National | 9/29/2008 Heterogeneous Catalytic Reduction of Perchlorate in Water University of Illinois, Champaign |
| Jara, Rory | Local | 3/21/2008 Extraction of Hemicellulose from Wood UM |
| Jara, Rory | Local | 1/26/2009 Hydrolysis of Near Neutral Hemicellulose Extracts Catalyzed by Sulfur Dioxide UM |
| Jellison, Jody | International | Jellison, J. and B. Goodell. 2007. Wood decay fungi: physiology, detection and control. Georg-August Universitat, Goettingen, Germany |
| Jellison, Jody | International | Goodell, B. and J. Jellison. 2007. Fungal degradation of wood by brown rot, white rot and molds. Georg-August Universitat, Goettingen, Germany |
| Jellison, Jody | International | Howell, C., A. C. Hastrop and J. Jellison. 2007. Temporal changes in cellulose crystallite size during degradation by brown rot fungi. Invited graduate student seminar. Goettingen, Germany |
| Jellison, Jody | International | Oliver, J. S. , Hastrop A. C., C. Howell and J. Jellison. 2007. Differences in oxalate and oxalate decarboxylase production in brown and white rot fungi. International Conference on Biodeterioration of Wood and Wood Products, FEMS Riga, Latvia, Awarded best student presentation by the Federation of European Microbiologists. |
| Jellison, Jody | International | Schilling, J. and J. Jellison. 2007. Gypsum effects on dry rot wood degradation as a function of environment International Research Group on Wood Preservation. IRG/WP Series Document 07-10624. |
| Jellison, Jody | International | Goodell, B., Daniel, G., Jellison, J. and Y. Qian. 2007. Chelator mediated Fenton chemistry in wood degraded by fungi. International Research Group on Wood Preservation. IRG/WP Series Document 07-10618 |
| Jellison, Jody | International | Howell, C., A. C. Hastrop and J. Jellison. 2007. The use of X-ray diffraction for analyzing biomodification of crystalline cellulose by wood decay fungi. International Research Group on Wood Preservation. IRG/WP Series Document 07-10622. |
| Jellison, Jody | International | Hastrop, A. C., Howell, C., and J. Jellison. Biomimetic studies of wood decay. 2007. International Research group on Wood Preservation Annual Meeting, Jackson Hole, WY May 20-24. |

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| Jellison, Jody | National | June 28, 2007 "Biodegradation and Biomodification of Wood" Seminar is part of the 2007 NSF REU (Research Experience for Undergraduates) |
| Jellison, Jody | International | Howell, C., J. Paredes, S. Shaler, and J. Jellison. Decay resistance properties of hemicellulose extracted oriented strand board. 39th Annual Meeting of the International Working Group on Wood Protection Istanbul, Turkey May 2008 |
| Jellison, Jody | International | Xie, X., Y. Qian, B. Goodell, D. Zhang, M. Peterson and J. Jellison. 2008. A novel method for carbon nanotube production and the mechanisms involved. TAPPI Nanotechnology Meetings St. Louis June 2008 |
| Jellison, Jody | International | Xie, X., Goodell, B., Nagle, D., ZHANG, D., Qian, Y., Peterson, M., Jellison, J. Fabrication and mechanical properties of carbonized medium density fiberboard (CMDF)/polymer composites. Biographies and abstracts p 35. Forest Products Society 61st International Convention Knoxville, TN June 2008 |
| Jellison, Jody | International | Goodell, B., Xie, X., Qian, Y., Daniel, G., Peterson, M., and J. Jellison. Multi-walled carbon nanotubes (MWNT) produced from natural cellulosic materials. Abstract Book p22. TAPPI 2007 International Conference on Nanotechnology for the Forest Products Industry June 2008 |
| Jellison, Jody | International | Howell, C., A-C. Hastrop and J. Jellison. 2009. X-ray diffraction analysis of white rot biodegradation. FEMS 2009 3rd Congress of European Microbiologists. June28-July 2, 2009. Goteborg, Sweden. Abstr. |
| Jellison, Jody | International | Xie, X. Y. Qian,B. Goodell, D. Zhang, M. Peterson, J. Jellison. 2008. Carbonization of wood,the production of carbon nanotubes, and the durability of historic artifacts. International Biodegradation and Biodeterioration meetings October 6-11, 2008, Messina, Italy. |
| Jellison, Jody | International | Jellison, J., J.Oliver and B. Goodell. 2008. The role of fungal metabolites in lignocelluloses biodegradation. International Biodegradation and Biodeterioration meeting October 6-11, 2008, Messina, Italy. |
| Jellison, Jody | National | Degradative physiology of inky cap fungi. Micological Society of America (Oliver et al) |
| Jellison, Jody | International | Jellison, J. Biological degradation and colonization of wood. University of Concepcion, Chile. (Centro de Biotecnologia Facultad de Ciencias Forestales) |
| Jellison, Jody | National | Shortle, W., K. Smith and J. Jellison. Potential of wood decay fungi for Ca enrichment and reduction of Al-induced stress in spruce forests. American Chemical Society Annual Meeting Boston, MA |
| Jellison, Jody | International | Howell, C. and J. Jellison. Characterizing changes in wood crystalline cellulose nanostructures using X-ray diffraction. TAPPI International Nanotechnology Meetings St. Louis |
| Jellison, Jody | National | Oliver, J. and J. Jellison. Wood decay mechanisms in the family Coprinaceae. Mycological Society of America Abstr. |
| Jellison, Jody | International | Biological Degradation of Wood. Presented Swedish University of Agricultural Sciences |
| Laustsen, Ken | State | 6/26/2008 Sustaining Maine's Forest Resouces - Past Experiences and Future Outlooks Maine Forest Service |

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| Leahy, Jessica | National | Kilgore, M., Leahy, J., Hibbard, C., and Donnay, J. "Family Forest Certification Opportunities and Barriers in the US: A Minnesota Case Study" for SAF 2006 National Convention. October 2006. Pittsburgh, PA. |
| Leahy, Jessica | National | Heldmann, G. and Leahy, J. "Implications of Land Use Change on Private Forest Land in the Urban/Rural Interfact in Penobscot County, Maine" (poster) for Urban/Rural Interfaces Conference, April 2007. Atlanta, GA. |
| Leahy, Jessica | Local | 7/31/2008 Environmental Aesthetics: Does it Matter When it Comes to Forest Biomass Harvesting UM |
| Leahy, Jessica | Local | Leahy. "Paying Privately for the Playing Public: Maine's Finite Family Forests." UMass-Amherst Departmental Seminar. |
| Leahy, Jessica | Regional | Leahy, J. "Social Availability of Biomass on Family Forests." New England Society of American Foresters Meeting. |
| Leahy, Jessica | National | Stone, I., J.G. Benjamin, and Leahy, J. "Feasibility of Using Insurance Company Records to Inventory Logging Equipment in the State of Maine." (poster) Society of American Foresters National Convention. |
| Leahy, Jessica | National | Leahy, J., Lilieholm, R. and Porter, T. "Social Acceptability of Biomass Harvests and Bioproducts Industry in Maine." Society of American Foresters National Convention. |
| Leahy, Jessica | Regional | Leahy, J. and Ma, Z. (presenter) "Educational Outreach – Marketing Forest Certification to Family Forest Owners in Northern Minnesota." Family Forest Stewardship Conference. |
| Leahy, Jessica | International | Leahy, J. and Hartford, K. "Natural Resource Managers' Perceptions of Trust in New England (USA)" for International Union of Forest Research Organizations Division VI Meeting. |
| Lilieholm, R.J. | National | July 5, 2007 "Stakeholder Views Toward Bioproducts and Biomass Harvesting" Seminar is part of the 2007 NSF REU (Research Experience for Undergraduates) |
| Lilieholm, R.J. | State | Alternative Future Visions for Maine's North Woods. Land Use Regulation Commission, State of Maine, Augusta. (Lilieholm presenting) (invited), June 2008 |
| Lilieholm, R.J. | National | UMaine's Center for Sustainability Solutions. American Association for the Advancement of Science review of the NSF EPSCOR Forest Bioproducts Research Initiative, Orono, ME. (Lilieholm presenting, with Hart), October 2008 |
| Lilieholm, R.J. | Local | Creating a UMaine Center for Sustainability Solutions. School of Forest Resources Seminar Series, UMaine. (Lilieholm presenting, with Hart) (invited), January 2009 |
| Lilieholm, R.J. | State | UMaine's Center for Sustainability Solutions: Alternative Future Scenarios for Maine's Forest Products Sector. Annual Meeting of the New England Chapter of the Society of American Foresters, Portland, ME. (Lilieholm presenting, with Hart and Wilson), March 2009 |
| Mao, Haibo | Local | December 6, 2007 Haibo Mao defense of thesis |

