Oak Ridge 2012

Short Rotation Woody Crops Operations Working Group

9th Biennial Short Rotation Woody Crops Operations Working Group Conference

Program & Agenda

November 5-8, 2012 – Oak Ridge, TN

Table of Contents

Oak Ridge 2012

Short Rotation Woody Crops Operations Working Group

About the Short Rotation Woody Crops Operations Working Group

The Short Rotation Woody Crops Operations Working Group is a private and public partnership. It is an ad-hoc structure and is open to all organizations and individuals with an interest in the commercialization of SRWC. Our mission is to promote collaborative efforts in developing needed operations for woody crop plantings that comply with the principles of economic viability, ecological soundness, and social acceptance. A major activity is information sharing about the efficient development of practices and equipment to culture, harvest, and handle large-scale woody biomass plantings. Biennial meetings highlight recent research results, discuss current issues surrounding the establishment, management, and utilization of woody crops, and often tour SRWC planting and harvesting activity.

Thanks to Our Sponsors

The Center for Renewable Carbon

National Council for Air and Stream Improvement, Inc.

Oak Ridge National Laboratory

Southeastern Partnership for Integrated Biomass Supply Systems - (IBSS)

Southeastern Sun Grant Initiative

WrightLink Consulting

Oak Ridge 2012

Short Rotation Woody Crops Operations Working Group

Meeting Information

General Meeting Information

All Conference events will be held at the DoubleTree by Hilton Oak Ridge - Knoxville, located at 215 South Illinois Avenue • Oak Ridge, TN 37830. For hotel information please call (865) 481-2468.

Registration Services

Registration will be open during the following hours:

Monday, November 5, 2012……6:00 pm – 8:00 pm (Salon A&B)

Tuesday, November 6, 2012……7:00 am – 8:00 am (Salon A&B)

Wednesday, November 7, 2012……7:00 am – 8:00 am (Salon A&B)

Badges

Badges should be worn at all official functions of the meeting. If you forget or lose your badge, please obtain a second bag at registration.

Posters

Posters will be presented during the formal poster session on Tuesday, November 6, 5:40 pm - 6:40 pm in Salon A.

Presenter Information

Conference personnel will be collecting your final presentation slides at the Registration table when you check in for the Conference. Please bring your file on a flash drive, and confirm that the uploaded presentation is correct. The Registration table will be open at the Welcome Reception on Monday evening (11/5, 6:00 - 8:00 pm), and during breakfast on Conference days (11/6-11/8, 7:00 - 8:00 am.) Conference personnel will be pre-loading your presentation into one repository and uploading it prior to your session.

Agenda

Monday, November 5, 2012

6:00 pm – 8:00 pm
Welcoming Reception and Registration (Room: Salon A&B)

8:00 pm – 9:00 pm
SRWCOWG Steering Committee Meeting (Room: Salon A&B)

Tuesday, November 6, 2012

7:00 am – 8:00 am
Registration and Poster Set up

7:00 am – 8:00 am
Breakfast (Room: Salon C)

8:00 am – 8:10 am (Room: Salon A&B)
Opening Remarks
Mark Downing, Oak Ridge National Laboratory
Tim Rials, The University of Tennessee

8:10 am – 9:45 am (Room: Salon A&B)
Opening Plenary Session
Moderator: Mark Downing, Oak Ridge National Laboratory

National Wood to Energy Roadmap *(8:15 am – 8:45 am)*
Bob Emory, Weyerhaeuser Company

Growing Trees for Fun and Profit *(8:45 am – 9:15 am)*
Jose Zerpa, Greenwood Resources

New Technology for New Markets *(9:15 am – 9:45 am)*
Jerry Tuskan, Oak Ridge National Laboratory

9:45 am – 10:00 am
Break

10:00 am – 11:20 am (Room: Salon A&B)

Opportunities and Hurdles for Genetically Engineered Tree Crops

Moderator: Randy Rousseau, Mississippi State University

Freeze Tolerant Eucalyptus: Opportunities and Challenges *(10:00 am – 10:20 am)*
Maud Hinchee, ArborGen Inc.

Wood quality and stress tolerance – can we have both? The promise and challenge of gene multiplicity in the post-genomics era *(10:20 am – 10:40 am)*
CJ Tsai, Warnell School of Forestry and Natural Resources, and University of Georgia

Opportunities and Challenges Associated with Genetically Engineered Southern Pines *(10:40 am – 11:00 am)*
Gary Peters, University of Florida

Poplar as an Energy Crop: A View from Indiana *(11:00 am – 11:20 am)*
Rick Meilan, Purdue University

11:20 am – 1:00 pm (Room: Salon A&B)

Markets and Economics of SRWC

Moderator: Jeff Wright, ArborGen Inc.

The Potential Impact of Improving Production and Harvesting Systems and Implementing Incentive Programs on the Economics of Willow Biomass Crops *(11:20 am – 11:40 am)*
Tim Volk, State University of New York College of Environmental Science and Forestry

Harvest Scheduling of Eucalyptus spp. In Florida for Economic & Environmental Optimization *(11:40 am - 12:00 pm)*
Matthew Langholtz, Oak Ridge National Laboratory Environmental Sciences Division

Poplar Production Costs, Opportunity Costs and Economics of Liquid Fuels Production *(12:00 pm – 12:20 pm)*
Bill Berguson, University of Minnesota – Duluth

Evaluating the Impact of Feedstock Quality on Delivered Cost: Two Case Studies from the US Southeast Region *(12:20 pm – 12:40 pm)*
Laurence Eaton, Oak Ridge National Laboratory

Eucalyptus Plantations in Florida USA: Economic Analysis of Current and Potential Uses *(12:40 pm – 1:00 pm)*
Jeff Wright, ArborGen Inc.

1:00 pm – 2:00 pm (Room: Salon A&B)

Lunch

2:00 pm – 3:40 pm (Room: Salon A&B)

Production Systems for SRWC (Part 1 - Poplars, Willows, Aspen)

Moderator: Matt Langholtz, Oak Ridge National Laboratory

Hybrid Poplar as a Bioenergy Feedstock for the Pacific Northwest *(2:00 pm – 2:20 pm)*
Jose Zerpa, GreenWood Resources

Developing Biomass Crop Production Systems for Eastern Cottonwood and Black Willow in the Lower Mississippi Alluvial Valley *(2:20 pm – 2:40 pm)*
Theodor Leininger, US Forest Service, Southern Research Station

Woody Perennial Feedstock Evaluation at the Energy Biosciences Institute *(2:40 pm – 3:00 pm)*
Gary Kling, University of Illinois

Effects of Topographic Position and Fertilizer Rate on the Early Growth of Hybrid Aspen 'Crandon' Alleycropped with Winter Triticale Near Ames, IA *(3:00 pm – 3:20 pm)*
William Headleea, Iowa State University

What You Don't Know CAN Hurt You: Why Disease-induced Catastrophe Threatens Short-rotation, Intensive-culture Woody Crop Production Systems *(3:20 pm – 3:40 pm)*
Glen Stanosz, University of Wisconsin

3:40 pm – 4:00 pm

Break

4:00 pm – 5:40 pm (Room: Salon A&B)

Genetics and Tree Improvement Strategies (Pines, Poplars, Willows, Other Species)

Moderators: Tim Tschaplinski & Jerry Tuskan Oak Ridge National Laboratory

Genomic & Mapping Resources for the Genetic Improvement of Shrub Willow Feedstock Crops *(4:00 pm - 4:20 pm)*
Michelle Serapiglia presenting for Lawrence Smart, Cornell University

Improvement of Black Willow in the Lower Mississippi Alluvial Valley *(4:20 pm – 4:40 pm)*
Randall Rousseau, Mississippi State University

Genetic Improvement of Cottonwood and Hybrid Poplar Clones for Short Rotation Woody Crop Systems *(4:40 pm – 5:00 pm)*
Bijay Tamang, ArborGen Inc.

Screening Hybrid Poplar for Resistance to Septoria musiva: Greenhouse to Field Correlations Using a Novel Inoculation Procedure *(5:00 pm – 5:20 pm)*
Jared M LeBoldus, North Dakota State University

Can Light Efficient Ideotypes of Loblolly Pine be Used to Produce High Productivity Short Rotation Bioenergy Plantations? *(5:20 pm – 5:40 pm)*
Kurt Johnsen, North Carolina State University

5:40 pm – 6:40 pm

Poster Session

Wednesday, November 7, 2012

7:00 am – 8:00 am
Breakfast (Room: Salon C)

8:00 am – 9:30 am (Room: Salon A&B)
International SRWC Production and Use
Moderator: Lynn Wright, WrightLink Consulting

Short Rotation Crops in New Zealand *(8:00 am – 8:10 am)*
Kevin Snowden, Vertichem Technology Limited

The Potential for Eucalyptus as a Woody Energy Crop in the United Kingdom *(8:10 am – 8:30 am)*
Andrew Leslie, University of Cumbria

Eucalyptus for Short Rotation Forestry in the British Isles – A Long History of Trials *(8:30 am – 8:50 am)*
John Purse, Prima Bio

Short Rotation Eucalypt Plantations for Energy in Brazil: an Overview *(8:50 am – 9:10 am)*
Laércio Couto, University of Toronto, Canada

Bionic Beaver Harvester Development and Testing *(9:10 am – 9:30 am)*
Richard Sulman, Biosystems Engineering

9:30 am – 9:50 am
Break

9:50 am – 11:50 pm (Room: Salon A&B)
Uses of SRWC for Social and Environmental Benefit/Sustainability
Moderator: Ron Zalesny, US Forest Service, Northern Research Station

Root Development in a Willow Vegetation Filter Under Different Irrigation and Fertilization Regimes *(9:50 am – 10:10 am)*
Michel Labrecque, Plant Biology Research Institute, Université de Montréal and Montreal Botanical Garden

Targeting Productive Lands Enrolled in Forest Stewardship Programs *(10:10 am – 10:30 am)*
Eric Holzmueller, Southern Illinois University

Using the 3-PG Model to Predict and Map Hybrid Poplar Biomass Productivity in Minnesota and Wisconsin *(10:30 am – 10:50 am)*
William Headlee, Iowa State University

An approach for siting poplar energy production systems to increase productivity and associated ecosystem services *(10:50 am – 11:10 am)*
Ronald Zalesney, US Forest Service, Northern Research Station

Opportunities in North Carolina for Producing Woody Biomass for Energy on Liability, Marginal, and Non-Productive Lands *(11:10 am – 11:30 am)*
Dennis Hazel, North Carolina State University

Environmental and Socioeconomic Indicators for Bioenergy Sustainability as Applied to Short Rotation Woody Crops *(11:30 am – 11:50 am)*
Virginia Dale, Oak Ridge National Laboratory

12:00 pm – 1:30 pm
Lunch

1:30 pm – 5:00 pm
ORNL Tours

Arboretum Tour (Forestry Research Center in Oak Ridge)

ORNL power plant recently converted to wood

6:00 pm
Dinner – Calhoun's Ft. Loudon

Thursday, November 8, 2012

7:00 am – 8:00 am
Breakfast (Room: Salon C)

8:00 am – 9:00 am (Room: Salon A&B)
Production Systems for SRWC (Part 2 – Pines, Eucalyptus and Sweetgum)
Moderators: Matt Langholtz, Oak Ridge National Laboratory & Lynn Wright, WrightLink Consulting

Identifying Optimal Nutrient Rates and Applications Frequency to Achieve and Maintain High Pinus taeda Plantation Production in the Southeastern United States *(8:00 am – 8:20 am)*
Timothy Albaugh, North Carolina State University

Potential Eucalyptus Species and the Required Silvicultural System for Biomass Production in the Ecological Regions of the Southeastern United States *(8:20 am – 8:40 am)*
Jose Stape; North Carolina State University

Development of High-Yielding Sweetgum Plantation Systems for Bioenergy Production in the Southeastern United States *(8:40 am – 9:00 am)*
Donald J Kaczmarek, USDA Forest Service

9:00 am – 10:20 am (Room: Salon A&B)
Harvesting/handling Technology Updates
Moderators: Kevin Hoyt, UT Forest Resources Research and Education Center and Dalia Abbas, Tennessee State University

Harvesting of "Small" Material from Natural Stands *(9:00 am- 9:20 am)*
Dalia Abbas, Tennessee State University

Handing/preparation of biomass wood chips (ORNL Gasification Unit) *(9:20 am- 9:40 am)*
Chris Keziah, Oak Ridge National Laboratory

Southern Biomass Harvesting Guidelines *(9:40 am- 10:00 am)*
Dr. Ken Smith, Sewanee: The University of the South

Production Results from Harvesting a 5-year Old Poplar Stand *(10:00 am- 10:20 am)*
Dana Mitchel, USDA Forest Service, Southern Research Station

10:20 am – 10:40 am
Break

10:40 am – 11:40 am (Room: Salon A&B)
Panel Discussion: Commercial Case Studies
Moderator: Mark Downing, Oak Ridge National Laboratory