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| Mason, Michael | Regional | Mason, MD; King, M. "Paper-based Field Biosensors for Bio-molecular Detection", Paper Surface Science Program Fall Meeting, The University of Maine, October 2007. |
| Mason, Michael | Local | Mason, M; King, M. "Paper-based micro-Biosensors for Rapid Detection of Pathogenic DNA", Departmental Graduate Seminar, December, 14 2008. |
| Neivandt, David | National | Characterizing the Mechanism of Improved Adhesion on Modified Wood Plastic Composite (WPC) Surfaces' Oporto, Gardner, Bernhardt, Neivandt, Graduate Student Association Research Exhibition 24 - 25 April 2007. Awarded Best Poster in the Science and Engineering Division |
| Neivandt, David | International | 'The Production of Cellulose Nanofibers from Wood Pulps' Siddiqui, Lena, Bousfield, Neivandt, Mills, Gardner, Shaler, TAPPI 2008 International Conference on Nanotechnology for the Forest Products Industry, St Louis, MO, 25-27 June 2008. |
| Nelson, Richard | Local | 10/31/2008 Development of High-Throughput Screening Technique for Screening Catalyst of Bio-Oil Upgrade UM |
| Norris, Greg | Local | March 27, 2007 "Introduction to Life Cycle Analysis" FBRI and Maine Forest Service are offerings an introductory seminar on Life Cycle Analysis |
| Norris, Greg | National | July 12, 2007 "Life Cycle Analysis and Sustainability" Seminar is part of the 2007 NSF REU (Research Experience for Undergraduates) |
| Norris, Greg | Local | November 15, 2007 FBRI Speaker's Bureau presents a Life Cycle Assessment seminar |
| Norris, Greg | Local | Hands-On Introduction to Life Cycle Assessment: 1-day short-course to introduce participants in an active, participatory, hands-on way to the principles, methods, data sources, and applications of environmental life cycle assessment (LCA). |
| Oporto, Gloria | International | Douglas J. Gardner and David J. Neivandt. Wood plastic composites manufactured from hot water extracted wood. Part II: Surface chemistry and adhesion by Inverse gas chromatography (IGC). 10th International Conference on Wood & Biofiber Plastic Composites. Madison, Wisconsin USA. May 11-12 (2009). |
| Paredes, Juan | Local | 2/5/2009 Wood Science & Technology Seminar: Influence of hot water extraction on cell wall mechanics UM |
| Pendse, Hemant | Regional | "Advancing 21st Century Forest based Economy through Forest Bioproducts Research," Northeast PIMA – Paper Industry Management Association, Bangor, ME (September 2006) (invited) |
| Pendse, Hemant | Regional | "Forest Bioproducts Research Initiative in Maine," Coalition of Northeast Governors (CONEG) Regional Roundtable, Essex Junction, VT (September 2006) (invited) |
| Pendse, Hemant | State | "Forest Bioproducts Research Initiative," Maine Technology Institute (MTI) Forest Bioproducts Working Group, Augusta, ME (September 2006) (invited) |
| Pendse, Hemant | National | "Hemicellulose Extract Utilization Research in Maine," Celunol Corporation, MDedham, MA (September 2006) (invited) |

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| Pendse, Hemant | State | Forest Bioproducts Research Initiative," E2TECH Forum, Freeport, ME (October 2006) (invited) |
| Pendse, Hemant | State | "Forest Bioproducts Research Collaborative," Maine Legislature Joint Select Committee on R&D and the Innovation Economy, Augusta, ME (November 2006) (invited) |
| Pendse, Hemant | State | "Advancing 21st Century Forest based Economy through Forest Bioproducts Research," Maine Forest Products Council, Augusta, ME (November 2006) (invited) |
| Pendse, Hemant | Regional | "Forest Bioproducts Research Initiative in Maine," Massachusetts Division of Energy Resources Cellulosic Ethanol Workshop, Boston, MA (November 2006) (invited) |
| Pendse, Hemant | International | "Hemicellulose Extract Utilization Research in Maine," University Institute of Chemical Technology, Mumbai, India (December 2006) (invited) |
| Pendse, Hemant | State | "Forest Bioproducts Research Initiative in Maine," Leadership Maine – Campus Tour, Orono, ME (January 2007) (invited) |
| Pendse, Hemant | State | "Forest Biorefinery Deployment Initiative in Maine," Pulp and Paper Foundation Exec. Committee, Augusta, ME (January 2007) (invited) |
| Pendse, Hemant | State | "Forest Bioproducts Research Initiative in Maine," Center for Science & Math Education Research, Orono, ME (February 2007) (invited) |
| Pendse, Hemant | National | "Forest Bioproducts Research Initiative in Maine," UMaine Technology Forum on Capitol Hill, Washington, DC (March 2007) |
| Pendse, Hemant | National | "Forest Bioproducts Research Initiative in Maine," Kennebec Valley Community College – NSF Visiting Committee, Fairfield, ME (March 2007) (invited) |
| Pendse, Hemant | Regional | "Forest Bioproducts Research Initiative in Maine," Pulp and Paper Foundation Open House – Paper Daze, Orono, ME (April 2007) (invited) |
| Pendse, Hemant | State | "Forest Biorefinery Deployment Initiative in Maine - Update," Pulp and Paper Foundation Board of Directors, Orono, ME (April 2007) |
| Pendse, Hemant | International | "Forest Bioproducts Research Initiative in Maine," American Institute of Chemical Engineers Spring Meeting, Houston, TX (April 2007) (invited) |
| Pendse, Hemant | National | "Forest Biorefinery Deployment Initiative in Maine," Biorefinery Deployment Consortium, Atlanta, GA (May 2007) (invited) |
| Pendse, Hemant | National | Evaluation of Northern Hardwood Biorefinery Using the Near-Neutral Hemicellulose Pre-extraction Process, 2008 Tappi Engineering, Pulping and Environmental Conference, Portland, OR (with Genco, van Heiningen, and Mao) |
| Pendse, Hemant | State | "Forest Biorefinery and FBRI update" Northern Forest Alliance, Augusta, ME (January 8, 2008) |
| Pendse, Hemant | State | "Towards Forest Biorefineires in Maine - Update on UMaine Forest Bioproducts Research Initiative", Northern Maine forest Forum, Caribou, ME (February 14, 2008) |

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| Pendse, Hemant | International | "Forest Bioproducts Research Initiative - NSF EPSCoR Research Infrastructure Investment in Maine" Universidad de Concepción, Concepcion, Chile (March 11, 2008) |
| Pendse, Hemant | National | "Thermochemical Conversion of Woody Biomass to Fuels and Chemicals - UMaine Program" AIChE Spring National Meeting, New Orleans, LA April 2008 |
| Pendse, Hemant | State | "Integrated Forest Biorefinery - Platform for Wood to Fuels and Chhemicals" Green Forest Summit, Portland, ME April 2008 |
| Pendse, Hemant | Regional | "Biomass Conversion to Liquid Fuels" AIChE Boston Section - Clean Energy Roundtable - Developing Solutions to Today's Energy Problems, Boxboro, MA (April 3, 2008) |
| Pendse, Hemant | International | "Forest Bioproducts Research in Maine" Atlantic BioEnergy Conference, Saint John, New Brunswick, Canada (April 10, 2008) |
| Pendse, Hemant | International | "Integrated Forest Biorefinery - The Maine Difference" Department of Chemical Engineering, Tsingua University, Beijing, China May 2008 |
| Pendse, Hemant | National | "Forest Biorefinery - The Maine Perspective on Biofuels Resource Management" PAPERCON PIMA-TAPPI Conference, Dallas, TX (May 5, 2008) |
| Pendse, Hemant | International | "Integrated Forest Product Refinery - a Promising Platform for Biomass to Biofuels and Much More", World Congress of iBio2008, Session on Pathways for Introducing New Biobased Trasportation Fuels, Hangzhou, China (May 18, 2008) |
| Pendse, Hemant | State | "Integrated Forest Biorefinery - The Maine Difference" GAA Conference, Bar Harbor, ME June 2008 |
| Pendse, Hemant | National | "Pre-extraction and Kraft Pulping - Mixed Hardwoods" (with van Heiningen) VPP Project Organization Meeting, Forest Products Laboratory, Madison, WI(August 29-30, 2007) |
| Pendse, Hemant | National | "Issues in Production of ethanol from Hardwood Extracts" (with Sara Walton VPP Project Organization Meeting, Forest Products Laboratory, Madison, WI(August 29-30, 2007) |
| Pendse, Hemant | Local | Introduction to Forest Bioproducts Research Initiative UM |
| Pendse, Hemant | International | Atlantica BioEnergy Task Force - Kick -Off - UMaine's role and plans for MTI support |
| Pendse, Hemant | Local | Forest Bioproducts Reserach Initiative - Maine's leadership in Integtraed Forest Biorefinery Development, SCHOOL OF FOREST RESOUCES, UMAINE |
| Pendse, Hemant | State | Forest and Agricultural Bioproducts Research, Development, and Commercialization Facility, MAINE TECHNOLOGY INSTITUTE (MTI) (with Mike Bilodeau) |
| Pendse, Hemant | National | Making of a Forest Biorefinery - The Maine difference, DOE EPSCoR ANNUAL MEETING, Oak Ridge, TN |

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| Pendse, Hemant | State | Forest Bioproducts Reserach Initiative (FBRI) - Framework for Integrated Forest Product Refinery, PINGREE DIRECTORS MEETING, Orono, ME |
| Pendse, Hemant | State | Forest Bioproducts Research Initiative, GOVERNOR'S TASK FORCE on Keeping Maine's Forests as Forests, Augusta, ME |
| Pendse, Hemant | Regional | Atlantica BioEnergy Perspective, NorthEast Paper Industry Management association (NE-PIMA), Orono, ME |
| Pendse, Hemant | State | Forest Bioproducts Research Initiative - a Framework for Future of Pulp Mills, Maine Pulp & Paper Association (MPPA), Annual Meeting, Rockland, ME |
| Pendse, Hemant | State | Rsearch Infrastructure Improvement (RII) - Forest Bioproducts Research Initiative (FBRI), Maine EPSCoR Conference, Orono, ME |
| Pendse, Hemant | State | Forest Bioproducts Research Initiative - Biorefinery Platform for Maine's Pulp Mills, MAINE DEVELOPMENT FOUNDATION'S LEADERSHIP MAINE PROGRAM, Orono, ME |
| Pendse, Hemant | National | Integrated Biorefinery at Old Town Pulp Mill, SOCIETY OF AMERICAN FORESTERS (SAF), ANNUAL MEETING, Reno, Nevada (with Dick Arnold, Red Shield Acquisitions) |
| Pendse, Hemant | International | Regional Science & Technology Center Framework for Forest Bioproducts Research, ATLANTICA BIOENERGY TASK FORCE, LEADERSHIP ROUNDTABLE, St. Andrews, New Brunswick, Canada |
| Pendse, Hemant | National | Integrated Forest Biorefinery in Old Town Pulp Mill - Technology Framework, DOE BIOMASS PROGRAM DUE DELIGENCE REVIEW, Golden, CO (with Dick Arnold, RSA) |
| Pendse, Hemant | National | Integrated Forest Biorefinery in Old Town Pulp Mill, DOE BIOMASS PROGRAM PEER REVIEW, Washington, DC (with Jim St. Pierre, RSA) |
| Pendse, Hemant | Regional | Forest Bioproduct Research Initiative - Biorefinery Platform, NORTHEAST SOCIETY OF AMERICAN FORESTERS, Portland, ME |
| Pendse, Hemant | Local | Forest Bioproducts Research Initiative (FBRI) - New Interdisciplinary Research Program, GENERAL STUDENT SENATE (GSS), UMAINE, Orono, ME |
| Pendse, Hemant | State | Forest Biomass for Energy - Atlantica BioEnergy Perspective, HASKELL ENERGY CONFERENCE, Bangor, ME |
| Pendse, Hemant | Regional | Forest Bioproducts and Biorefinery Research at UMaine, PULP & PAPER FOUNDATION OPEN HOUSE, Orono, ME |
| Pendse, Hemant | National | Pre-pulping Extarction of Southern Mixed Hardwood, AF&PA VPP CONSORTIUM REVIEW MEETING, Syracuse, NY (with van Heiningen, Genco, and Hutto) |
| Pendse, Hemant | Regional | Wood-derived Sugars for Conversion to Jet Fuel, LOGOS-DARPA KICK-OFF MEETING, Washington, DC |
| Pendse, Hemant | National | Integrated Forest Biorefinery in Old Town Pulp Mill - Mill Extraction Trials, DOE BIOMASS PROGRAM, BUDGET PERIOD ONE, PROJECT MANAGEMENT PLAN REVIEW, Golden, CO (with Dick Arnold, RSA) |
| Pendse, Hemant | State | "Forest Biorefinery - Future of today's pulp mill" NSF-KVCC Pulp & Paper Summer Institute |