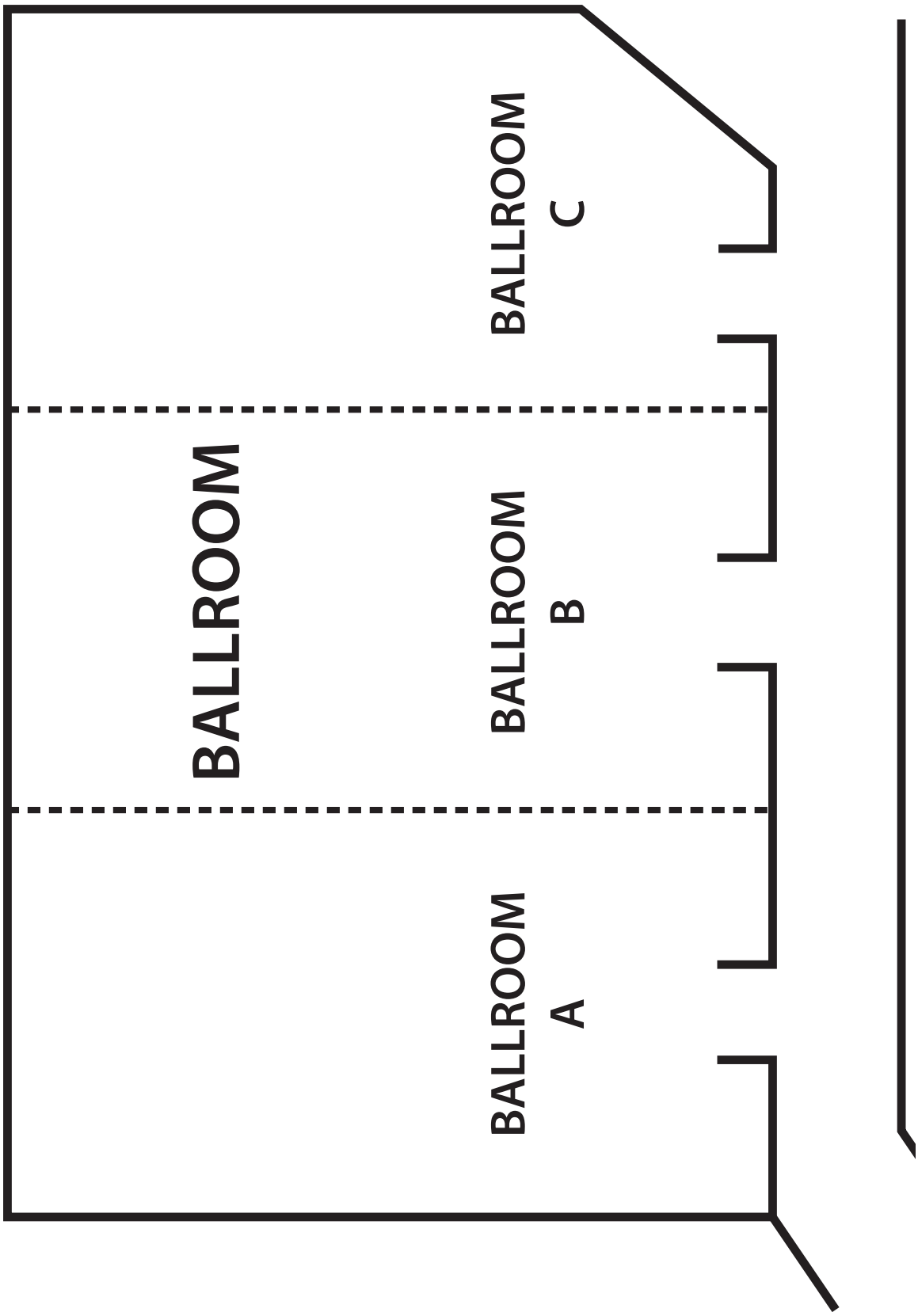
Maryville college Wood-Fired Boiler Operation *(10:40 am – 11:10 am)*
Andrew McCall, Maryville College

Wood Utilization - Multiple Considerations, and the Case of the Gainesville Florida Power Plant *(11:10 am – 11:40 am)*
Richard Schroeder, BioResource Management, Inc.

11:40 am – 12:30 pm
Wrap Up with Conference Summary and Challenges
Mark Downing, Oak Ridge National Laboratory & Tim Rials, The University of Tennessee

12:30 pm
Close of Conference

Floor Plan



Plenary

Bob Emory
Weyerhaeuser

National Wood to Energy Roadmap

In 2010 and 2011, the "25x25"Alliance and the Federal Interagency Woody Biomass Working Group convened a Wood-to-Energy Workgroup, consisting of representatives from landowner groups, professional forestry organizations, environmental organizations, traditional forest industries, emerging renewable energy industries, and academia. Together they explored four topics vital to the future of biomass energy in America: wood demand and supply, sustainability of forest resources, carbon and climate change, and related policies. Bob Emory, Environmental Affairs Manager for Weyerhaeuser's Timberlands operations in the US South, was a member of the Workgroup and will provide a summary of its findings.

Biography

Bob Emory has been an employee of Weyerhaeuser since 1972 where he has worked as a land use manager, a contract logging manager and raw materials manager. Since 2001 he has served the company as their Southern Timberlands Environmental Affairs Manager. In additional to his responsibilities for Weyerhaeuser, he is involved in several related public policy organizations. He was appointed by the Governor of North Carolina as Chairman of the North Carolina Coastal Resources Commission, a body that designates Areas of Environmental Concern in the 20 coastal counties of NC and regulates development in them. The Commission also develops Land Use Planning requirements in the coastal areas and certifies that local government land use plans are consistent with the requirements. Bob was also appointed by the Speaker of the NC House of Representatives to the North Carolina Forestry Advisory Council and serve as it's Chairman. The Council advised the NC Division of Forest Resources on the condition of forests and forestry in the state. Bob has special expertise in forest certification, forest management regulatory issues and forest biomass.

Jose Zerpa
Greenwood Resources

Growing Trees for Fun and Profit

GreenWood Resources was founded on and has grown through a shared vision and commitment in investing into and sustainably managing one of earth's most renewable resources – trees. GWR has been a firm believer in the goals for developing renewable sources of energy and fuels and is a leader in the development and management of dedicated biomass plantations critical to the long term sustainable solutions for biomass supply. GWR's efforts in plant material improvement work, improved agronomic/silvicultural and harvesting technologies to optimize biomass production, and strategies and approaches to capital markets and strategic partnerships are key elements to the growth and success in the development of dedicated biomass supply. GWR will provide its view of the future through highlights on specific global projects underway and strategic partnerships being developed.

Biography

Jose Zerpa is a silvicultural researcher at GreenWood Resources. His research interest is centered on the management of site resources to improve productivity, with emphasis on tree nutrition. He obtained his bachelor degree in Forestry from Universidad de Los Andes, in Venezuela, and did his Master in Science and Doctoral studies in Forestry at North Carolina State University where he received the Hofmann Forest Graduate Research Fellowship and the Charles B. Davey Graduate Fellowship for Excellence in Biological Sciences. He has experience in silviculture of Eucalyptus, Gmelina, Caribbean and loblolly pines, and hybrid poplar. Jose is currently responsible for the short rotation trials established at the AFRI demonstration plantings in the Pacific Northwest.

Jerry Tuskan
Oak Ridge National Laboratory

New Technology for New Markets

Plant molecular biology and genetics is advancing at an unprecedented pace, fueled in part by the next generation, low-cost high throughput sequencing platforms. Abundant, deep, accurate sequence information, coupled with expression, proteomic and metabolic profiling data, provide the datasets needed to identify and characterize individual genes and allelic variants of genes related to biologically and economically relevant phenotypes. Identifying and assaying relevant phenotypes is now the time and cost limiting step in process. At the nexus of high-quality genotyping data and relevant phenotyping data there emerges the opportunity for deployment of marker-aided selection strategies for advancing breeding lines and/or transgenic strategies for deriving new plant materials. Cellular, molecular and whole-plant phenotypes relevant to traditional and emerging forest products industries, including biofuels production and boutique chemical production, are now being measured within a large association genetics study involving 1100 Populus trichocarpa clones planted in three replicated common gardens. Gene discoveries coming forth from this project will be highlighted.

Biography

Jerry Tuskan splits his time between his responsibilities as a Distinguished Scientist in the Environmental Sciences Division of Oak Ridge National Laboratory (ORNL) (90%) and a Lead for the Department of Energy's Laboratory Science Program at the Joint Genome Institute (JGI) (10%). His ORNL responsibilities include coordination of the BioEnergy Science Center effort to reduce recalcitrance in Populus, including coordinating all internal and external collaborations related to Association Studies, Activation Tagging, Expression Experiments, and QTL Analysis. His JGI responsibilities include: coordination of the solicitation and review of PI-lead sequencing proposals submitted through the Department of Energy (DOE) laboratory system and establishment of multiple large-genome sequencing projects that address DOE missions in the area of biofuels development, carbon sequestration, and global climate change. Finally Jerry is responsible for facilitating DOE, laboratory, and JGI interactions.

Abstracts

Dalia Abbas
Tennessee State University

Harvesting of "Small" Material from Natural Stands

The issue of harvesting small material vs. the conventional timber harvesting for larger material has been an interest of new emerging industries, such as bioenergy, new market economies and fuel reduction to offset fire hazards. This presentation combines results from different studies that look at the conventional wisdoms, costs and logistics linked to harvesting small materials from nationwide case studies. In an attempt to look at the state of the logging communities and potential for harvesting small wood material forest biomass for multiple uses, this presentation first discusses a nationwide study that looked at the state of harvesting forest biomass on federal, state and tribal lands in the United States. Operators and forestry agencies representatives have commented on reasons for not utilizing biomass harvesting opportunities from fire hazard sites in the northern, southern, western and eastern regions. The study identified "conventional wisdoms" among the logging community linked to: guaranteed supply of woody biomass, long-term stewardship contracting, scale of the wildfire and forest health problem, the low value of biomass, utilization increases acres treated, budgets and staffing and transportation costs as reasons that affect biomass utilization nationwide. The presentation then looks into further details at methods used to assess the cost and the workforce capacity of these potential emerging industries.

Biography
Dr. Abbas graduated with a Ph.D. from the Department of Forest Resources at the University of Minnesota. Her areas of research include forest biomass feedstock supply logistics, ecosystem services protection, logging cost analysis, technical standards development, life cycle assessment, and sustainability sciences. Prior to her degree she was a technical researcher for British Standards Institution in London, United Kingdom, researching technical standards and the chain of custody of wood products. Before joining Tennessee State University she was a Visiting Assistant Professor with Michigan State University, working on forest biomass logistics and economics for two state-wide and industrial projects.

Timothy J. Albaugh[1], Thomas R. Fox[2], H. Lee Allen[1], Colleen A. Carlson[2], Jose L. Stape[1], Rafael A. Rubilar[3]
1 North Carolina State University, 2 Virginia Tech, 3 Universidad de Concepción

Identifying optimal nutrient rates and application frequency to achieve and maintain high Pinus taeda plantation production in the southeastern United States

There is renewed interest in using forest products from the southeastern United States as a bioenergy source. To meet this interest, forest managers will need to intensively manage stands throughout the rotation given that nutrients are the primary limiting factor to loblolly pine growth (Pinus taeda L.) in the southeastern United States. We examined nutrient dose and application frequency in stands as young as 2 years old to determine the optimum nutrient amendments to maintain high productivity at 23 sites across the region. We applied nitrogen and phosphorus at a 10:1 ratio and other elements as needed. Elemental nitrogen rates were 0, 60, 120, 180 and 240 lbs ac-1 applied at 1, 2, 4 and 6 year intervals which resulted in cumulative nitrogen additions from 240 to 720 lbs ac-1 over eight years. Eight year volume growth response was not affected by application frequency for the same cumulative dose. While diameter growth responses were evident up to the 720 rate, height, basal area and volume achieved asymptotic values at the 360 rate. Control growth averaged 245 ft3 ac-1 yr-1 and ranged from 85-350 ft3 ac-1 yr-1 while volume growth response varied from none to >100% where sites with greater control growth had less response to nutrient additions. Sites with high growth and a low nutrient response would be best suited for short rotations of pine for bioenergy because inherent site productivity reduces the need for nutrient additions and keeps production costs low.

Biography
Tim Albaugh is a Senior Research Associate at North Carolina State University and the Associate Director for the Forest Productivity Cooperative. His research is focused on plantation productivity, silviculture and ecophysiology.

Bill Berguson, Bernie McMahon, Dan Buchman
University of Minnesota – Duluth, Natural Resources Research Institute, Duluth, MN

Poplar Production Costs, Opportunity Costs and Economics of Liquid Fuels Production

Technologies to convert cellulosic materials to liquid fuels are rapidly becoming commercially viable and cost-competitive as evidenced by new investment in production facilities using cellulosic feedstocks. Demand for new sources of biomass to provide cellulosic feedstock for the nascent liquid fuels industry could exceed the production capacity of native forestlands and outstrip supplies of agricultural residues. While much of the initial development of this industry is expected to rely on existing sources such as agricultural crop residue and wood derived from existing forestlands, dedicated energy crops are expected to play an important role in the expansion of the industry as readily-available supplies are used. Woody crops such as hybrid poplar have the potential to meet a portion of this demand. While the conversion technology is a critically important aspect of the production system, the economics of production and opportunity costs associated with alternate uses of land on which the dedicated biomass crop is grown is also critical. Using cost data and output of cashflow models of commercial poplar plantation production and financial inputs for a variety of agricultural crops, this presentation will highlight production costs and opportunity costs associated with production of biomass from a dedicated energy cropping system using hybrid poplar in the Upper Midwest. Finally, data published by the National Renewable Energy Laboratory will be used to estimate the cost of ethanol incorporating feedstock costs and place the final cost of production in the context of current markets for transportation fuels.

Laércio Couto
Faculty of Forestry of the University of Toronto, Canada

Short Rotation Eucalypt Plantations for Energy in Brazil: an Overview

Eucalypts were introduced in 1904 by Edmundo Navarro de Andrade in Brazil, to provide biomass for energy used by the locomotives of a railroad company in the state of Sao Paulo. Later on, eucalypt plantations became the main source of timber to produce charcoal for the pig iron and steel industry in Brazil, mainly in the state of Minas Gerais. In the 60's and 70's Brazil experienced a great development in the use of eucalypts for pulp and paper production as well as for particle board and fiber boards. With the advance of the vegetative propagation of eucalypts in Brazil, clonal silviculture allowed a multiproduct use of the timber originated from such genus, including timber for civil construction and furniture. The need to reduce emission of green house effect gases and to replace fossil fuels brought Brazilian scientists and researchers to look at short rotation eucalypt plantations as sources of biomass for energy. In 2001 a closely spaced research trial was established in Itamarandiba, Minas Gerais. It became the basis for most of the subsequent work in Brazil dealing with the short rotation production of eucalypt biomass for energy. The need for pellets in Europe for heating and electricity generation and the need for woodchips to generate steam and heat for industrial processing of grains and food in Brazil, has attracted forest companies to invest in eucalypt plantations in this country. Suzano Renewable Energy (SER) is one of the most significant examples of eucalypt-based pellet production. Renewable Energies of Brazil (ERB) is the best example of steam production using eucalypt woodchips. Two new pellet companies are starting operations in Brazil at the moment, PelletBraz, located in Porto Feliz and BioPellets Brazil, located in Lins, both in the state of Sao Paulo. Some other tree species are being studied to be used in semi-arid regions where climatic conditions might restrain the use of eucalypts.