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| Pendse, Hemant | National | "Forest Bioproducts Research Initiative - NSF EPSCoR Research Infrastructure Investment in Maine" FBRI Advisory Board Meeting, Orono, ME |
| Pendse, Hemant | State | "Forest Bioproducts Research Initiative - NSF EPSCoR Research Infrastructure Investment in Maine" AAAS Review & Evaluation Visit, Orono, ME |
| Pendse, Hemant | National | "Forest Bioproducts Research Initiative - NSF EPSCoR Research Infrastructure Investment in Maine" NSF Reverse Visit, Washington DC |
| Pendse, Hemant | State | "Forest Bioproducts Research Initiative - New Products Commercialization through Small Business Interactions" Maine EPSCoR Conference, Portland, ME |
| Pendse, Hemant | Local | "State of the UMaine ChB Department and FBRI Update" Pulp & Paper Foundation Executive Committee, Portland, ME |
| Pendse, Hemant | National | "Thermochemical Conversion of Woody Biomass to Fuels and Chemicals - UMaine Program" AIChE Spring National Meeting, New Orleans, LA |
| Pendse, Hemant | State | "Integrated Forest Biorefinery - Platform for Wood to Fuels and Chemicals" Green Forest Summit, Portland, ME |
| Porter, Terry | State | Porter, T., Lilieholm, R., Leahy, J., (2008). Social Science Research Applications in the Forest Bioproducts Research Initiative. Upward Bound Orientation and Introduction, University of Maine, Orono, Maine |
| Porter, Terry | International | Lilieholm, R.J., Leahy, J., and Porter, T. (2008). Stakeholder Views towards Maine's Emerging Bioproducts Industry. International Symposium on Society and Resource Management. Burlington, VT |
| Porter, Terry | International | Leahy, J., Lilieholm, R., and Porter, T. (2008). Media Framing, Agenda-Setting, and Public Discourse of Forest Biomass and Bioproducts in Maine, International Symposium on Society and Resource Management. Burlington, VT. |
| Porter, Terry | State | Porter, T., Lilieholm, R., Leahy, J., (2008). Social Science Research Applications in the Forest Bioproducts Research Initiative. Upward Bound Orientation and Introduction, University of Maine, Orono, Maine June 2008 |
| Porter, Terry | International | Lilieholm, R.J., Leahy, J., and Porter, T. (2008). Stakeholder Views towards Maine's Emerging Bioproducts Industry. International Symposium on Society and Resource Management. Burlington, VT June 2008 |
| Porter, Terry | International | Leahy, J., Lilieholm, R., and Porter, T. (2008). Media Framing, Agenda-Setting, and Public Discourse of Forest Biomass and Bioproducts in Maine, International Symposium on Society and Resource Management. Burlington, VT. June 2008 |
| Porter, Terry | International | Porter, T. and Zivanovic, A. (2009). Proactive stakeholder alliances in the renewable energy industry: Theoretical framework and evidence from the field. International Association for Business and Society. Snowmass, CO. June 21. |
| Rubin, Jonathan | International | Teisl, Mario F., Jonathan Rubin and Caroline L. Noblet; Eco-Information & Passenger Vehicle Consumers: Eco-Modelling the interaction and its impact on Behavior . Evencon 2006: Applied Environmental Economics Conference, The Royal Society, London,. |

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| Rubin, Jonathan | State | Rubin, Jonathan, "Growing Maine's Green Economy," Maine's Green Chemistry & Bio-Based Manufacturing Summit," University of Southern Maine, Portland, 26 October 2007. |
| Rubin, Jonathan | National | Dickerson, Kate, Jonathan Rubin and Jacob Kavkewitz, "Biomass and Biofuels in Maine: Estimating Supplies for Expanding the Forest Products Industry," Margaret Chase Smith Policy Center, November 2007. |
| Rubin, Jonathan | National | Dickerson, C. & Rubin, J. (2008). Maine Bioproducts Business Pathways. Margaret Chase Smith Policy Center and Forest Bioproducts Research Initiative, School of Economics, University of Maine, Orono. |
| Rubin, Jonathan | Regional | Rubin, Jonathan, "Tradable Fuel Economy Credits CAFE & EISA," invited talk, University of Vermont, Transportation Research Center, 14 November 2008 |
| Rubin, Jonathan | State | Invited speaker, "The Future of Alternative Energy Development in Maine," Environmental Forum: History and Policy in the Northeast, University of Maine, Department of History, 12 June 2009. |
| Rubin, Jonathan | Regional | Rubin, Jonathan and Fan, Qin, "Hedonic Price Model for Light-Duty Vehicles: Consumer's Valuation of Automotive Fuel Economy," Eastern Economic Association Annual Conference, February 27-March 1, 2009, New York City. |
| Rubin, Jonathan | National | Teisl, Mario, Jonathan Rubin, Caroline Noblet, "Does Saving the Planet Endanger my Engine: Focus Group Results Related to Biofuels," Sun Grant Initiative Energy Conference, March 10-13, 2009 Washington DC. |
| Rubin, Jonathan | International | Teisl, M., C. Noblet and J. Rubin. 2009. The Psychology of Eco-Consumption - Invited paper. 2nd International Workshop at Laboratory of Forest Economics, Nancy, France June 29-30. |
| Rubin, Jonathan | Regional | Olesniewicz, Tim and Jonathan Rubin, "Unanticipated Consequences of Regional Pollution Control Policies: Criteria Emissions and the Regional Greenhouse Gas Initiative," Joint Annual Meeting of the Canadian Agricultural Economics Society and the Northeast Agricultural and Resource Economics Association |
| Rubin, Jonathan | State | Rubin, Jonathan, "Energy Alternatives and Policy, Legislative Mini-Forums: Bridging Research and Policy in Maine," State House, Augusta, Maine Development Foundation, Margaret Chase Smith Policy Center, Muskie School of Public Service, University of Maine School of Law, 6 |
| Rubin, Jonathan | Regional | Rubin, Jonathan, "Maine Forest Biorefinery Research Initiative and Green Chemistry: Opportunities for Bioproducts," Northeast Sun Grant Regional Feedstock Summit, Cornell University. |
| Rubin, Jonathan | International | Session co-organizer and Chair panel 3 Research Needs, "Cutting Carbs in the Transportation Sector: International Efforts to Address Global Climate," 87th Annual Meeting, Transportation Research Board of the National Academies |
| Rubin, Jonathan | National | Noblet, Caroline L., Jonathan Rubin, Mario F. Teisl, "The Design of an Eco-Marketing and Labeling Program for Vehicles in Maine," Transportation Research Board 85th Annual Meeting, Washington, DC . |
| Rubin, Jonathan | International | Barker, Terry and Jonathan Rubin, "Macroeconomic Effects of Climate Policies for Road Transport: Efficiency Agreements v. Fuel Taxation," Transportation Research Board 85th Annual Meeting, Washington, DC J |