Biography

Laercio Couto graduated in Forestry in 1967, is an Adjunct Professor at the Faculty of Forestry of the University of Toronto, Canada in the areas of Short Rotation Wood Crops and Agroforestry. Previous work included 8 years in forest companies in the states of Sao Paulo, Parana, Bahia and Para, in Brazil, dealing mainly with pine and gmelina plantations. He served as a professor at the Department of Forestry of the Federal University of Vicosa - UFV, Minas Gerais, Brazil, where he took his M. Sc. in Forestry in 1977. In Canada he took his Ph.D. in Forestry from 1977 to 1982 at the University of Toronto as a fellow of the Canadian International Development Agency – CIDA. In 1993 he took a Post Doctorate training in Short Rotation Wood Crops and Agroforestry at the Department of Forestry of Colorado State University in Colorado, USA. At that time he was a fellow of Oak Ridge National Laboratory – ORNL, comparing short rotation wood crops in USA and Brazil in a project coordinated by Lynn L. Wright and David R. Betters. Laercio Couto introduced the formal teaching of simulation and forest planning and agroforestry at both undergraduate and graduate levels in the Department of Forestry of the Federal University of Vicosa in Minas Gerais, Brazil. He was head of the Department of Forestry at that University and also the administrative and scientific director of the Society for Forest Research – SIF a link between UFV and forest companies in Brazil and Latin American countries, for research and development. He was the President of the Brazilian Center for Nature Conservancy and Sustainable Development – CBCN and the founder and President of the Brazilian Network of Biomass for Energy – RENABIO and the Brazilian Society of Agroforestry – SBAG. He has been a forest consultant in the areas of short rotation wood crops, agroforestry and forest strategy for several brazilian and international companies since his retirement as a full professor at UFV. Actually he is a member of the board of the World Bioenergy Association, a forest consultant for the Brazilian Confederation of Agriculture and Livestock – CAN, Polimix Energia, Jari and Orsa Group, Tecflora and a counselor for Ecomtrading and Renewable Energies of Brazil – ERB. He has advised more than 25 master and doctorate theses, published more than 100 scientific papers and participated as a guest speaker in several national and international meetings. In 2010 he received the World Bioenergy Award in Jonkoping, Sweden, for his work with closely spaced eucalypt plantations to produce biomass for energy in short rotation in Brazil. He was also a forest consultant for the Brazilian Agency of International Cooperation – ABC in Chile and all countries of Central America. Current work includes eucalypt based agroforestry systems and closely spaced eucalypt plantations to produce biomass for energy in short rotations.

Virginia H. Dale, Latha M. Baskaran, Maggie R. Davis, Mark E. Downing, Laurence M. Eaton, Rebecca A. Efroymson, Charles T. Garten Jr., Michael R. Hilliard, Keith L. Kline, Henriette I. Jager, Matthew H. Langholtz, Paul N. Leiby, Allen McBride, Patrick J. Mulholland, Gbadebo A. Oladosu, Esther S. Parish, Peter E. Schweizer, John M. Storey
Oak Ridge National Laboratory

Environmental and Socioeconomic Indicators for Bioenergy Sustainability as Applied to Short Rotation Woody Crops

Indicators are needed to support assessment of both environmental and socioeconomic sustainability of bioenergy systems. Effective choice and application of indicators can assist in both identifying and quantifying the sustainability characteristics of bioenergy options. Our team at Oak Ridge National Laboratory has worked from existing literature and other sustainability efforts to identify and define the measurement units for a set environmental and socioeconomic indicators that are essential to characterize sustainability of bioenergy systems. The set includes 19 environmental indicators for soil quality, water quality and quantity, greenhouse gases, biodiversity, air quality, and productivity and 15 socioeconomic indicators that fall into the categories of social well being, energy security, external trade, resource conservation, profitability, and social acceptability. This suite of indicators assumes the existence of institutional frameworks that provide governance, legal, regulatory and enforcement services. Applying this indicator suite to short rotation woody crops in the United States provides a basis for the practical evaluation of socioeconomic and environmental sustainability in those systems. The utility of each indicator, methods for measurement, target establishment, and applications appropriate for short rotation woody crops bioenergy systems in the United States are described and provide a framework to identify research needs.

Biography
Dr. Virginia H. Dale is director of the Center for BioEnergy Sustainability (CBES: http://www.ornl.gov/sci/ees/cbes/) in the Environmental Sciences Division at Oak Ridge National Laboratory (ORNL) and was selected as the 2006 Distinguished Scientist for the Laboratory. She is also an adjunct professor at the University of Tennessee in the departments of both Forestry, Wildlife, and Fisheries and Ecology and Evolutionary Biology. She obtained her Ph.D. in mathematical ecology from the University of Washington. Virginia has authored 10 books and more than 220 published articles and is the Co-Editor in Chief of the journal Environmental Management. She has served on national scientific advisory boards for five federal agencies. Recent papers include Dale, Kline, et al. [2011. Interactions among bioenergy feedstock choices, landscape dynamics and land use. Ecological Applications 21(4):1039-1054] and McBride, Dale et al. [2011. Indicators to support environmental sustainability of bioenergy systems. Ecological Indicators 11(5):1277-1289].

Laurence Eaton, Matthew Langholtz, Craig Brandt, Erin Webb, Mark Downing
Oak Ridge National Laboratory

Evaluating the impact of feedstock quality on delivered cost: Two case studies from the US Southeast region

Woody feedstocks represent a significant portion of projected biomass available for new industrial uses, according to a recent DOE study. The types of resources are calculated as available at a wide range of roadside prices, material quality and quantity, and projected timeframe. In a recent multi-lab study, facility-specific supply curves are generated using a GIS-based optimization model that accounts for feedstock preprocessing logistics and delivery to end-use facilities. Two locations are chosen based upon the relative feedstock density on the landscape for a baseline and high-yield scenario.

Dennis Hazel, Elizabeth Guthrie Nichols, Shawn Dayson Shifflett
North Carolina State University

Opportunities in North Carolina for Producing Woody Biomass for Energy on Liability, Marginal, and Non-productive Lands

The need for alternative energy resources in the United States continues to grow. Through policies North Carolina has positioned itself to use woody biomass as one of its primary supplies for non-fossil based energy. Yet, it is unclear where adequate sustainable supplies of woody biomass will come from. Gleaning logging residues and harvesting low-value trees from established forests may not supply enough feedstocks for a growing biopower industry, an emerging large wood pellet industry, and a coming biofuels industry. It is becoming apparent that short-rotation woody crops (SRWC) will have to be grown to supply the additional feedstocks needed. Producing SRWC on highly productive agricultural lands is often seen as unfavorable because of impacts on food market prices. Clear-cutting natural stands to establish SRWC is likely to be publicly

unacceptable due to perceived ecological consequences including habitat loss for wildlife, biodiversity reduction, and carbon-cycle disturbance. We believe that there are other locations that have yet to be considered. We propose growing bioenergy crops on so-called “liability lands”, many of which require phytoremediation. These lands are ideal for energy production as they cannot compete with lands designated for food crops and they may be less likely to negatively affect surrounding ecological communities. By planting species with phytoremedial properties like Populus species, landowners may be able to resolve contamination issues in addition to producing woody biomass for energy. Our research aims are to evaluate these benefits and determine the distribution of liability and non-productive lands throughout the state.

Biography

Dennis Hazel is an Extension Specialist and Associate Professor in the Department of Forestry and Environmental Resources at North Carolina State University. His current areas of responsibility include technology and policy development for woody-biomass based renewable energy, forest health and productivity, wildlife research, and Christmas tree production. His degrees are in wildlife biology and forestry from NC State University. Prior to joining the Extension Forestry group in 2003, Dr. Hazel held several other positions at NC State University where he conducted research on threatened furbearer species, use of managed forest land for reducing off-site impacts of agricultural practices, and silviculture. Most recent paper: Forest Markets and Trends: Current and Future Outlook. National Woodlands Vol 35(2):10. Spring 2012.

William L. Headlee[1], Ronald S. Zalesny Jr.[2], Richard B. Hall[1]

1 Iowa State University, 2 US Forest Service, Northern Research Station

Effects of Topographic Position and Fertilizer Rate on the Early Growth of Hybrid Aspen ‘Crandon’ Alleycropped with Winter Triticale Near Ames, IA

Hybrid poplars have demonstrated high productivity as short rotation woody crops (SRWCs) in the U.S. Midwest, and the hybrid aspen ‘Crandon’ has exhibited particularly promising yields on marginal agricultural lands in Iowa. However, a key obstacle for landowner acceptance of SRWCs is the lack of economic returns early in the rotation. Planting annual crops between the tree rows (alleycropping) has the potential to address this issue, especially with the use of winter triticale which completes its growth cycle early in the summer and therefore has minimal competitive interaction with the establishing trees. In addition, well-placed fertilizer in low rates at planting has the potential to improve tree establishment and shorten the rotation, which is also economically desirable. To test the potential productivity of this alleycropping system under a variety of conditions, we established ‘Crandon’ plots on five different topographic positions (hilltop, upper-slope, mid-slope, lower-slope, and bottomland) with four different rates (0, 10, 20 , and 40 g tree-1) of 20-10-5 NPK fertilizer tablets placed in the planting hole. We then harvested trees from the plots after each of the first three growing seasons to evaluate aboveground and belowground biomass productivity. We will present the results of our research, with a focus on the effects of landscape position and fertilization on aboveground biomass productivity of the trees.

Biography

Dr. Headlee completed his PhD in Forestry with a minor in Biorenewable Resources and Technology in the summer of 2012, and started a post-doctoral research associate position at Iowa State University in the fall with joint support from the Forest Service. His graduate research focused on regional modeling of hybrid poplar productivity, quantifying the effects of fertilizer and topographic position on hybrid poplar growth, and utilizing bio-energy byproducts in hybrid poplar production. His post-doctoral research is focused on quantifying aboveground biomass development and carbon sequestration over time for a variety of hybrid poplar clones recently harvested from a network of sites in Iowa, Minnesota, Wisconsin, and Michigan.

William L. Headlee[1], Ronald S. Zalesny Jr.[2], Deahn M. Donner[2], Richard B. Hall[1]

1 Iowa State University, 2 US Forest Service, Northern Research Station

Using the 3-PG Model to Predict and Map Hybrid Poplar Biomass Productivity in Minnesota and Wisconsin

Hybrid poplars have demonstrated high biomass productivity in the North Central United States as short rotation woody crops (SRWCs). However, our ability to quantitatively predict productivity for sites which are not currently in SRWCs is limited. As a result, stakeholders are also limited in their ability to evaluate different areas within the region as potential supply sheds for wood-based bioenergy facilities. A reliable method for predicting productivity across the region is needed; preferably, such a method will also lend itself to generating yield maps that stakeholders can use to inform their decision-making. In this study, the Physiological Processes Predicting Growth (3-PG) model was (i) assigned parameters for hybrid poplars using species-specific physiological data and allometric relationships from previously-published studies, (ii) calibrated for the North Central region using previously-published biomass data from eight plantations along with site-specific climate and soils data, (iii) validated

against previously-published biomass data from four other plantations using linear regression of actual versus predicted total aboveground dry biomass (R2 = 0.89, RMSE = 8.1 Mg ha-1, mean bias = 5.3 Mg ha-1), (iv) evaluated for sensitivity of the model to manipulation of the parameter for age at full canopy cover (fullCanAge) and the fertility rating (FR) growth modifier, and (v) combined with soil and climate data layers to produce a map of predicted biomass productivity for the states of Minnesota and Wisconsin. Mean annual biomass productivity (total aboveground dry biomass divided by age) ranged from 4.4 to 13.0 Mg ha-1 yr-1 across the states, with the highest productivity mainly concentrated in the area stretching from south-central Minnesota across southern Wisconsin; these results are consistent with previously-published research for the region with respect to hybrid poplar productivity and spatial productivity patterns for corn grain.

Biography

Dr. Headlee completed his PhD in Forestry with a minor in Biorenewable Resources and Technology in the summer of 2012, and started a post-doctoral research associate position at Iowa State University in the fall with joint support from the Forest Service. His graduate research focused on regional modeling of hybrid poplar productivity, quantifying the effects of fertilizer and topographic position on hybrid poplar growth, and utilizing bio-energy byproducts in hybrid poplar production. His post-doctoral research is focused on quantifying aboveground biomass development and carbon sequestration over time for a variety of hybrid poplar clones recently harvested from a network of sites in Iowa, Minnesota, Wisconsin, and Michigan.

Maud Hinchee

ArborGen Inc.

Freeze Tolerant Eucalyptus: Opportunities and Challenges

Eucalyptus hybrids, such a Eucalyptus grandis x E. urophylla (E. urograndis), have exceptional productivity and are grown operationally in plantations in many regions of the world, including Brazil. These hybrids can be grown in non-freeze challenged regions of the southeastern United States, and can achieve productivity rates of greater than 30 green tons /acre/ year. However, freezing temperatures occasionally experienced in the southeast limit the range of where these hybrids can grow. ArborGen has introduced freeze tolerance into E. urograndis and has been able to extend the planting range to land along the gulf coast. These trees, when experiencing the intermittent freezing temperatures of the southeast can survive, and can provide 15 to 30 green tons / acre/ year depending on environmental conditions. The benefits and challenges associated with the commercialization of these trees will be discussed.

Eric J. Holzmueller, John W. Groninger

Southern Illinois University

Targeting productive lands enrolled in Forest Stewardship Programs

The Spatial Analysis Project (SAP) was designed to determine the stewardship potential of land enrolled in the US Forest Service - Forest Stewardship Program and prioritize land for limited program dollars. Illinois forest policy states that timber production must be the primary goal of plans in the Illinois FSP. Using seven southern Illinois counties as a case study, we analyzed the effectiveness of the FSP in enrolling area according to stewardship potential and forest productivity. While the FSP is preferentially capturing high stewardship potential areas, the program is not effective in prioritizing highly productive land for cost-share assistance or identifying such areas for future enrollment. This study illustrates how GIS can be used to modify the SAP stewardship potential data layer to identify lands with both high stewardship potential and high forest productivity. This methodology could be adapted to maximize FSP values by targeting tracts of the greatest programmatic value (i.e. the most productive biomass lands) to preferentially receive limited public funds.

Biography

Eric Holzmueller is an Associate Professor in the Department of Forestry at Southern Illinois University. He received a Bachelor of Science and master's degree in forestry from Iowa State University and a PhD in Forest Ecology from the University of Florida. Currently, Dr. Holzmueller's research is primarily focused on ecological and management issues in central hardwood forests. He has conducted research across the eastern United States concerning these issues and recently funded projects range from improving urban and community forestry opportunities in Illinois to analyzing the impacts of acidification on hardwood forest ecosystems in the central Appalachians. His latest paper concerning the role of agroforestry in biomass production was recently published in Agroforestry Systems : Holzmueller, E.J. and S. Jose. 2012. Biomass production for biofuels using agroforestry: Potential for the North Central region of the United States. Agroforestry Systems. 85:305-314

Kurt Johnsen[1], Chris Maier[1], Robert Teskey[2], Ying Wang[2], Tim Albaugh[3], Phil Dougherty[4]
1 US Forest Service Southern Research Station, 2 University of Georgia, 3 North Carolina State University, 4 Retired, Summerville, SC

Can Light Efficient Ideotypes of Loblolly Pine be Used to Produce High Productivity Short Rotation Bioenergy Plantations?

With respect to trees, an ideotype is a model representing the physical and chemical attributes of a tree for a specified end-use grown in a particular environment. “Precise” ideotypes can be identified and produced using clonal forestry. Less “precise” ideotypes can be identified and produced using less expensive methods such as mass controlled pollination to create full sibs. We have identified and grown in field plantations two clones of loblolly pine that represent distinct ideotypes. One ideotype has a narrow crown with less leaf area conferring both light and nutrient use efficiency. The other ideotype has a wider crown, more leaf area and requires higher amounts of N and P. There is conflicting evidence whether the characteristics of the ideotypes are converging as time passes and what the ramifications will be on growth potential in short rotation plantations. For example, would closer spacing of the narrow crown ideotype reduce the rotation length required to supply the same amount of biomass produced by a wide crown ideotype in, let’s say, 15 years? This and other questions will be addressed using the model 3-PG, which has been modified to incorporate distinct genetic ideotype parameters into its algorithm.

Biography

Kurt Johnsen received his B.A. in Forestry from The University of Vermont, his M.S. in Forest Biology from Virginia Tech, and his Ph.D. in Physiological Genetics from The University of Georgia. He then worked for the Canadian Forest Service for 7 years where he studied the physiological genetics of black and red spruce. Currently he is Team leader of the US Forest Service Southern Research Station Southern Institute of Forest Ecosystem Biology located in RTP, NC where he has studied loblolly pine responses to elevated CO2, pine physiology and physiological genetics; this work is now being extended to Eucalyptus. He is involved in a multi-institution study to develop a model for quantifying and managing carbon sequestration of longleaf pine stands on DOD bases. In 2007 he received the Southern Research Station Director’s Award for Distinguished Science. He has authored or co-authored over 90 peer reviewed publications.

Donald J. Kaczmarek[1], Brian C. Wachelka[2], Jeff Wright[3], Victor Steele[3], Doug P. Aubrey[4], David R. Coyle[5], Mark D. Coleman[6].
1 USDA Forest Service, 2 Formerly MeadWestvaco Forest Research, 3 ArborGen LLC. 4 Georgia Southern University,
5 University of Georgia. Warnell School of Forestry and Natural Resources, 6 University of Idaho

Development of High-Yielding Sweetgum (Liquidambar styraciflua L.) Plantation Systems for Bioenergy Production in the Southeastern United States

Sweetgum has one of the largest ranges and site adaptabilities of hardwoods in the Southeast and is generally insect and disease resistant. These are desirable characteristics for a dedicated bioenergy crop. In 2000, the Forest Service established a 2 × 2 factorial experiment with differing water and nutrient availabilities in West-Central South Carolina. On this, sandy, nutrient-poor site, sweetgum responded to both water and nutrient additions, but nutrients were the primary factor limiting productivity. In 2001, MeadWestvaco established three Sweetgum Culture × Density Studies in South Carolina. In-situ nitrogen dynamics and foliar nutrients were measured for the first 3 growing seasons. There was a high potential for asynchronous soil nutrient supply and plant nutrient demands to develop. These gaps could be corrected by properly timed nutrient additions. At age 7, differences in initial plantation densities had relatively small effects on total biomass yields, but relatively large effects on individual tree sizes. On two of the three sites, age 7 growth equaled growth in the best fertilized and irrigated treatment in the Forest Service Study even though N additions were only one quarter as high. A growth and yield model was used to project age 15 yields based on age 7 measurements. Per acre yields are projected to be approximately 8.5, 10.7, and 11.4 green tons per acre per year in the best Culture × Density treatments at each site. These results suggest that it is currently possible to obtain high plantation yields without irrigation if proper cultural regimes are implemented.

Biography

Donald J. Kaczmarek is a Research Forester with the Forest Service at the Savannah River Site in South Carolina. He has graduated with a B.S. in Forestry from the University of Illinois and M.S. and Ph.D. degrees from Purdue University. Prior to joining the Forest Service, he was a Senior Research Scientist with ArborGen LLC. coordinating field testing for transgenic trees. He has also served as a Research Scientist with Westvaco and MeadWestvaco Forest Research. He was Mission Leader for Stand Nutrition and Fiber Farm Research Programs. He has extensive experience developing plantation silviculture systems of pine, sweetgum, sycamore, Liriodendron, Populus, oak, and Eucalyptus species. His research interests include development of short rotation woody cropping regimes, developing and defining nutrient supply and plant demand relationships, quantification of nutrient cycling processes in forested ecosystems, development and deployment strategies for elite genotypes, and the quantification of plant responses to environmental or cultural stresses.

Chris Keziah
Oak Ridge National Laboratory

Handling/preparation of biomass wood chips (ORNL Gasification Unit)
Abstract not available

Gary Kling, Thomas Voigt, Robert Miller, Tim Mies, Andy Wycislo
University of Illinois

Woody Perennial Feedstock Evaluation at the Energy Biosciences Institute
Replicated trials of 21 species of woody plants were planted in a short-rotation field trial in the spring of 2010 and the first coppicing treatment was applied at the conclusion of the 2011 growing season. After two years of growth, black locust (Robinia pseudoacacia) yielded more than 10 Mg ha-1 dry biomass with a moisture content of 34%. Yields (Mg ha-1) of the next most productive species were: 4.0, northern catalpa (Catalpa speciosa); 3.7, flameleaf sumac (Rhus copallinum); 3.6, silver maple (Acer saccharinum); and 2.7, sycamore (Platanus occidentalis). River birch (Betula nigra), red oak (Quercus rubra) and American sweetgum (Liquidambar styraciflua) were replanted after the first season due to establishment difficulties. Insufficient growth in American filbert (Corylus Americana) and possumhaw (Ilex decidua) delayed the coppicing treatment for an additional season. The various species showed differences in regrowth patterns from the coppicing treatment, ranging from upright growth to sprawling branches laying on the ground and weak connection points that resulted in wind breakage in the spring of 2012. Evaluation work also includes 28 clones of poplar from the US Forest Service and Iowa State University, 61 hybrid poplar clones from the University of Minnesota, 20 clones of hybrid willow from the State University of New York, and Chinese wingnut (Pterocarya stenoptera) in short rotation experiments. These were planted in the spring of 2010 and coppiced at the conclusion of the 2010 season.

Biography
Gary Kling is an associate professor of horticulture in the Department of Crop Sciences and the Energy Biosciences Institute at the University of Illinois. Previous work included 30 years of research in nursery crop production, use of bio-containers in greenhouse production and evaluation of landscape plant materials along with teaching experience in woody plant materials at the University of Illinois. Current work includes the evaluation of native herbaceous plants (forbs) and perennial woody plants for short rotation feedstock production. His most recent paper is T.B. Voigt, D.K. Lee and G.J. Kling (2012). Perennial herbaceous crops with potential for biofuel production in the temperate regions of the USA. CAB Reviews 7(15):1-13.

Ahmed Jerbi, Werther Guidi, Michel Labrecque

Plant Biology Research Institute, Université de Montréal and Montreal Botanical Garden

Root Development in a Willow Vegetation Filter Under Different Irrigation and Fertilization Regimes
Root biomass production and spatial distribution were investigated in the context of a 3-year old willow plantation (Salix miyabeana SX67) used as a vegetation filter. The experimental design, including four doses of secondary treated urban wastewater (0, 350, 500, 750 mm yr-1) and two fertilization treatments (0 - 100 kg N ha-1), was set up in Saint-Roch-de-l'Achigan, 30 kilometers north-east of Montreal, Quebec, Canada. All growth parameters were determined for coarse and fine roots based on soil core samples. Fine roots represented on average 75% of overall root biomass and were not affected by either irrigation or fertilization. Spatial distribution showed that most (i.e. 87.6%) root biomass was concentrated in the uppermost (0-20 cm) soil layer, whereas only a very small amount (i.e. 0.9%) was found below a depth of 60 cm. In most cases, wastewater supply enhanced the amount of both coarse and fine root biomass in upper soil layers and reduced that found in deeper layers. On the other hand, fertilization reduced fine and coarse root biomass in upper layers and enhanced that in deep soil. As wastewater supply doses increased, overall root biomass in the entire soil profile was enhanced and reached a maximum (2.8 t ha-1) at a dose of 500 mm, after which it dropped to a minimum (1.4 t ha-1) at a dose of 750 mm yr-1. Increased irrigation doses and fertilization treatments decreased root/shoot ratio mainly due to increased aboveground biomass yield compared to roots. Irrigation with treated urban wastewater led to high biomass yields but restricted root development which in return would affect soil properties such as organic carbon content.

Biography
M. Labrecque is Curator and Head of the Research and Scientific division since 1997. Adjunct professor at the Department of Biological Sciences at the Université de Montréal. A specialist in ecophysiology, he is conducting studies on the use of plants to address environmental issues and examine, in this context, the physiological functioning of plants. M. Labrecque is also involved in research on the cultivation of fast growing woody plants for energy and environmental ends. He has developed an expertise in the use of plants for phytoremediation and studied the assimilation pathways of diverse contaminant in plants. M. Labrecque has directed or co-directed 17 MSc and/or PhD students and post-doctoral fellows. As author or co-author he published more than 75 peer-reviewed papers and presented 100 conferences at national and international level. Chair of the International Symposium on the Tree Montreal 2000, and the International workshop on environmental applications of willows and poplars in 2007 (IPC FAO). He has also co-founded the "Société Québécoise de phytotechnologie" (Quebec Society of Phytotechnology) in 2007.

Matthew Langholtz[1], Donald L. Rockwood[2], Brian Becker[3], Douglas R. Carter[2],
1 Oak Ridge National Laboratory Environmental Sciences Division, 2 University of Florida School of Forest Resources and Conservation, 3 Community Power Initiative Public Policy Virginia

Harvest Scheduling Of Eucalyptus spp. in Florida for Economic and Environmental Optimization
Economic optimization and optimal harvest scheduling of Eucalyptus spp. is influenced by various parameters, including stumpage price, operational costs, discount rate, and growth and yield. Growth and yield is in turn influenced by genotype, management, and site-specific variables. Further, incorporation of values for environmental amenities can influence optimal harvest scheduling and time of replanting. Field trials of Eucalyptus spp. in Florida have demonstrated measurable environmental benefits, including mitigation of nutrient loading from reclaimed water and municipal solid waste, phytoremediation of contaminated sites, and reclamation of mined lands. Research to date indicates that Eucalyptus amplifolia and Eucalyptus grandis coppice systems in Florida is potentially profitable, and that compensation for environmental amenities improves profitability and changes economically optimal coppice scheduling. Ongoing work includes development of updated growth and yield data from clay settling areas to be included in the economic model. A decision support system to evaluate profitability and optimum coppiced management has been developed.

Biography
Dr. Matthew Langholtz is a Natural Resource Economist in the Bioenergy Group at Oak Ridge National Laboratory. His research interests include biomass resource economics, short-rotation woody crops, and bioenergy from forest resources. He has worked on valuation of non-market externalities, and developed biomass supply curves for commercial projects, the South, and the US. Dr. Langholtz received his PhD in Forest Economics from the University of Florida in 2005. He has a BS in Forestry from Oklahoma State University, and a Masters of Forestry from UF.

Jared M. LeBoldus[1], Glen R. Stanosz[2], Ruqian Qin[1], Odaliz Faria[3]
1 North Dakota State University, 2 University of Wisconsin – Madison, 3 University of Puerto Rico, Mayaguez.

Screening hybrid poplar for resistance to Septoria musiva: Greenhouse to field correlations using a novel inoculation procedure
Hybrid poplars are an important short rotation woody crop in the United States and around the world. Yields of these rapidly growing trees are often impacted by a suite of plant pathogens affecting the leaves, shoots, and stems of susceptible genotypes. Leaf spots and stem cankers caused by the fungus Septoria musiva are the most important diseases in short rotation hybrid poplar plantations in the north-central United States and the majority of central and eastern Canada. Disease resistance is considered the only economic means of managing these diseases, which negatively impact yield and survival in these plantations. In each of three greenhouse studies, young trees of different hybrid parentages (P. deltoides x P. nigra, P. nigra x P. maximowiczii, and (P. trichocarpa x P. deltoides) x P. deltoides) were inoculated with a conidial suspension of the pathogen. Responses (recorded as numbers of lesions per unit length of stem) repeatedly yielded significant differences in relative disease resistance among the different genotypes tested. The potential to scale-up the assay to increase numbers of genotypes rapidly screened was also demonstrated, with up to 1000 individual trees inoculated in a single day. The fourth study, using clones of diverse parentage, examined the relationship between results of the greenhouse inoculation assay and long term-field performance. The need and potential to incorporate a repeatable, reliable disease resistance screening assay into existing breeding programs will be discussed.

Biography
Dr. LeBoldus joined the department of plant pathology at North Dakota State University as an assistant professor in 2011 and conducts research in the area of forest pathology. He received his B.Sc. (2003) in Forest Science from the University of British Columbia and his M.Sc. (2006) and Ph.D. (2010) in Forest Biology and Management from the University of Alberta. His recent publications include: (1) LeBoldus, J.M., Blenis P.V., Thomas B.R. (2010) A method to induce stem cankers by inoculating nonwounded Populus clones with S. musiva spore suspensions. Plant Dis. 94: 1238-1242; (2) LeBoldus, J.M., Blenis P.V., Thomas B.R., Feau, N., and Bernier, L. (2009) Susceptibility of P. balsamifera to S. musiva: a field study and greenhouse experiment. Plant Dis. 93: 1146-1150; and (3) LeBoldus, J.M., Blenis P.V., and Thomas B.R. (2008) Clone by isolate interaction in the hybrid poplar – S. musiva pathosystem. Can. J. For. Res. 38: 1888-1896.

Theodor D. Leininger[1], Ray A. Souter[1], Emile S. Gardiner[1], Jennifer Knoepp[2], Dana Mitchell[3], Robert B. Rummer[3], Randy Rousseau[4], Michael C. Tyree[5]

1 US Forest Service, Southern Research Station-Stoneville 2 US Forest Service, Southern Research Station-Otto

3 US Forest Service, Southern Research Station-Auburn, 4 Mississippi State University, 5 Louisiana Tech University

Developing Biomass Crop Production Systems for Eastern Cottonwood and Black Willow in the Lower Mississippi Alluvial Valley.

We are developing short rotation woody cropping systems to produce eastern cottonwood (Populus deltoides Bartr. Ex Marsh.) and black willow (Salix nigra Marsh.) biofuels feedstocks on clay soils that have proven unprofitable for row cropping within the Mississippi Alluvial Valley. Methods must be environmentally and economically sustainable so an energy budget will be established that includes the costs of planting stock, site preparation, establishment, tending, and harvest compared to bioenergy production on areas of operational acreage over complete rotation periods. Soil organic carbon and CO2 efflux will be monitored along with fossil fuel use to determine carbon cycling dynamics. Soil nutrient pools as well as available C and N and potential denitrification are being measured annually. The study was established in February 2012, with experimental units replicated three times and at four planting densities suitable for varying growth and harvest regimes that include: a) plant 4,100 trees per acre (tpa) with production harvests in years 2, 4, 6, 8, and 10; b) plant 2,489 tpa and early coppice (1st yr) with production harvests in years 4, 7, and 10; c) plant 807 tpa with a production thin in year 3 followed by a production clear-cut with reestablishment in yr 5; and d) plant 302 tpa with a production clear-cut in year 10. Production inputs and outputs data will allow us to determine the net energy yield of these four cropping systems. Results of first growing season establishment and growth, along with lessons learned in controlling weed competition, will be discussed.