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| Rubin, Jonathan | International | Teisl, Mario F., Jonathan Rubin, Caroline Noblet, "Do eco-communication strategies provide a road to sustainability? Evidence from the passenger vehicle market," GIN 2006 Cardiff, Cardiff, 13th International Conference of The Greening of Industry Network |
| Rubin, Jonathan | National | Rubin, Jonathan, Paul Leiby and David Greene, Tradable CAFE Credits and Low-Carbon Fuel Standards, Invited talk, Institute for Transportation Studies, University of California, Davis, |
| Rubin, Jonathan | State | Rubin, Jonathan, "Economics & Environment Maine Rural Land Use," presentation to Maine Woods Forever Roundtable, Unity Community Center. |
| Rubin, Jonathan | Regional | Mario F. Teisl, Jonathan Rubin and Caroline L. Noblet; Modeling the interaction between eco-labels and consumers: A psychonomic assessment, selected paper. Annual meeting of the Northeast Agricultural and Resource Association. |
| Shaler, Stephen | International | Jara, R., J. Parades, A. vanHeiningen, S.M. Shaler. 2006. Influence of hemicellulose extraction on suitability for oriented strand board (OSB) production. Presented at First Latin American Congress on Biorefineries: Innovation Opportunities for the Forestry Sector. Nov 22-22. Concepcion, Chile. 2006 |
| Shaler, Stephen | Regional | Shaler, S.M. 2007. New Products Out Of The Forest. Climate Change & Working Forests Conference. Concord, NH. March 1 |
| Shaler, Stephen | National | June 7, 2007 Local Sustainable Forest Bioproducts: An overview of the FBRI program to the NSF REU students and other interested graduate students and faculty. |
| Shaler, Stephen | National | June 22, 2007 Local Sustainable Forest Bioproducts: General description of research activities in the Forest Bioproducts Research Initiative program presented to students and faculty associated with the IGERT Sensors program |
| Shaler, Stephen | State | The Future of Wood to Energy in Maine - A Panel Discussion Jan. 2009 |
| Shaler, Stephen | International | PAREDES JJ, and SHALER SM (2008) OSB properties after hot water extraction. Presented at 4th Eastern CANUSA Forest Science Conference, 17-18 October, 2008, University of Maine, Orono, ME, USA. pp 51. |
| Shaler, Stephen | International | Paredes, J.J., R. Edgar, BJ Cole, and SM Shaler. 2009. VOC Emissions and Performance of OSB from Extract Southern Yellow Pine. Poster presented at 43rd International Wood Composites Symposium. March 30-April 1. 2009 Seattle WA. |
| Shaler, Stephen | International | Heller, JJP and SM Shaler. 2008 Oriented Strand Board (OSB) from Hot water Extract Wood. September 11-12, 2008 International 3rd International Conference on Environmentally Compatible Forest Products Porto, Portugal |
| Shaler, Stephen | International | VOC Emissions and Performance of OSB from Extracted Southern Yellow Pine Presented by J J Paredes @ 63rd International Convention of the Forest Product Society. Boise, ID |
| Shaler, Stephen | National | Performance of OSB from Chemically Modified Wood Presented to industry advisory board members who fund the Wood Based Composites Consortium. |
| Shaler, Stephen | International | Forest Bioproducts Research at University of Maine Presented to faculty and graduate students at the University of Chile - Santiago |

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| Shaler, Stephen | State | Maine Forest Bioproducts Research Presented to Project Learning Tree Teacher Training Winter Harbor, ME |
| Shaler, Stephen | Regional | Stephen Shaler; The Forest Bioproducts Research Initiative at UMaine. New England Society of American Forester Convention. |
| Shaler, Stephen | Regional | Stephen Shaler; Wood Composites from Biorefinery Derived Polymers. Materials Science Seminar Series. Durham, NH. |
| Shaler, Stephen | National | Stephen Shaler; Wood Based Composites Research at the AEWCCenter. Invited presentation to Industrial Advisory Board - Blacksburg VA. |
| Siddiqui, Nazia | Local | December 14, 2007 Graduate Research Seminar Nazia Siddiqui, Ph.D. candidate |
| Siddiqui, Nazia | Local | 10/14/2008 Characterization of Mechanically and Enzymatically Produced Nanometer Scale Cellulose Fibers from Wood Pulp UM |
| Tunc, Mehmet Sefik | Local | 7/17/2008 Hemicellulose Extraction of Mixed Southern Hardwoods UM |
| Um, Byung-Hwan | National | June 27, 2007 "Optimization of Ethanol Production from Concentrated Substrate" Byung H. Um is a PhD candidate in Chemical Engineering at Auburn University (AL). |
| van Heiningen, Adriaan | International | "Biorefinery for Botnia and UPM", Espoo, Finland, March 22 nd , 2007 |
| van Heiningen, Adriaan | International | "Converting a Kraft Pulp Mill into an Integrated Forest Biorefinery", Solander Symposium, Pitea, Sweden, March 29 th , 2007 |
| van Heiningen, Adriaan | International | "Forest Refinery and Its Potential Chemical Products", Wood-based Chemicals for Papermaking Workshop, Jaako Poyry, Espoo, Finland, April 13 th , 2007 |
| van Heiningen, Adriaan | International | "Potential New Bulk Products in a Forest Biorefinery", Åbo Akademi University, Turku, Finland, April 19 th , 2007 |
| van Heiningen, Adriaan | National | "Integrated Forest Products Refinery; Overview of Project", DOE Review Meeting, Orono, ME, May 10 th , 2007 |
| van Heiningen, Adriaan | National | "Integrated Forest Products Refinery; Hemicellulose Extraction", DOE Review Meeting, Orono, ME, May 10 th , 2007 |
| van Heiningen, Adriaan | International | "Strategies for a Forest BioRefinery", Helsinki University of Technology, Espoo, Finland, May 24 th , 2007 |
| van Heiningen, Adriaan | International | "The U.S. Forest Industry Biorefinery Agenda", PulPaper Conference, Helsinki, Finland, June 6 th , 2007 |
| van Heiningen, Adriaan | National | July 26, 2007 "Potential New Bulk Products in the Forest Biorefinery" Seminar is part of the 2007 NSF REU (Research Experience for Undergraduates) |
| van Heiningen, Adriaan | International | "High Boiling Point Organosolv Pulping", Presentation to Shell Global Solutions, University of Maine, Orono, August 24 th , 2007 |
| van Heiningen, Adriaan | Local | "Potential New Bulk Products in the Forest Biorefinery", CHB 111 Seminar, Orono, September 20 th , 2007 |

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| van Heiningen, Adriaan | Local | 7/17/2008 Forest Biorefineries Producing Pulp, Biofuels, Chemicals and Polymers UM |
| van Walsum , G. Peter | Regional | G. Peter van Walsum. Biorefinery Research at the University of Maine. NCASI North Eastern regional meeting, May 21, Auburn, ME. |
| van Walsum , G. Peter | State | G. Peter van Walsum. Biomass Conversion Technology Development. Growing Maine's Green Economy: Technology Development Panel. University of Southern Maine, October 26, 2007. |
| van Walsum , G. Peter | International | Parag Shah, G. Peter van Walsum. Process Modeling And Economic Evaluation Of Mix Alco Process To Produce Various C2 To C7 Chemicals. AIChE National Meeting, Salt Lake City, UT, November 2007. |
| van Walsum , G. Peter | Local | Peter van Walsum. Value and Sustainability from Biological Resources. Research Presentation to Department of Chemical and Biological Engineering, University of Maine, Dec 7, 2007. |
| van Walsum , G. Peter | Local | G. Peter van Walsum. Energy: Where have we been and where are we going? Presented in the town of Dover, ME. December 12, 2007. |
| van Walsum , G. Peter | Local | G. Peter van Walsum Biomass Fermentation Paradigms. Presented to U. Maine FBRI Biofuels workshop, Jan 10, 2008. |
| van Walsum , G. Peter | International | Sara Walton, Adriaan van Heiningen, G. Peter van Walsum. Fermentation of hardwood-derived hemicellulose pulp mill extract to ethanol using E.coli KO11. 30th Symposium on Biotechnology for Fuels and Chemicals, New Orleans, May 2008. |
| van Walsum , G. Peter | International | Byung Um, G. Peter van Walsum. Optimal acid hydrolysis of hardwood-derived hemicellulose pulp mill extract. 30th Symposium on Biotechnology for Fuels and Chemicals, New Orleans, May 2008. |
| van Walsum , G. Peter | International | Bowen Du, Lekh Sharma, Peter van Walsum, Kevin Chambliss. Effect of varying feedstock-pretreatment chemistry combinations on the production of potentially inhibitory degradation products in biomass hydrolysates. 30th Symposium on Biotechnology for Fuels and Chemicals, New Orleans, May 2008. |
| van Walsum , G. Peter | Regional | G. Peter van Walsum. Biorefinery Research at the University of Maine. NCASI North Eastern regional meeting, May 21, Auburn, ME. |
| van Walsum , G. Peter | Local | 6/12/2008 Processing Options for Production of Fuels and Chemicals from Lignocellulosic Biomass UM |
| van Walsum , G. Peter | Regional | G. Peter van Walsum. Biorefinery Research at the University of Maine. Invited presentation to Thayer School of Engineering and Mascoma Inc. Dartmouth College, June 13, 2008. |
| van Walsum , G. Peter | Regional | G. Peter van Walsum. Biocommodities and Biorefining. Presentation to project Learning Tree, University of Maine, August 12, 2008. |
| van Walsum , G. Peter | Regional | Sara Walton, G. Peter van Walsum, Adriaan van Heiningen, Fermentation of Near-Neutral pH Extracted Hemicellulose Derived from Northern Hardwood. 1st Annual Conference on Cellulosic Biofuels. U. Mass Amherst, Sept 19 2008. |

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| van Walsum , G. Peter | Regional | Byung-Hwan Um, G. Peter van Walsum, Evaluation of Acid and Enzymatic Hydrolysis of Hemicellulose Extracts Produced from Northeast Hardwood. 1st Annual Conference on Cellulosic Biofuels. U. Mass Amherst, Sept 19 2008. |
| van Walsum , G. Peter | Local | G. Peter van Walsum. Bioconversion Research in the FBRI. AAAS-NSF EPSCoR Review meeting. University of Maine, October 30, 2008. |
| van Walsum , G. Peter | International | G. Peter van Walsum. Modification of a Hardwood Pulp Mill into an Integrated Forest Biorefinery. NSERC Environmental Design Engineering Chair Seminar, Ecole Polytechnique, University of Montreal, Montreal, Quebec, Canada. Dec 1, 2008. |
| van Walsum , G. Peter | International | Sara Walton, Dwane Hutto, G. Peter van Walsum, Adriaan van Heiningen. Value Prior to Pulping: Extraction of Hemicellulose from Hardwood. 31st Symposium on Biotechnology for Fuels and Chemicals. San Francisco, May 2009. |
| van Walsum , G. Peter | International | Aymn Abdulrahman, Rakhi Baddam, Byung-Hwan Um, Adriaan van Heiningen, G. Peter van Walsum Acetic Mixed Culture Acidogenic Fermentation and Acid Extraction from Pre-Pulping Wood Extract. 31st Symposium on Biotechnology for Fuels and Chemicals. San Francisco, May 2009. |
| van Walsum , G. Peter | International | Byung-Hwan Um and G. Peter Van Walsum, Efficiencies of Designed Xylanase Combinations in Releasing Sugars from Hemicellulose Extract on Mixed Northeast Hardwood. 31st Symposium on Biotechnology for Fuels and Chemicals. San Francisco, May 2009. |
| van Walsum , G. Peter | National | G. Peter van Walsum, M. Clayton Wheeler. Production of higher alcohols liquid biofuel via acidogenic digestion and chemical upgrading of industrial biomass streams. DOE Biochemical Platform Review. Denver CO, April 14-16, 2009. |
| van Walsum , G. Peter | International | Sara Walton, G. Peter van Walsum, Adriaan van Heiningen, Fermentation of Near-Neutral pH Extracted Hemicellulose Derived from Northern Hardwood. 8 th World Congress on Chemical Engineering. Montreal, August 23-27, 2009 |
| van Walsum , G. Peter | International | Sara Walton, Adriaan van Heiningen, G. Peter van Walsum Fermentation of hemicellulose extracted from wood into lactic acid by <i>Bacillus coagulans</i> MXL-9. Polysaccharides as a Source of Advanced Materials, Sep. 21-24, 2009, Turku, Finland. |
| van Walsum , G. Peter | Regional | Lekh N. Sharma, Bowen Du, G. Peter van Walsum and C. Kevin Chambliss, Identification and Quantitation of Potential Fermentation Inhibitors Resulting from Chemical Pretreatment of Lignocellulosic Biomass. 64th SW Regional Meeting ACS conference. |
| Walton, Sara | Local | 3/28/2008 Conversion of Hemicellulose Extracts from Wood: Production of Fuel Ethanol by <i>Escherichia coli</i> K011 UM |
| Weiskittel, Aaron | Regional | Assessing the Potential of 3PG to Model Forest Response to Climate Change, Sept 2008 |
| Weiskittel, Aaron | Regional | Efficiency of some sampling alternatives to estimate tree- and stand-level foliage biomass, Sept 2008 |
| Weiskittel, Aaron | Regional | Efficiency of some sampling alternatives to estimate tree- and stand-level foliage biomass, Sept 2008 |

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| Weiskittel, Aaron | Regional | Development of an Acadian Variant of FVS, Oct 2008 |
| Weiskittel, Aaron | State | Perry, T.E., Weiskittel, A.R., Wagner, R.G., and Saunders, M.R. Austin Pond Study: Re-analysis of net present value for treatments using a calibrated FVS. University of Maine, Cooperative Forestry Research Unit Fall Advisory Meeting. Greenville, ME. October 28, 2008. |
| Weiskittel, Aaron | International | Weiskittel, A.R. Douglas-fir, genetics, and climate change: A synthesis of past and present research in the Pacific Northwest. Invited seminar. Baden-Württemberg Forest Research Institute. Freiburg, Germany. December 22, 2008 |
| Weiskittel, Aaron | International | Li, R. and Weiskittel, A.R. Regional variation in dominant height growth for balsam fir and red spruce in Maine. Eastern Canada and United States Forest Science Conference. Orono, ME. October 17-18, 2008. |
| Weiskittel, Aaron | Regional | Li, R. and Weiskittel, A.R. Development and evaluation of regional taper and volume equations for the primary conifer species in Maine. Northeastern Mensurationists' Meeting. Bar Harbor, ME October 7-8, 2008. |
| Weiskittel, Aaron | Regional | Weiskittel, A.R. and Temesgen, H. Efficiency of some sampling alternatives to estimate tree- and stand-level foliage biomass. Southern Mensurationists' Annual Meeting. St. Augustine, FL. November 6-8, 2008. |
| Weiskittel, Aaron | Regional | Li, R., <i>Weiskittel, A.R.</i> , Kenefic, L., Brisette, J. 2009. Long-term influence of early respacing treatments on stand attributes in a northern conifer stand of central Maine. New England Society of American Foresters Annual Meeting. Portland, ME. March 18 – 19. |
| Weiskittel, Aaron | Regional | Guiterman, C.H., Seymour, R.S., and <i>Weiskittel, A.R.</i> 2009. The influence of density and thinning on the growth and form of eastern white pine logs. New England Society of American Foresters Annual Meeting. Portland, ME. March 18 – 19. |
| Weiskittel, Aaron | National | Li, R., Bettinger, P. and <i>Weiskittel, A.R.</i> 2009. Comparison of three different methods used to generate forest landscapes for spatial harvest scheduling problems with adjacency restrictions. 13 th Symposium on Systems Analysis in Forest Resources. Charleston, SC. May 26 – 29. |
| Weiskittel, Aaron | International | Sader, S. and Weiskittel, A.R. Monitoring Maine forests from above: From science to application. Physically based remote sensing of forests 2nd annual workshop. June 3-4, 2008. Helsinki, Finland. |
| Weiskittel, Aaron | International | Temesgen, H., Monleon, V., <i>Weiskittel, A.R.</i> , and Wilson, D.S. 2009. A tale of two phases: Design and estimation of tree foliage biomass. 20 th Annual International Envirometrics Society Annual Conference. Bologna, Italy. July 5 – 9. |
| Weiskittel, Aaron | International | Temesgen, H., Weiskittel, A.R., and Wilson, D.S. Efficiency of some sampling alternatives to estimate tree- and stand-level foliage biomass. 9th Annual The International Environmetrics Society Conference. June 8-13, 2008, Kelowna, BC, Canada. |
| Weiskittel, Aaron | International | Weiskittel, A.R. and Hein, S. Predicting crown attributes for wood quality: Are model form, regional, and species differences important? IUFRO Working Party 5.01.04 Wood Quality Modelling Conference. June 8-14, 2008. Koli, Finland. |