Biography

Ted Leininger is a Research Plant Pathologist and Project Leader for the US Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research in Stoneville, MS, where he has studied the production, protection and sustainable management of bottomland hardwoods for more than 20 years. In addition to his research interest in developing biofuels feedstock crop production systems for eastern cottonwood and black willow, Ted and his cooperators are developing disease resistance in American sycamore to be grown in plantations for pulpwood and biofuels feedstocks. Ted has helped to refine and promote the use of an eastern cottonwood-oak interplanting method developed by his Center to the point where the method has been used in the past 5 years to plant more than 3 million hardwood trees on more than 5,000 acres of formerly unproductive agricultural land in the Mississippi Alluvial Valley.

Andrew Leslie

National School of Forestry, University of Cumbria

The potential for Eucalyptus as a woody energy crop in the United Kingdom

Demand for wood for bioenergy is increasing in the UK, driven by government energy and climate change policies. One of the approaches identified as giving the best opportunities for short term carbon sequestration is planting new areas of short rotation forestry. A genus identified as providing the most rapid growth is Eucalyptus, however only small, scattered plantings of eucalypts exist in the UK and so reliable growth data are not available. This has been compounded by the failure of larger scale trials during the extremely cold winters of 2009-10 and 2010-11. This presentation describes current information on species choice, growth rates, costs and preliminary predictions of yield, financial return and risk.

Biography

MSc in Forestry and its Relation to Land Use from Oxford University, MBA from Herriot Watt University, BSc (Hons) in Ecological Sciences / Forestry from Edinburgh University and currently studying for a part-time PhD at Edinburgh University. My interests lie in the silviculture and sustainable management of natural and plantation forests, particularly of short-rotation forestry for biomass. Prior to my university post of twelve year I worked mainly overseas as a forest researcher and in project management in countries as diverse as Somalia, Lesotho, Guyana and Vanuatu on projects focused on natural and plantation forests. My most recent relevant publications are:

Leslie, A.D.; Mencuccini, M. and Perks, M. (2012) The potential for Eucalyptus as a wood fuel in the UK. Applied Energy Vol 89 No1, p176-182.

Leslie, A.D.; Mencuccini, M. and Perks, M. (2011) Eucalyptus in the British Isles. Quarterly Journal of Forestry. Vol 105, No 1. p43-53.

Andrew K. McCall

Maryville College

Maryville College Wood-Fired Boiler Operation

In the mid to late 1970's, an energy Crisis creating high fuel cost and short fuel supply caused Maryville College and many other educational institutions across the nation serious financial problems. A technical report, prepared by the Tennessee Valley Authority in 1977 concluded that a conversion from the oil-fired boiler system to a wood-fired boiler system would create operating cost savings for the College. The conversion to a wood-fired boiler system took place in 1982 and has been in operation since that date. An overview of the Maryville College boiler systems operation will be presented.

Biography

Andrew McCall is the Physical Plant Director at Maryville College, in Maryville, TN.

Rick Meilan

Purdue University

Poplar as an Energy Crop: A View from Indiana

The future looks promising for poplar (species within the genus Populus) as a renewable energy feedstock. Thirty states have passed Renewable Portfolio Standards (RPSs); similar legislation was debated in the last session of the Indiana General Assembly. After careful study, a major electrical supplier in Indiana has decided to use woody biomass to help fuel its next generation of power plants and meet RPSs that are likely to be adopted in IN. Developments in the aviation sector are also encouraging. The Air Force and Navy are already committed to biofuels, and the civil aviation industry is moving in that direction. The recently formed Midwest Aviation Sustainable Biofuels Initiative (MASBI) includes representatives from across the biofuels value chain, who will explore ways of "leveraging regional assets to become a national leader in the emerging aviation biofuels market" (http://www.masbi.org/). Woody biomass is likely to provide a major feedstock for producing renewable jet fuel.

Agricultural economists at Purdue are conducting an economic analysis of the entire supply chain along the wood-to-wheels fuel pathway. This is being done in conjunction with a life-cycle analysis of this pathway's potential environmental impacts. The goal is to develop an economic model to predict profitability for growers of dedicated, woody energy crops. Toward this end, I have installed field trials with poplar at two Purdue Agricultural Centers to help develop a yield function for the model.

Many researchers are attempting to genetic engineer (GE) poplars to increase their utility as bioenergy crops. However, before transgenic trees can be grown commercially, federal regulators require that a system be established to minimize the spread and persistence of introduced genes (i.e., transgenes) in the environment. Many labs have spent considerable effort trying, with limited success, to GE reproductive sterility as a means of achieving transgene confinement. I will discuss some recent, related work in my laboratory using the Cg1 gene. Researchers in various parts of the world are experimenting with high-density poplar plantings that are being coppiced at short intervals. This may also be an effective strategy for transgene confinement, because coppicing restores poplars to a juvenile state.

Currently, regulatory decisions concerning GE trees are based largely on the technique(s) used to produce them. Instead, these decisions should be made on a case-by-case basis that considers the gene(s) being used, the biology of the species being engineered, and where the trees will be deployed. This and other regulatory hurdles contribute to industry's reluctance to support research that is needed to advance the technology. To foster investment and expedite progress, it will be necessary to implement regulatory reforms rather than requiring innovators to jump through unjustified regulatory hoops that are based on hypothetical or unfounded risks. It is possible to reduce the regulatory burden for GE trees while ensuring the integrity of safety assessment. Such a move would free up critical funds, time, and energy for the development and deployment of many more GE trees for the benefit of society. Revision of the regulatory framework will involve engaging lawmakers and attracting a spectrum of stakeholders to take part in scientific and public debate. Together, we can work to achieve a regulatory system that is based on science and not politics, and one that enables rather than hinders advancements with GE trees.

Dana Mitchell
USDA Forest Service, Southern Research Station

Production Results from Harvesting a 5-year-old Poplar Stand

This study examined production rates and costs associated with harvesting short rotation hybrid poplar (Populus spp.). A 26.7 acre stand, located near Paterson, WA, was harvested in August, 2012. The five-year-old stand was planted in single rows at a density of 293 tpa. Cruise plots were measured to collect pre-harvest stand data. The average stem dbh was approximately 8 inches, and the trees had been pruned to 25 feet. Trees were felled with a tracked harvester and transported to roadside with a large grapple skidder. Elemental cycle time was collected on both machines. The operational characteristics of the harvester were recorded, including the number of rows harvested in each pass. Bunches were numbered, measured, and GPS location coordinates were recorded. Documented skidder activity included the number of trees per bunch, bunches per skid, and the distance between bunches. A sample of trees was weighed to obtain an average weight per stem for determining payloads and production rates. Machine rates were calculated to determine costs. The operation typically chips at roadside, but due biomass chip market conditions, trees were processed into log lengths. In addition to production data, moisture content was sampled using a moisture meter. Because of interest in maintaining the integrity of stool beds in short rotation woody crops, stool damage was classified based on amount and type of damage. Additionally, the processor was equipped with debarking knives and a sample of trees was debarked and processed at roadside. Debarking cycles were timed and efficacy of debarking was measured.

Biography
Dana Mitchell is a Research Engineer with the Forest Operations Research Unit of the USDA Forest Service Southern Research Station. Previous work included assignments on various National Forests located in Washington, Oregon, California, Alaska and Mississippi. These assignments ranged from presale forester, sale preparation forester, NEPA coordinator/documents writer, and planning team leader. She left the Forest Service and worked as an area harvesting manager for Georgia Pacific for four years before returning to the Forest Service in 2004. Her primary research interests include harvesting technologies and forest worker health.

Gary F. Peters
University of Florida

Opportunities and challenges associated with genetically engineered southern pines

In the southern US, pines are the most important commercial forest tree species. On over 13 million hectares of genetically improved loblolly and slash pine have been planted and are managed with advanced silvicultural methods, which have dramatically increased yields and reduced rotation lengths. Despite these large gains, a number of approaches are being pursued to increase the landowner value of planted pines, including increasing growth rates to further reduce rotation lengths, managing for larger stem diameters to get more solidwood, and altering wood chemical properties to improve product yields in traditional pulp and paper mills, integrated forest biorefineries or stand alone bioenergy facilities. A long researched opportunity is the genetic engineering of wood lignin content and composition. In forest trees, reduced lignin content offers greater cellulose yields and the potential for reduced costs. Increased syringyl relative to guaiacyl lignin offers faster pulping and improved saccharification. The genetic engineering of loblolly pine with lower lignin content and with syringyl lignin, a novel trait in pine, has been achieved. Thus, in this example, the barrier for commercialization is likely no longer technical, but rather regulatory, economics, timing and scale of adoption. An alternative approach is to engineer the pine resinosis pathway to increase wood terpene levels. In this example, terpenes can be extracted from the wood during pulping or prior conversion of the lignocelluloses to bioenergy or biofuels. The benefits and challenges associated with commercialization of trees with altered wood chemistry will be discussed.

John Purse
Prima Bio

Eucalyptus for short rotation forestry in the British Isles – a long history of trials

Eucalypts have been grown as ornamentals in the British Isles for over 150 years, and forestry trials started 100 years ago. A range of hardy species have been trialled, and some impressive plots and specimens exist in many lowland areas today. These indicate that growth rates can be substantially higher than that of species currently used for timber and pulpwood. The highest growth rates and yields have been obtained with E. nitens, but this species is only suited to areas with milder winters. E. gunnii

appears well-adapted to all but the coldest lowland areas, provided it does not experience extreme cold (below -16°C) when young, but its form is usually poor. The main constraint to establishment and long-term survival of all eucalyptus species in the British Isles is unusually low temperature in winter; other constraints have been a lack of appreciation of the importance of seed provenance, inadequate weed control during establishment, and in some locations damage to newly-planted trees by browsing mammals. Increased interest in biomass production (woodchip and firewood logs) in the past 10 years has led to application of the establishment practices associated with short rotation forestry, and trials of hardy species as alternatives to E. gunnii. Of the alternative species, E. glaucescens has generated particular interest because of its combination of vigour, good form, cold tolerance, and unpalatability. There is a need for further work on site-species matching, and on optimising methods for establishment of eucalypts on different site types.

Biography

John Purse has been Director of Prima Bio (part of Prima Informatics Ltd) since 2000. Prima Bio provides consultancy on short rotation forestry, supplies Eucalyptus and Nothofagus forestry planting stock raised under contract for the UK market, and breeds hybrid eucalypts for the ornamental, cut foliage and biomass markets. These activities are described at www.primabio.co.uk . Prior to 2000, John worked for Shell, and spent 15 years as scientist and subsequently manager of Shell Forestry's UK-based research activities. This group conducted R&D and technology transfer in genetics, propagation, biotechnology and wood properties for Shell's forestry and biomass businesses, and mainly involved eucalyptus species.

Randy Rousseau

Mississippi State University

Improvement of Black Willow in the Lower Mississippi Alluvial Valley

Various species and hybrids of willows (Salix spp.) have been used in Europe and proposed for the northeastern United States as a source of fast growth species for the bioenergy and biofuels production. Although black willow (Salix nigra L.) grows throughout the southern United States it has received very little attention as a biomass species. This research represents the initial steps taken in developing genetically superior clones that can be used in dedicated energy plantations. A collection of one to two-year-old juvenile willows found along selected river systems, which included the Mississippi River, the Atchafalaya River, the Trinity River, and the Brazos River was completed in 2009. From each of the five selected locations a total of four separate stands and five clones per stand were collected. This material was grown for one year in a stoolbed and then included into a series of clonal screening trials established in 2010 and 2011 on various sites in Mississippi. The early results from these trials will be reported as well as future plans for the program.

Biography

Randy Rousseau is currently an Associate Professor at Mississippi State University and is working in biomass production of eastern cottonwood, hybrid poplar, black willow, and co-culture of switchgrass and loblolly pine. Previous work included 25 years of pine and hardwood tree improvement research for Westvaco and later MeadWestvaco. The major emphasis research was on that of hardwood improvement of eastern cottonwood, hybrid poplar, sycamore, and sweetgum for alluvial, fertigated, and upland sites in Kentucky, Missouri, Illinois, and Tennessee.

Richard Schroeder

BioResource Management, Inc.

Wood Utilization - Multiple Considerations, and the Case of the Gainesville Florida Power Plant

Utilizing wood for energy involves a long line of steps, processes, and pitfalls that growers and producers need to be aware of. Over thirty years of experience has taught us what to do, and sometimes what not to do, as both a wood producer or as the project manager of a wood facility, to ensure that all parties' interests are represented and that required quantities, specifications and costs are met. In this discussion we will talk about our early efforts in the bioenergy sector, how conflicts arose and were eventually resolved (or not) between buyer and seller, and some lessons learned going forward. We will also discuss our current efforts involving the procurement of 1,000,000 tons annually for the new Gainesville 100MW power plant, schedule to begin operation next year.

Biography

Mr. Schroeder is the President and founder of BioResource Management, Inc., and brings over thirty years' forestry experience in planning, developing, and operating facilities throughout the US. Mr. Schroeder's experience includes governmental service and field operations of forestland management, sawmills operations, and recycling firms. Mr. Schroeder received his BS in Forestry and a Masters Degree in Agriculture from the University of Florida. He also earned an MBA from Nova Southeastern University. He served in numerous positions with the Florida Division of Forestry, operated biomass companies nationally, and in 2005 founded BioResource Management Inc., headquartered in Gainesville.