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| Weiskittel, Aaron | International | Hein, S. and Weiskittel, A.R. Generalized mixed models on knottiness of European beech. IUFRO Working Party 5.01.04 Wood Quality Modelling Conference. June 8-14, 2008. Koli, Finland. |
| Weiskittel, Aaron | National | Burke, A.M., Fernandez, I.J., <i>Weiskittel, A.</i> , and Wagner, R. 2009. Modeling balsam fir nutrient uptake to address sustainability concerns in an age of bioenergy opportunity. Carbon in Northern Forests meeting. Traverse City, MI. June 9 – 12. |
| Weiskittel, Aaron | Regional | Assessing the Potential of 3PG to Model Forest Response to Climate Change |
| Weiskittel, Aaron | Regional | Development of an Acadian Variant of FVS |
| Wheeler, M. Clayton | National | July 19, 2007 "Thermal Conversion of Biomass to Fuels and Chemicals" Seminar is part of the 2007 NSF REU (Research Experience for Undergraduates) |
| Wheeler, M. Clayton | National | Poster: "DOE Implementation Award: Thermochemical Conversion of Woody Biomass to Fuels and Chemicals," Renewable Energies for a Global Economy: DOE EPSCoR State/National Laboratory Program Review Conference, Golden, CO, July 23, 2007 – M. C. Wheeler (presenter), W. J. DeSisto, B. G. Frederick, A. van Heniningen, and H. Pendse. |
| Wheeler, M. Clayton | National | Invited Talk: "Thermochemical Conversion of Woody Biomass to Fuels and Chemicals," Renewable Energies for a Global Economy: DOE EPSCoR State/National Laboratory Program Review Conference, Golden, CO, July 24, 2007 - M. C. Wheeler, W. J. DeSisto, B. G. Frederick, A. van Heniningen, and H. Pendse. |
| Wheeler, M. Clayton | National | Poster: I. T. Ghampson, B. Walsh, M. C. Wheeler, W. J. DeSisto, B. G. Frederick, A. van Heniningen, Infrastructure development for rapid screening of potential catalysts for the thermal conversion of woody biomass to fuels and chemicals, Gordon Research Conference: Nanoporous Materials, Waterville, ME 2008. |
| Wheeler, M. Clayton | Local | 7/3/2008 Thermal Conversion of Biomass to Fuels and Chemicals UM |
| Wheeler, M. Clayton | National | Poster: "DOE Implementation Award: Thermochemical Conversion of Woody Biomass to Fuels and Chemicals," DOE EPSCoR State/National Laboratory Program Review Conference, Oak Ridge, TN, July 23, 2008 – M. C. Wheeler (presenter), W. J. DeSisto, B. G. Frederick, A. van Heniningen, and H. Pendse. |
| Wheeler, M. Clayton | Regional | M. C. Wheeler, W. J. DeSisto, B. G. Frederick, A. van Heniningen, Thermochemical Conversion of Woody Biomass to Fuels and Chemicals, First Annual Conference on Cellulosic Biofuels, University of Massachusetts Amherst, September 19, 2008. |
| Yang, Han-Seung | International | Alper Kiziltas, Douglas J. Gardner, Yousoo Han, Han-Seung Yang, Chris West. 2008. "Mechanical Properties of PET/PTT Composite Filled with Microcrystalline Cellulose". 4th International Conference on Advanced Engineered Wood & Hybrid Composites |
| Yang, Han-Seung | International | Han-Seung Yang, Pizhong Qiao, Michael P. Wolcott. 2008. "Probability of Survival/Reliability Analysis of Wood Flour-Polypropylene Composites". 4th International Conference on Advanced Engineered Wood & Hybrid Composites |

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| Yang, Han-Seung | International | Reliability Analysis on Flexural Fatigue Properties of Wood Flour/High-Density Polyethylene Composites June 2008. |
| Yang, Han-Seung | International | Han-Seung Yang, Douglas J. Gardner. 2009. "Dispersion Study of MCC/Nano Fibrillated Cellulose Filled Polypropylene Composites using Thermogravimetric Analysis". Forest Products Society Cellulose Nanocomposites Symposium, pp.6 |

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

APPENDIX 9: FBRI Member Recognitions & Honors

| FBRI Member Recognitions & Honors | |
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| Donahue, Darrell | 2007: Dean's Award for Excellence |
| Donahue, Darrell | American Association for the Advancement of Science - Science and Technology Fellowship |
| Gardner, Douglas | 2008: Chosen as co-recipient of the 2008 Forest Products Society L. J. Markwardt Engineering Award for the following paper: "Evaluation of Load Transfer in the Cellulosic-Fiber/Polymer Interphase Using a Micro-Raman Tensile Test." that was published in Wood and Fiber Science in 2007. |
| Gardner, Douglas | 2007: The AEWG Center Director's Award 2007 Outstanding Faculty |
| Gardner, Douglas | 2006: Guest Editor for the Journal of Adhesion Science and Technology |
| Gardner, Douglas | Invited lecturer Beijing Forestry University Dec 2005 |
| Gardner, Douglas | Invited Lecturer University of Bodekultur, Vienna, Austria June 2006 |
| Genco, Joe | Feb. 2009: selected to be one of seven professionals as a 2009 TAPPI (Technical Assoc. of Pulp & Paper Industry) Fellow, which is an honorary title bestowed on less than 3% of TAPPI's membership. |
| Jellison, Jody | 2009: External examiner for the University of Waikato, New Zealand |
| Jellison, Jody | Invited session chair, International Biodegradation and Biodeterioration Meetings, Messina, Italy |
| Jellison, Jody | 2008: Invited participant and session chair in international meetings and planning activities including the International Working Group (Turkey), the International Biodegradation and Biodeterioration Society (Latvia and Italy), Forest Products Society and SWST national planning committee. |
| Jellison, Jody | 2007: External examiner Swedish Agricultural University |
| Jellison, Jody | International Research Group, elected member and member of nomination and membership committee |
| Jellison, Jody | 2006: 2005-2006 winner of the NSFA research award |
| Leahy, Jessica | 2007: 2007 Mentor Award for Graduate Faculty – College of Natural Sciences, Forestry and Agriculture. |
| Neivandt, David | Characterizing the Mechanism of Improved Adhesion on Modified Wood Plastic Composite (WPC) Surfaces' Oporto, Gardner, Bernhardt, Neivandt, Graduate Student Association Research Exhibition 24 - 25 April 2007. Awarded Best Poster in the Science and Engineering Division |
| Neivandt, David | Wood-Plastic Composites Manufactured from Hot Water Extracted Wood, Part II: Surface Chemistry and Adhesion by Inverse Gas Chromatography (IGC)' Oporto, Gardner, Neivandt, 10th International Conference on Wood & Biofiber Plastic Composites, Madison, WI, 11-12 May 2009. Jerry Saeman Award for Student Achievement in WPC Resear |