Lawrence B. Smart[1], Fred E. Gouker[1], Michelle J. Serapiglia[1], Christopher D. Town[2], Haibao Tang[2], Edward S. Buckler[1],[3], Robert J. Elshire[1], Sharon E. Mitchell[1], Stephen DiFazio[4], Eli Rodgers-Melnick[4], Kerrie Barry[5], Gerald A. Tuskan[5],[6],, John E. Carlson[7],[8]

1 Cornell University, 2 J. Craig Venter Institute, 3 USDA-ARS, 4West Virginia University, 5 U.S. Dept. of Energy Joint Genome Institute, 6 Oak Ridge National Laboratory, 7 Pennsylvania State University, 8 Chonnam National University, Korea

Genomic and mapping resources for the genetic improvement of shrub willow feedstock crops

Development of genomics-based selection methods will greatly accelerate the genetic improvement of shrub willow bioenergy crops to attain improved biomass yield, stress tolerance, disease and pest resistance, nutrient and water use efficiency, and optimum biomass composition for conversion. To investigate the molecular basis for variation in those traits, we have used next-generation sequencing data generated through a DOE Joint Genome Institute initiative to produce an initial de novo assembly of the S. purpurea genome. RNA samples from flowers, leaves, roots, and stems were also sequenced and used to assemble the S. purpurea transcriptome. Comparative analysis of the S. purpurea and P. trichocarpa genomes will be discussed, as will patterns of gene expression revealed through RNA-seq analysis. We have developed low cost, high density markers using genotyping-by-sequencing and have applied those to produce a linkage map of a S. purpurea full-sib F2 population. The use of this mapping technology to improve the genome assembly will also be presented. Additional intra- and inter-specific hybrid mapping populations and an association mapping population of S. purpurea have been produced and are being characterized. Present and future strategies for the breeding of improved genotypes of shrub willow energy crops that take advantage of these resources will be described.

Ken Smith

The University of the South

Southern Biomass Harvesting Guidelines

In forests where landowner objectives encompass multiple uses, such as timber production, wildlife habitat, and recreational opportunities, recommendations that guide the sustainable removal of biomass are crucial. The Forest Guild guidelines to biomass harvesting were designed to fill the gaps where existing Best Management Practices (BMPs) or new state-based biomass guidelines may be insufficient to protect forest resources under new biomass harvesting practices and technologies. The Forest Guild developed these guidelines to assist several audiences: field foresters, loggers, state policy makers, biomass facilities wishing to assure sustainability, third-party certifiers, and non-industrial private forest landowners. The focus of these guidelines is primarily on post-harvest forest conditions and not on the type of harvest. For example, in southern Appalachian forests, a minimum of 3 tons (per acre) of coarse woody debris is suggested for retention on the site (well distributed), and higher volumes should be retained if soils are poor. If available, at least 10 snags over 4” diameter (per acre) and existing (pre-treatment) dead and downed woody debris should be retained on the site. Overall, the guidelines suggest that harvest intensity, harvest frequency, soil nutrient status, and pre-existing volumes of downed woody debris govern the volumes of post-treatment material to be left on the site.

Biography

Ken Smith is a professor in the Forestry and Geology Department at the University of the South. He is active in the university’s land management team, which is currently considering using wood as a winter heating source for several campus buildings. He is also working with Sewanee personnel and consulting firms to determine if Sewanee will sell carbon offsets in the California cap and trade program. Outside of Sewanee, Smith works on the managerial board for the Valles Caldera National Preserve in New Mexico, and has worked in forests in Brazil, Quebec, and West Africa.

Kevin Snowdon, Ian Nicholas

New Zealand

Short Rotation Crops in New Zealand (Video Interview)

With an enviable climate, New Zealand has well developed plantation resources of Radiata pine and Douglas Fir. Plantations of eucalypt have been more problematic, partly due to market uncertainty, and partly due to pests, diseases and the proximity to the host country Australia. Some companies seeking to develop a hardwood biomass resource in New Zealand have targeted SRC willow. Vertichem Technology Limited supported trials and nursery development with S schweirinii, S viminalis and S purpurea in several locations. Efforts were initiated to identify and deploy clones of S viminalis that would improve productivity

by 20 to 40% and efforts to propagate S purpurea crosses were initiated. The commercial goal was to develop single crops of 5,000 ha, owned by foresters and farmers, and dedicated to a single biorefinery. However Vertichem recently made the decision to implement their first biorefinery in North America, rather than New Zealand. Meanwhile efforts are continuing to generate interest by farmers in growing trees. While neither Kevin nor Ian will be able to attend the conference, a short video interview will be used to communicate ongoing activities on short rotation woody crops in New Zealand.

Biography

Kevin Snowdon has over 20 years of experience in the rural and forestry sectors, having held strategic roles with a particular emphasis in business development and innovation. He was worked in a number of organizations establishing and implementing forestry projects and monitoring environmental impact, harvesting and technology transfer all in the context of strategic and business management. Kevin was General Manager and Feedstock Manager for Vertichem, a company whose goal is to make specialty chemicals green. His responsibilities included establishing nurseries, securing land, ensuring suitable planting materials from several input sources, and overseeing trials for establishment and weed control. Kevin, now with Salix Ltd, has continued the interest in SRC willow deployment, and has a partnership dedicated to using SRC willow for waste water treatment including the uptake of nutrient rich waste water. This is expected to provide efficient forms of waste water treatment for council and industrial sites. Ian Nicholas recently retired from a position as a research scientist working on renewable energy projects for Scion, a New Zealand Crown Research Institute focusing on forestry, wood products and other biomaterials. He is currently traveling around the New Zealand countryside organizing workshops called “Trees on Farms”.

Glen R. Stanosz

University of Wisconsin-Madison

What You Don’t Know CAN Hurt You: Why Disease-induced Catastrophe Threatens Short-rotation, Intensive-culture Woody Crop Production Systems

Tree disease epidemics producing catastrophic losses can be attributed to: new tree host and pathogen combinations due to introduction of either; increased production (scale-up) of a crop; narrowing of the genetic diversity of a host; changes in a pathogen population; and deployment or production practices that alter a previous balance in a tree host-pathogen relationship. Success in agricultural crop production systems is based on proactive, substantial, and sustained investment in plant pathology research. In contrast, tree disease research historically has been initiated in response to catastrophe, and insufficient in scale, scope, or duration to provide durable, biologically based solutions. The future of short-rotation, intensive-culture woody crop production systems is threatened by a lack of support to obtain fundamental information, both basic and applied, critical to understanding, avoiding, and managing impacts of diseases.

Biography

Professor Glen R. Stanosz earned a B.S. in Forest Biology from the State University of New York College of Environmental Science and Forestry at Syracuse in 1976, and M.S. and Ph.D. degrees in Plant Pathology from the University of Wisconsin-Madison in 1983 and 1985, respectively. Prior to joining the departments of Plant Pathology and Forest Ecology and Management at UW-Madison in 1992, Glen was the forest pathologist of the Pennsylvania Bureau of Forestry for almost 5 years. He has authored or co-authored nearly 100 scientific papers, and has particular interests in fungal pathogens and diseases of trees including poplars and pines. Glen currently teaches students in biology, forestry, and “green industry” professionals. A recent paper is: Oblinger, B. W., Smith, D. R., and Stanosz, G. R. 2011. Red pine harvest debris as a potential source of inoculum of Diplodia shoot blight pathogens. Forest Ecology and Management 262: 663–670.

Richard Sulman

Biosystems Engineering

Bionic Beaver Harvester Development and Testing

Biosystems Engineering has designed and built the Bionic Beaver, a short rotation woody crop harvester in collaboration with the Australian Future Farm Industries Cooperative Research Centre and the WA Department of Environment and Conservation. The machine is an efficient upright biomass harvester that can cut and chip woody biomass in one continuous operation, analogous to how farmers harvest forage and sugar crops. The original prototype of the Bionic Beaver was developed in Western Australia between the mid 1990s and early 2000s by Western Australian engineer Harley Pederick and Department of Conservation and Land Management researcher Rick Giles. This harvester was developed to harvest mallees, which are a group of many species of eucalyptus trees adapted to regenerate from an underground lignotuber. Due to the diverse nature of the mallees, the harvester had to be able to handle a wide range of tree shapes, stem numbers and sizes. The prototype harvester’s unique attribute is that it cuts, conveys and chips the trees vertically, leveraging the operational efficiency of harvesting and chipping continuously in one pass. The prototype harvester, once fully developed is anticipated to have an operational cost of less than 50% compared with conventional forestry harvesting and chipping techniques. The current prototype is able to process trees with basal diameters between 70mm to 150mm (2.75 to 6 inches) but it can be scaled to handle trees with basal diameters up

to 200mm (8 inches) and tree heights up to 20 meters (65 feet). Trials have demonstrated an average harvesting rate of 39.9 green tonnes per hour, but with further development of the harvester together with an efficient on-farm transport system, it is expected to achieve a production rate of up to 80 green tonnes per hour.

Biography
Richard Sulman is President and CEO of Biosystems Engineering and has more than 20 years engineering experience in the agricultural, food, forestry, water and energy sectors. He is experienced in project management, technology design, data acquisition, structural component analysis, 3D modeling, manufacturing and comparative product testing. Richard is also a forensic engineer, providing expert testimony in litigation matters where machinery has failed, causing economic loss, injury or death.

Bijay Tamang, Jeff Wright, Victor Steel
ArborGen Inc

Genetic improvement of cottonwood and hybrid poplar clones for short rotation woody crops systems

Cottonwood and hybrid poplars are amongst the fastest growing forest species with great potential for applications in the conventional wood-based and emerging bio-energy markets. They are also used by the pulp and paper industries. Many commercial cottonwood and hybrid poplar clones have been developed over the years for short rotation woody crop plantations in North America and Europe. ArborGen established six varietal trials in the states of Alabama, South Carolina and North Carolina to identify fast-growing and highly productive clones for the Southeastern US. A total of 422 clones were included in the tests. One of the widely tested and best performing clones was used as a control. The age of the tests ranged between 2 and 8 years. Trees were measured for diameter at breast height (DBH) and height, and their volumes were estimated using DBH and height. Best linear unbiased prediction (BLUP) showed that seven clones had more than 10% volume gain over the control. There were 8 clones with more than 10% height gain and 17 clones with more than 10% DBH gain over the control. These results suggest that these new superior clones have the ability to produce more biomass to meet the demands from both the conventional wood-based and emerging bio-energy markets.

Biography
Bijay Tamang is a Hardwood Project Leader for ArborGen. For the past year, he worked as a Bioenergy Project Leader developing short rotation woody crop systems applicable to ArborGen product lines and assessing the products for bioenergy characteristics to support bioenergy business development. He spent seven years (2003-2010) at the University of Florida as a Postdoctoral Associate and Graduate Research Assistant working on short rotation woody crops. Bijay is lead or co-author on more than 13 articles on various subjects. The latest one is: Tamang B, Andreu MG, Staudhammer CL, Rockwood DL and Jose S (2012) Equations for estimating aboveground biomass of cadaghi (Corymbia torelliana) trees in farm windbreaks. Agroforestry Systems (DOI: 10.1007/s10457-012-9490-z). He has MS and PhD degrees in forest resources and conservation from the University of Florida's School of Forest Resources and Conservation, and BS degree in Biology from Tribhuvan University (Nepal).

CJ Tsai
University of Georgia

Wood quality and stress tolerance – can we have both? The promise and challenge of gene multiplicity in the post-genomics era

Combinatorial trait improvement is vital for the commercial success of short rotation woody crops, due to their perennial growth habit and the persistent biotic and abiotic challenges that they face. Multi-trait selection by conventional breeding is a lengthy process. Decades of research on genetic engineering have already shown promise for accelerating tree improvement via approaches such as gene stacking in one or multiple sequential transformation experiments. With the advent of genomic technologies and systems research, a growing number of structural genes have been shown to exhibit functional multiplicity that can be exploited for combinatorial trait improvement in woody bioenergy crops. I will present one case study with tubulins, the component proteins of microtubules that are ubiquitous in all cell types, with functions ranging from cell division and expansion to cell wall synthesis. Microtubule dynamics also affect stomatal guard cell movements – a process that is highly sensitive to environmental cues, such as temperature and water status. Transgenic manipulation of tubulin expression and post-translational modifications in Populus led to altered wood properties, leaf development and responses to drought stress. This signifies untapped potential for simultaneous improvement of bioenergy traits, such as wood properties and drought tolerance. However, pleiotropic effects such as these can present potential drawbacks for regulatory approval. Clearly, the promise and challenge of gene multiplicity both depend on continuing basic as well as applied research to advance our understanding and control of the underlying mechanisms.

Jose L. Stape[1], Thomas R. Fox[2], Rafael A. Rubilar[3], Timothy J. Albaugh[1], Jose Alvarez[1]
1 North Carolina State University, 2 Virginia Tech, 3 Universidad de Concepción

Potential Eucalyptus Species and the Required Silvicultural System for Biomass Production in the Ecological Regions of the Southeastern United States

The potential to growth Eucalyptus species to supply the US energy and fiber demands have generated increasing interest in evaluating, again, Eucalyptus plantation systems in the southeastern United States. This evaluation need to be comprehensive to actually evaluate the system under the harsh climatic conditions of the region for the Eucalyptus forests. The ultimate goals are to identify species that can thrive the SE winters and develop silvicultural protocols that lead to adequate forest productivity for the distinct ecological regions inside the SE US. Subsequent goals also includes the sustainability of these short rotations. To direct address these uncertainties the Forest Productivity Cooperative (www.forestproductivitycoop.org) has installed with the support of 15 forest companies 25 Eucalyptus trials across the SE US during 2010, 2011 and 2012 with a total of 150 species and 333 entries. The trials are located across a North-South and East-West transects, with 11 sites ranging from Raleigh NC to Palmdale FL and Merryville LA to Citra FL. After two contrasting winters (cold 2011 and mild 2012) the results are showing that: i) the SE US has very specific ecological zones for Eucalyptus leading to a G x E interaction; ii) Species like E.benthamii, E.dorrigoensis, E.viminalis, E.dalrympleana and E.macarthurii seems to be potential for the more cold areas while E.grandis, E.camaldulensis and E.amplifolia for the South of Florida region; iii) The cold acclimation process is required even for the cold-hardy species; iv) Forest nutrition seems to affect species cold-hardness; and v) If no frost damage occurs, the Eucalyptus growths thorough the winter, although modulated by the minimum temperatures.

Biography
JL Stape is an Associated Professor of Silviculture at North Carolina State University, Co-director of the Forest Productivity Cooperative, Site Director Center of NSF-Advanced Forestry System at NCSU, and invited scientist of the Brazilian Institute of Forest Research and Studies. Stape is lead or co-author on more than 60 articles on the topic of forest plantation productivity, ecophysiology, forest nutrition and silvicultural systems and is lead PI or co-PI in current projects related with Eucalyptus and Pine production ecology in temperate and tropical system.

Timothy A. Volk[1], Lawrence Abrahamson[1], Mark Eisenbies[1], Eric Fabio[1], Michael Buckley[2], Chris Foster[3], John Posselius[3], Virginia Green[4], Dennis Rak[5]
1 SUNY ESF, 2 ReEnergy Holdings, 3 Case New Holland, 4 USDA Farm Service Agency, 5 Double A Willow

The Potential Impact of Improving Production and Harvesting Systems and Implementing Incentive Programs on the Economics of Willow Biomass Crops

Despite the numerous environmental and rural development benefits associated with willow biomass crops, they have not been widely adopted and feedstock production, markets and supply systems remain underdeveloped. The main barrier to the deployment of willow biomass crops is the current high cost of production and delivery to an end user. The delay in recovering upfront costs, narrow margins, and uncertainly about the underdeveloped market for woody biomass are recognized impediments for potential growers. Recent research and development efforts have focused on improving yields and the performance of the production system while reducing costs. Developing new varieties and improving crop management could increase yield by as much as 50%, which could result in an internal return rate 2.5 times greater than current estimates. Harvesting remains the single largest cost of production but deployment of a single-pass cut and chip system based on a New Holland forage harvester can reduce that cost. Improving the efficiency of planting stock production and changes in recommended planting densities will lower establishment costs, which are the second largest expenditure in this system. Implementation of the USDA Biomass Crop Assistance Program for shrub willow in northern NY will have a positive impact on returns for the land enrolled in this program and will help spur commercial scale expansion and innovations that will further reduce production costs. With advancements in key components of the system, returns will improve and willow biomass crops will become more attractive to landowners and investors.

Biography
Timothy Volk has over 25 years of experience in forestry, agroforestry, short-rotation woody crops, bioenergy and phytoremediation in the Northeastern United States and in West Africa. He holds degrees from the University of Guelph (BS (Agr.)) in Natural Resources Management, Cornell University (MS) in Forest Science and SUNY – ESF (PhD, Syracuse, NY) in Forest and Natural Resources Management. He is currently a senior research associate at SUNY-ESF and is responsible for research projects focused on the development of shrub willow biomass cropping and harvesting systems and the use of willow as an alternative cover for industrial waste sites. He is also actively involved in research and development of sustainability assessments of bioenergy systems, life cycle assessments of willow biomass crops and woody biomass from forests, assessments of woody biomass availability from natural forests, economic modeling of short rotation woody crops, living snow fences, and regional woody biomass resource supplies.

Jeff Wright
ArborGen Inc.

Eucalyptus plantations in Florida USA: Economic Analysis of Current and Potential Uses

The history of introduction of Eucalyptus in Florida USA began in the 1870's. During the decade of the 1960's, with the advent of large scale eucalypt plantations for pulping in Spain, Portugal, Brazil, South Africa and other countries, there was a large effort to achieve success with eucalypt plantations in Florida. Cold temperatures, lack of adequate eucalypt plantation culture techniques as well as limited availability of improved seed or clones made these early efforts largely unsuccessful. An area of eucalypt plantations that were begun in the 1960's by Lykes Brothers in southern Florida were successful and now approach 8,000 ha in extension.

In the first years of the 2000 decade there was renewed interest in eucalypt plantations in Florida for mulch, pulp and especially for bio-energy. Developments in bio-energy national and international markets for wood pellets, biofuel, combined heat and power as well as co-generation have promoted the use of short rotation and coppice management in eucalypts in Florida. The eucalypt species showing promise have been E. benthamii, E. macarthurii, E. grandis, E. amplifolia and the hybrid E. urograndis (E. grandis x E. urophylla). Current success in eucalypt plantations involves improvement in weed control, fertilization, nursery practice and the availability of local and imported improved seed and clones.

Eucalypt wood yields in Florida are lower in the northern part of the state (MAI 9-18 green tons/ha/year with a rotation of 8-10 years) compared to the southern part of the state (MAI 18-36 green tons/ha/year with a rotation of 6-8 years). Production costs of eucalypt plantation stumpage vary from US$4-10/green ton. Discussion will focus on eucalypt plantation techniques utilizing improved seed or clones, fertilization, site preparation, harvesting techniques and wood utilization for various commercial end uses.

Ronald S. Zalesny Jr.[1], Deahn M. Donner[1], David R. Coyle[2], William L. Headlee (co-presenter)[3]
1 US Forest Service, Northern Research Station, 2 University of Georgia, 3 Iowa State University

An approach for siting poplar energy production systems to increase productivity and associated ecosystem services

Short rotation woody crops such as Populus spp. and their hybrids (i.e., poplars) are a significant component of the total biofuels and bioenergy feedstock resource in the USA and are, therefore, vital for growing a bioeconomy. Production of these dedicated energy crops may result in large-scale land conversion, which leads to questions about their economic, logistic, and ecologic feasibility. To address such concerns, we used available social (i.e., land ownership and cover) and biophysical (i.e., climate, soil characteristics) spatial data to map eligible lands suitable for establishing and growing poplar biomass and bioenergy crops across Minnesota and Wisconsin, USA. We confirmed the validity of this mapping technique by sampling and assessing biotic variables within locations identified on the maps. Lastly, we estimated potential poplar productivity within identified areas using a process-based growth model (3-PG) to determine spatial distribution of productive lands across the study area (see Headlee et al.). We will present highlights from a manuscript recently submitted to Forest Ecology and Management. Overall, eligible lands suitable for poplar production systems totaled 373,630 ha across both states; these lands represented 30.8% of the study area. Mean poplar biomass differed between states ($P < 0.0077$); Minnesota averaged 10.6 ± 0.2 Mg ha-1 yr-1 and Wisconsin 11.2 ± 0.1 Mg ha-1 yr-1. While this novel approach was validated for Minnesota and Wisconsin, our methodology was developed to be useful across a wide range of geographic conditions, irrespective of intra-regional variability in site and climate parameters. Thus, this information is vital for siting poplar energy production systems to increase productivity and associated ecosystem services, and is widely applicable to woody biomass production systems worldwide.

Biography

Dr. Zalesny is Team Leader and Research Plant Geneticist studying short rotation woody crop systems (i.e., poplars and willows) for fiber, energy, and phyto-technologies. He earned his Ph.D. in Forest Biology (Quantitative Forest Genetics) from Iowa State University (ISU), where he was the Sande McNabb Research Fellow from 1999 to 2003. He has since published over 45 peer-reviewed manuscripts and 65 proceedings papers, and has given over 70 technical presentations. Currently, he is the bioenergy science leader of the Station's Climate Change Science Council and the Station's biomass and bioenergy co-leader of the USDA Northeast Regional Biomass Center. Notable professional affiliations include an adjunct appointment in the Department of Natural Resource Ecology and Management at ISU, as well as serving as: 1) deputy coordinator of IUFRO Working Party 2.08.04 (Poplar and Willow Physiology and Genetics), 2) delegate of the IPC-FAO International Poplar Commission Environmental Applications of Poplar and Willow Working Party, 3) steering committee member of the SRWCOWG, and 4) steering committee member of the U.S. Poplar Council. He serves on the editorial boards of the International Journal of Phytoremediation and BioEnergy Research.

Jose Zerpa[1], Brian Stanton[1], Richard Shuren[1], Luke Maynard[1], Rick Stonex[1], Richard Gustafson[2]

1 GreenWood Resources, 2 University of Washington

Hybrid poplar as a bioenergy feedstock for the Pacific Northwest

Poplar production as a bioenergy feedstock in the Pacific Northwest will entail regeneration management through coppice in short rotations. This production system present some challenges: A continuous supply of biomass may be required by bioenergy plants, the productivity of hybrid poplar established at high planting densities in this area is not thoroughly known, and the complete removal of above-ground biomass at higher frequencies may pose a challenge for the productivity and long-term site sustainability of these systems. To address these questions, GreenWood Resources, funded through a USDA-AFRI grant in partnership with the University of Washington, has established field trials with hybrid poplar in two representatives and distinct growing zones of the region, a mesic and a xeric zone with annual precipitation of 53" and 26" respectively, to determine the effects of planting density, harvesting time, and alder intercropping on poplar regeneration and productivity. An overview of these trials and the potential of hybrid poplar as a bioenergy feedstock are presented.

Biography

Jose Zerpa is a silvicultural researcher at GreenWood Resources. His research interest is centered on the management of site resources to improve productivity, with emphasis on tree nutrition. He obtained his bachelor degree in Forestry from Universidad de Los Andes, in Venezuela, and did his Master in Science and Doctoral studies in Forestry at North Carolina State University where he received the Hofmann Forest Graduate Research Fellowship and the Charles B. Davey Graduate Fellowship for Excellence in Biological Sciences. He has experience in silviculture of Eucalyptus, Gmelina, Caribbean and loblolly pines, and hybrid poplar. Jose is currently responsible for the short rotation trials established at the AFRI demonstration plantings in the Pacific Northwest.

Posters

Paul Bloese, Raymond Miller, Daniel Keathley
Michigan State University

Identifying Superior Poplar Clones for the Production of Biofuel in Michigan: Year-2 Results

Poplar biomass trials to identify superior clones for specific sites for the production of biofuel were established at five locations in northern Michigan. Survival, height growth, insect and disease resistance were scored. Analysis shows significant variation in both height and survival after two years of field growth across all five sites. Genotype x site interactions were significant for both height and survival. Single-site broad-sense heritablities ranged from 0.19 to 0.60 for year-2 height. The broad-sense heritability estimate for height across all sites was 0.13. Clone x site interactions contributed to the reduced heritability estimate for height across sites, and underscores the importance of local testing and selection of appropriate clonal stock for attaining optimal growth in biofuel plantations. Growth rates of P. nigra X maximowiczii (NM) clones were superior to P. deltoides X nigra (DN) clones at all test sites. Melampsora rust incidence also varied among sites and clones, with DN clones having significantly higher infection rates than NM clones. After two years in the field NM clones outperformed DN clones in height growth and rust incidence. If this trend continues to rotation age, it highlights the need for high performing non-NM clones to diversify biofuel plantings in Michigan.

Biography
Paul Bloese has served as the Tree Improvement Supervisor for Michigan State University's Department of Forestry for 28 years. Over that time period the Michigan State Forest Genetics (MSFG) program has established over 150 plantations and worked with over 30 species to improve planting stock for Michigan. Species of interest have ranged from pulp and timber species including jack and red pine; to biofuel species such as poplar, aspen, and black locust; to Christmas tree species including Fraser fir and Scots pine; to species facing grave insect and disease threats such as native ashes and American beech. Paul has been lead or co-author on 14 papers and received an MS in Applied Forest Genetics from Colorado State University.

B. Landis Herrin[1], Randall Rousseau[1], Jake Camp[2]
1Mississippi State University, 2Mississippi Forestry Commission

Black Willow (Salix nigra Marsh.) Tree Improvement in the Development of a Biomass Species for Marginal Agricultural Land in the Lower Mississippi Alluvial Valley

The increased emphasis on dedicated biomass plantations for use in the production of renewable bioenergy and biofuels are being forced on marginal agricultural land. These types of soils are characterized as poorly drained heavy clay sites, which are suited to black willow (Salix nigra Marsh.). Unfortunately, very little genetic improvement has been made in black willow, even though this species possesses a number of excellent traits. In 2008, Mississippi State University and the Center for Bottomland Hardwood Research entered into a joint venture to examine the possibility of developing a genetically improved set of black willow clones. A selection strategy was developed to systematically sample a limited southern population along four river systems totally 113 clones. These clones were tested in 2010 and 2011 Black Willow Screening Trial that was designed to quickly determine the better geographic source and the best clones for inclusion into a more highly replicated clonal test. Results from the 2010 Screening Trial showed that geographic sources were non-significant for only age-one height. The most southern source was Atchafalaya River and proved to be the tallest source in the combined analysis at age one and two. Four of the top 10 clones for age-2 height were from the Atchafalaya source, with three from the Mississippi River Rosedale, MS, two from the Brazos River source, and one from the Mississippi River Tunica, MS source. The top 25 tallest clones at age two will be included into the 2012 Black Willow Clone Test.

Biography
Landis Herrin is a Research Associate in the College of Forest Resources at Mississippi State University. He has recently completed a Master's of Science in Forestry. His master's research focused on the response of varietal loblolly pine to various management schemes and a comparison among genetic improvement levels. Currently he is working to further develop populus and black willow species under Dr. Randall Rousseau.

W. Henry McNab[1], Bill Alexander[2]
1USDA, Forest Service, 2The Biltmore Company

Potential for Dual Cropping Eastern White Pine for Biomass and Conventional Products on Low Quality Upland Sites in the Southern Appalachians: Results from a 100-Year Case Study at Biltmore

Eastern white pine (EWP) has long been recognized for its value as a native species that is long lived, relatively free of insect and disease pests, responds well to management, and has high commercial value for conventional wood products. Particularly noteworthy, however, is its ability to outgrow all native hardwoods on forest sites of low to moderate quality and accumulate high basal area (>300 ft2/ac) as stands age. EWP has drawn little attention for biomass production and only scant information is available on potential yields. An historic 1899 planting of EWP on a severely eroded hillside of the Biltmore Estate (the Old Orchard Plantation) has been studied since 1916 and provides a case study of periodic biomass and woody crop production. Planted with 3,800 seedlings/ac, three small plots were established in the 5.6 ac plantation to follow growth resulting from thinned versus unthinned treatments. After 18 years production of total biomass ranged from 2.0 to 2.5 dry tons/ac/yr. One plot was thinned in 1916 by removing about 33% of the trees, resulting in a biomass harvest of 13.0 tons/ac. Five years later (1922) biomass of the thinned stand had regrown to about its prethinned level. Results of this case study suggest that EWP has potential for management both for biomass and conventional products depending on markets and management objectives. However, additional studies are required before EWP can be recommended for biomass, particularly regarding changes in soil fertility resulting from biomass removal and response to fertilization.

Biography
Henry McNab is a research forester in the Upland Hardwood Ecology and Management Research Work Unit at the Bent Creek Experimental Forest. Since 1983, his research assignment has dealt with various methods of forest site classification. He has authored many publications mainly on topics related to silviculture and management of southern Appalachian hardwoods. Two recent papers on white pine are: (1) McNab, W.H., Ritter, B.A. 2000. The Old Orchard white pine plantation at Biltmore after 100 years. Journal of Forestry.98:18-23. and (2) McNab, W. H. 2012. Effects of thinning on aboveground carbon sequestration by a 45-year-old eastern white pine plantation - a case study. Proceedings of the 16th Biennial Southern Silvicultural Research Conference, Charleston, SC.

L. David Ostlie
Energy Performance Systems

Development and Testing of the EPS Whole Tree Harvester

Energy Performance Systems, Inc. has been involved in improving the cost systems for wood based renewable energy since its inception in 1988. After analyzing every part of the typical renewable energy power cycle, it was obvious that the areas with the highest improvement opportunity included tree farm establishment, tree harvesting and conversion to electricity. Our latest focus is on “Whole Tree Harvesting.” Whole Tree Harvesting is a process where the trees (planted in rows) are cut within 2 to 4 inches from the ground and lifted 13 feet off the ground for direct loading on a truck trailer in a continuous manner. A 130,000 pound prototype was built and tested where it continuously cut and handled trees at a rate of more than 1 tree per second. The 900 horse power, 4 track prototype is designed to handle trees up to 30 inches in diameter and more than 100 feet in height. Present estimates suggest that harvesting costs can be reduced from conventional harvesting by a factor of three or more.