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| Neivandt, David | 2008: Faculty inductee into Phi Kappa Phi Honors Society in Recognition of Outstanding Scholarship and Service to the University of Maine |
| Neivandt, David | 2007: Faculty Inductee into Phi Kappa Phi Honors Society in Recognition of Outstanding Scholarship and Service to the University of Maine 25 April 2007 |
| Neivandt, David | Awarded College of Engineering Early Career Research Award, University of Maine 03 Nov. 2006 |
| Oporto, Gloria | Jerry Saeman Award for Student Achievement in WPC research. 10th International Conference on Wood & Biofiber Plastic Composites. Madison, Wisconsin USA. May 11-12 (2009). |
| Oporto, Gloria | Director's award AEWC Advanced Structures & Composites Center. Outstanding Graduate Student |
| Oporto, Gloria | Blumenstock family forest products Graduate Student of the year, School of Forest Resources College of Natural Sciences, forestry & Agriculture, University of Maine, April (2009). |
| Oporto, Gloria | Nov. 2008: Society of Wood Science & Technology, Concepcion, Chile – poster prize for “Wood Plastic Composites manufactured from hot water extracted wood” |
| Oporto, Gloria | Fred Griffe Memorial Award. Outstanding achieve in research. College of Natural Sciences, forestry & Agriculture, University of Maine, April (2009). |
| Pendse, Hemant | Jan. 2009: elected to the Board of Directors for the Transport and Energy Processes (TEP) Division of the American Institute of Chemical Engineers (AIChE). |
| Pendse, Hemant | 2008: Appointed to Maine Innovation Economy Advisory Board |
| Rubin, Jonathan | 2007: Collaborative Visiting Fellowship, Economic & Social Research Council - Social Science Research Council (United Kingdom) 2007-2008. |
| Rubin, Jonathan | 2006: Elected as a Visting Fellow, Clare Hall, University of Cambridge |
| Shaler, Stephen | 2008: 2008 G. Peirce & Florence Pitts Webber Outstanding Research Award - College of Natural Sciences, Forestry, and Agriculture. University of Maine |
| Shaler, Stephen | 2008 L.J. Markwardt Wood Engineering Award - Presented annually by the Forest Products Society for the most outstanding paper in the field of wood as an engineering material |
| Van Heiningen, Adriaan | 2007: appointed Finland Distinguished Professor (FiDiPro) by the Finnish Funding Agency for Technology and Innovation (Tekes). Included 1M euro award for research in collaboration with Helsinki University. |
| Weiskittel, Aaron | 2009: 2009 School of Forest Resources Pierce-Webber Outstanding Researcher |
| Wheeler, M. Clayton | 2008: College of Engineering Early Faculty Teaching Award |

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

APPENDIX 10: FBRI Advisory Board

| BOARD MEMBER: | AFFILIATION: |
|---|---|
| David Thompson Biochemical Engineer-Renewable Resources | Idaho National Laboratory Idaho Falls, ID |
| Robert Bryan Forest & Wetlands Ecologist | Maine Audubon Falmouth, Maine |
| Ken Kehrer Senior principal scientist, ABP Technology | Armstrong World Industries, Inc. Lancaster, PA |
| Del Raymond Consultant | Raymond Consulting Services (retired from Weyerhaeuser), Kent, Washington |
| Jay Vreeland Consultant | Environmental Modeling (retired from SAPPI) Scarborough, ME |
| Paul Davis (alt: Steve Robe) General Manager, Northeast Region | Plum Creek Fairfield, Maine |
| Thomas Doak Executive Director | Small Woodlot Owners Association of Maine (SWOAM), Augusta, ME |
| Stephen Schley President | Pingree Associates, Inc. Bangor, Maine |
| Jennifer Holmgren, Ph.D. Director, Exploratory & Fundamental Research | UOP LLC Des Plaines, IL |
| Sean Mahoney (alt: Jerry Morris) Maine Advocacy Center Director | Conservation Law Foundation Brunswick, ME |
| Ron Reinsfelder Technology & Innovation | Shell Global Solutions, Westhollow Technology Center, South Houston, Texas |
| Stanley Bower Director, Biochemical R&D | Tate & Lyle LLC Decatur, IL |
| Kirk Schulz V.P. for Research & Economic Development | Mississippi State University Mississippi State, MS |
| Wolfgang Glasser Professor | Virginia Polytechnic Univ. (retired) |
| Dick Siegel Professor, Center Director | Rensselaer Polytechnic Institute Nanotechnology Center |
| Peter Axegard Director, Division Fibre, Pulp, Energy, & Chemicals | STFI – Packforsk AB Stockholm, Sweden |
| Arthur Fricke Professor and Department Chair | University of Florida (retired) Huntington, WV |
| John Williams | Maine Pulp & Paper Association (MPPA) |
| Tim Fitzsimmons Director | DOE EPSCoR |

The FBRI Advisory Board was formed during Year 1 under the direction of founding chair Del Raymond (retired from Weyerhaeuser), and consists of a mix of regional, national, and international experts in fields of relevance to the FBRI research mission. The Advisory Board was charged with reviewing FBRI's programs, activities, and progress, and providing feedback and recommendations. Throughout the year, the Advisory Board also acts in a proactive capacity to assist the FBRI in networking and forming new collaborations.

The full FBRI Advisory Board met on-site during July 2007, 2008, and 2009, with a full two-day agenda each time that allowed for interactions with FBRI participants and stakeholders. In addition, the Executive Committee also conducted meetings in September 2008, December 2008, and March 2009, and produced a mid-year report in January 2009.

Maine NSF EPSCoR Research Infrastructure Award EPS 05-54545
Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts

APPENDIX 11: AAAS Assessments

American Association for the Advancement of Science, Research Competitiveness Service
Review Panel Members:

Michael Mann, Ph.D., Depart. Chair and Prof. of Chem. Eng., University of North Dakota, ND

Eric Welch, Ph.D., Assoc. Prof. Public Admin., Director, Science, Technology, and Environment Policy Lab, University of Illinois, Chicago, IL

Michael Wolcott, Ph.D., Prof. Civil and Environmental Eng., Washington State University, WA

Mark Milutinovich, Ph.D., Sr. Prog. Assoc., AAAS Science & Policy Dir., Washington, DC

The AAAS Research Competitiveness Service provided programmatic guidance and assessment on a yearly basis to Maine EPSCoR, to help ensure the overall success of the NSF EPSCoR FBRI project.

The first visit in October 2006 occurred approximately six months after establishment of the FBRI and provided guidance on measuring and tracking the progress and impact of the program; whether the right processes were in place to facilitate collaborative interactions and interdisciplinary research; identifying the strong and weak points of the FBRI; and advising what the best strategies for enhancing the sustainability of the program may be.

During the second visit in August 2007, the AAAS review panel was tasked with evaluating the project's resources, activities, processes, and progress to date in achieving the following objectives: 1) Advance cutting-edge science and engineering capabilities for discovery and innovation in forest bioproducts research; 2) Enhance human resource development in forest bioproducts research; 3) Improve the state's physical infrastructure in forest bioproducts research; and 4) Show a positive economic impact for the state by providing a solid scientific platform for the effective transfer of technology from Maine's research institutions to the private sector.

The final visit in October 2008 had a focus similar to the second visit, with the main difference being an increased focus on issues of sustaining the efforts made during the previous two years.

To facilitate the review, AAAS convened a four-member external review panel consisting of one RCS staff member and three members who served on the review panel that visited in year two. Two of the four members (Mann and Wolcott) have been members of the AAAS review panel for all three visits and the other two have participated in two visits. The panel reviewed appropriate background material prior to site visits. During the site visit, the AAAS panel met with FBRI program administrators, faculty, students, stakeholders, and science and education outreach partners. A report was issued each year with the panel's evaluation and recommendations for strengthening and sustaining Maine EPSCoR's FBRI project, and a copy was included in each corresponding year of the NSF EPSCoR annual reports that were filed in Fastlane for this project.