Biography
L. David Ostlie received his degree in Electrical and Electronics Engineering from North Dakota State University and has been focused on developing new and more efficient methods and systems for energy production. Currently David is president and CEO of Energy Performance System, Inc. and holds several patents on technologies such as the Whole Tree Energy™ method for power production, Whole Tree Harvester™, Injection Planter and other power plant systems. David has also co-authored many publications on his renewable energy research and power plant systems and was instrumental in developing a four state hybrid poplar production program.

R. Andrew Rodstrom[1], Alejandro I. Del Pozo[2], John J. Brown[3]
1GreenWood Resources, Inc., 2North Carolina State University, 3Washington State University

Challenging Change: Shifting Pest Pressures in Biomass Production

Pests pose challenges to the successful production of high-quality hybrid poplar products. Poplar pests can generally be grouped into three categories: defoliators (browsers), borers, and below-ground herbivores. Most of these pests are native, naturally occurring in areas where poplars are being grown. Species in the Salicaceae family are susceptible to attack from many

native riparian insects. In eastern Oregon, these pests include a clearwing moth (Parathrene robiniae, Sessidae), carpenterworm moth (Prionoxystus robiniae, Cossidae), cottonwood leaf beetle (Chrysomela scripta, Chrysomelidae), and poplar-and-willow borer (Cryptorhynchus lapathi, Curculionidae). Often the desired end product determines how these pests are managed within a plantation. Timber production values clean, intact wood needed to obtain a higher grad product, stains due to insect attack on pulpwood require added bleaching, whereas biomass production emphasizes quick growth and rapid bioaccumulation. Biomass operations focus on quick rotations (2-4 years), effectively managing pests, like carpenterworm, that can cause extensive damage in older stands. Biomass stands, especially coppiced fields, will have a greater number of smaller stems and young tender leaves than timber or pulp stands. This growth form provides challenges to the producers due to several pests that prefer young leaves and small stems. Although control measures utilized in timber and pulp stands can be used in these biomass systems, these techniques may need to be modified to provide adequate management of common pests across all systems. Solutions to pest outbreaks will ultimately be rooted in stock selection, irrigation and chemigation system, site preparation, and defining an economic threshold for each pest and production goal.

Biography

R. Andrew Rodstrom is the Crop Protection and Certification Manager for GreenWood Resources, Inc. His research has focused on understanding the terrestrial arthropod communities in hybrid poplar stands, pest monitoring and distribution, and developing novel pest management techniques in hybrid poplar agroecosystems. Andrew's work with Washington State University has focused on identifying emerging pests on GreenWood's Boardman Tree Farm and further developing an integrated pest management plan for poplar plantations. Current work concentrates on protecting unrooted cuttings from defoliators in biomass plantations and monitoring the effects of pesticide applications on natural enemies. Andrew is an active member of the Ecological Society of America, Entomological Society of America and has published abstracts from their annual meetings. He also presented his work at the International Poplar Symposium V in Orvieto, Italy in 2010. He has won several awards for his paper presentations at the Entomological Society of America Annual Meetings.

Philippe Savoie[1], François-Simon Robert[2], Pierre Luc Hébert[2]

1Agriculture and Agri-Food Canada, 2Université Laval

Harvesting, storing and processing woody crop plantations with a biobaler

The biobaler was used to harvest short-rotation woody crops in the form of round bales (1.22 m wide x 1.22 m diameter). Field data were collected in 2009 and 2010 in willow and poplar plantations in Canada (546 bales monitored). Bale mass averaged 427 kg wet matter (WM) and harvest rate averaged 35 bales/h or 7.69 t dry matter (DM)/h. The overall average moisture content (MC) was 48.6%. Harvested yield ranged from 9.68 to 31.84 t DM/ha (average 19.41 t DM/ha). The average harvest costs were estimated at $22.84/t DM, ranging from $18.01/t DM at high capacity (45 bales/h) to $31.51/t DM at low capacity (25 bales/h). Non recovered DM (chips on ground, uncut stems) ranged from 10 to 20%. A total of 132 bales was stored for up to 12 months to assess natural drying and DM loss. Bales dried to less than 15% MC when placed on individual pallets during summer. Bales placed in a pile dried down to only 35% MC on the periphery and 40% MC within the stack. DM loss averaged 1% per month for bales that dried well (stored individually outside) but was more than 2%/mo when bales remained humid (inside a cold shelter or within a stack). Grinding bales into a coarse mulch required about 1 L of fuel/bale and could be done a rate of 1 to 2 bales/min. The biobaler is versatile because it can also remove natural stands of invasive woody crops up to 75 mm in diameter.

Biography

Dr. Philippe Savoie is a Research Scientist at Agriculture and Agri-Food Canada since 1982 in the area of forage and biomass engineering. He obtained his academic degrees at McGill (B. Sc. Agr. Eng.), Laval (M. Sc.) and Michigan State (Ph.D). He has developed various prototypes to improve the field drying of forages (U.S. Patent 6,055,799), artificial drying of hay and biomass bales (U.S. Patent 6,988,325) and the biobaler for woody crops (U.S. Patent 7,743,595). The latter technology has been commercialized by the Anderson Group since 2009. Recently, his research group has been working on harvest, storage, handling and utilization (combustion for heating) of agricultural and woody crop biomass.

Shawn Dayson Shifflett, Dennis Hazel, Elizabeth Guthrie Nichols

North Carolina State University

Species Trials of Short Rotation Woody Crops on a Wastewater Application Fields in North Carolina, USA

The woody biomass industry in North Carolina is rapidly developing, and there is substantial interest to evaluate woody biomass potential from forest and managed lands in N.C. Municipal wastewater treatment plants are one example of managed lands available for woody biomass production. Currently, there are 86 municipal systems in N.C. accounting for 8,750 acres of wastewater application fields. This project will compare survival and biomass potential of native and non-native tree species at two municipal wastewater treatment systems in Gibson and Jacksonville, North Carolina, USA. Nutrient concentrations in

groundwater and soil were monitored concurrent with woody biomass production. The Gibson WWTP is 6.9 acre facility that currently irrigates sycamore trees and services about 600 citizens. Jacksonville is a much larger municipality that irrigates about 4,942 hectares of primarily loblolly pine forest. Trial studies were started at both sites in 2012 with preliminary trial study initiated at Gibson, NC in 2011. At both sites, a randomized block design was used to evaluate the performance of 6 hybrid poplar clones on wastewater- irrigated land. Early summer drought conditions in 2011 resulted in high mortality for most hybrid poplar species at the Gibson site. Surviving trees did grow well with the onset of rain. Total biomass productivity ranged from 3.7 to 21.8 dm3 for surviving hybrid poplar clones. The site was replanted in 2012 as part of a larger study with ArborGen. 2012 survival and growth will be discussed at both sites.

Biography

Shawn Dayson Shifflett is a second year masters student of the Forestry and Environmental Resources Department at North Carolina State University. In the Spring of 2013, he will begin his PhD in the same department.

Lynn Wright[1], David Ostlie[2]

1WrightLink Consulting, 2Energy Performance Systems

Hybrid Poplar Production Using Energy Performance Systems Injection Tree Planter

Improving the efficiency of planting, tending and harvesting farm-grown trees was the goal of a project initiated by Energy Performance Systems (EPS) in fall 2005. The overreaching technical issue identified by EPS was that new equipment and systems needed to be developed to facilitate the production of high quality hybrid poplar biomass fuels in a sustainable manner at less than the cost of coal. Achievement of this goal required solving several technical challenges. The first challenge addressed by the project was to design and build a high-speed planting machine capable of establishing tree cuttings in untilled cropland with very accurate spacing. Associated challenges included finding good farmland that was not tiled, high-yield clonal material, and good quality cuttings. Also challenging was the process of identifying and applying best herbicides and other management practices for site preparation and weed control. Planting was done with the newly built EPS Injection Machine Planter in early June of 2007 on cropland formerly planted to corn or soybeans. Experienced hand planting crews also planted hybrid poplar at the same location with the same planting stock. The technique of “injecting” cuttings into the ground at high speed was proven to be successful, accurate, and non-damaging on both tilled and untilled cropland as long as the cuttings were > 3/8 inch diameter. Survival and growth results were similar for the machine and hand-planted sections of the field. Growth variation across the field was attributed to biological factors such as variation in soil characteristics, cutting quality, weather conditions, and grass competition. The desired machine planting speeds were demonstrated to be possible, but not achieved consistently due to materials failure. Field trial experience led to a re-design of the injector spring.

Biography

Lynn Wright is an Adjunct Faculty member of the Biosystems Engineering and Soil Science Department at the University of Tennessee, and sole proprietor of WrightLink Consulting. Previous work included nearly 30 years at Oak Ridge National Laboratory where she managed Woody Crops research for the U.S. Department of Energy’s Biomass Program. She served as a U.S. representative to several International Energy Agency Bioenergy task groups between 1987 and 2003. Lynn is lead or co-author on more than 85 articles on the topic of bioenergy feedstocks, both woody and herbaceous, has contributed to a Biomass Energy Data Book available online, and maintains the website for the SRWCOWG (www.woodycrops.org). Current work includes supporting Energy Performance Systems in testing new equipment for hybrid poplar production in Minnesota and working with Oak Ridge National Laboratory staff to produce publications. The latest overview paper is: Wright LL, Eaton LM, Perlack RD and Stokes BJ (2012) Woody Biomass. In Sayigh A, (ed.) Comprehensive Renewable Energy, Vol 5, pp. 263-291. Oxford:Elsevier.

Ronald S. Zalesny Jr.[1], Edmund O. Bauer[1], Bruce A. Birr[1], John Brissette[2], Steve Colombo[3], Robert E. Froese[4], Les Groom[5], Richard B. Hall[6], William L. Headlee[6], Thomas M. Isenhart[6], Pengxin Lu[3], Bill Parker[3], Jesse A. Randall[6], Ngaire Roubal[3], Christopher W. Swanston[7], Adam H. Wiese[1], JunYong Zhu[8]

1U.S. Forest Service, Northern Research Station, Rhinelander, WI, 2U.S. Forest Service, Northern Research Station, Durham, NH, 3Ontario Ministry of Natural Resources, 4Michigan Technological University, 5U.S. Forest Service, Southern Research Station, 6Iowa State University, 7U.S. Forest Service, Northern Research Station, Houghton, MI, 8U.S. Forest Service, Forest Products Laboratory, Madison, WI

Assessing the environmental sustainability of plantation Populus and Pinus in North America

Woody production systems and conversion technologies are needed to maintain healthy forests and ecosystems, create high-paying manufacturing jobs, and meet local/regional energy demands. Certain Populus species and genotypes are dedicated

energy crops that can be strategically placed in the landscape to conserve soil and water, recycle nutrients, and sequester carbon (C). However, key environmental and economic uncertainties preclude broad-scale production of biofuels, bioenergy, and bioproducts from their wood. Therefore, considering the entire energy supply chain, we are evaluating the fate of C in soils and woody biomass, soil greenhouse gas emissions, and conversion efficiency barriers associated with purpose-grown Populus throughout the north-central United States. In the current presentation, we will report results of C storage in aboveground biomass of four ten-year-old and eleven twenty-year-old Populus plantations belonging to regional testing networks throughout the region. Initial results indicate that C comprises 45 to 48% of the Populus wood, with broad variability among genotypes and among positions along the bole. In addition, we are assessing the impacts of varying climatic conditions on growth, productivity, and wood properties of white pine (Pinus strobus L.) established in the early 1960's in a unique range-wide network of provenance trials throughout the eastern United States and Canada. Our overarching objective is to identify provenances with enhanced adaptation to climate change pressures and C sequestration potential. In the current presentation, we will report initial results from dendrochronological analyses assessing changes in radial growth relative to varying climatic conditions, as well as changes in wood density over time. Lastly, we will integrate results from both genera to assess the environmental sustainability of both systems, especially as they relate to the provision of ecosystem services.

Ronald S. Zalesny Jr.[1], David R. Coyle[2]
1US Forest Service, Northern Research Station, 2University of Georgia

Short Rotation Populus: A Biography and Database of North American Literature, 1989 – 2011

Poplars (Populus spp.) and their hybrids have a rich history of being studied and utilized for multiple societal benefits. Modern society uses poplars in a plethora of applications, such as structural lumber, building materials, biofuels and bioenergy, and as phytoremediative agents on polluted sites. There have been three comprehensive poplar Biographies dating back to 1854 and the most recent contained literature published through 1988. Given that the number of forestry/bioenergy related journals has increased dramatically (along with subsequent publications), and there have been profound advances in science (particularly in the areas of genetics and molecular biology) within the last two decades, we developed a Biography (i.e., the General Technical Report included in conference materials) and an associated online database (www.poplardatabase.com). In addition to compiling the information into one location, our objectives were to encourage publication in peer-reviewed journals and to enhance collaborations with partners outside the poplar community. Four primary constraints were considered when including literature. The papers (1) had to be peer-reviewed, (2) they had to contain information about poplars, cottonwoods, aspens, and their hybrids grown as short rotation woody crops (3) in North America, and (4) be pertinent to at least one topic area (listed as the keywords below). The current database contains 864 unique studies that are cross-listed among up to three topic areas, resulting in 1,395 total entries. Our presentation will include a history of project development, details about the Biography/database content, and a tour of the website.

J.G. Isebrands[1], J. Richardson[2], R.S. Zalesny[3]
1Environmental Forestry Consultants LLC, 2Poplar Council of Canada, 3US Forest Service, Northern Research Station

A new poplar and willow publication for a global audience

In 1980 the Food and Agriculture Organization (FAO) of the United Nations published a comprehensive volume on poplars and willows. That book is now out-of-date and out of print. As a project of the International Poplar Commission (IPC), a new book entitled 'Poplars and Willows: Trees for society and the environment' is being produced. This is a co-publication of FAO, of which IPC is a part, and CAB International, a UK-based scientific book publisher specializing in agricultural and environmental topics. The book, presently in press and expected to appear early in 2013, has more than 500 pages and is illustrated in full colour. The 13 chapters of the book, prepared by nearly 70 contributing authors from 15 countries worldwide, cover all aspects of poplar and willow taxonomy, ecosystems, physiology, genetics and breeding, operational production, environmental applications, abiotic stresses, diseases, insect pests, products and utilization, markets and trends, as well as their importance for rural livelihoods and sustainable development. An outstanding feature of the book is its nearly 2500 references. It also includes an up-to-date taxonomic treatment of the Salicaceae. Looking to the future, the book is offered in the belief that poplars and willows, as trees for society and the environment, can help us meet future environmental challenges sustainably and on a sound scientific base.

Notes

Woodycrops.org