

## OVERVIEW OF THE DEPARTMENT

This report highlights accomplishments in learning, discovery, and engagement in the Department of Forest Resources and Environmental Conservation (FREC) during 2011. The department continues to be one of the leading programs of its type and is poised to achieve even higher levels of excellence in the future. Following are selected departmental achievements during 2011:

- FREC undergraduate enrollment grew from 165 in Fall Semester 2010 to 191 in Fall Semester 2011—an increase of 16%.
- We are actively working with several other units on campus to launch a new undergraduate degree, Water: Resource, Policy, and Management. In addition we are in the process of developing a new undergraduate major, Environmental Informatics. When these programs are approved, we anticipate that our undergraduate enrollment will increase even more.
- In the past year our research funding increased by 45% as a result of some large new research projects, including:
  - a Faculty Early Career Development Program grant from the National Science Foundation to study how tree populations adapt at the genomic scale as a result of climate change (Jason Holliday)
  - a Coordinated Agricultural Grant from the USDA National Institute of Food and Agriculture to study the effects of climate change on southern pine forests (Thomas Fox, Harold Burkhart, Randolph Wynne, John Seiler, Jason Holliday, Valerie Thomas, Brian Strahm)
  - two USDA National Needs Fellowship projects (Harold Burkhart, Carolyn Copenheaver, Stephen Prisley, Phil Radtke, Valerie Thomas, Randolph Wynne, Chad Bolding, Jay Sullivan)
  - a grant funded by Virginia Tech's Institute for Critical Technology and Applied Science to conduct research on integrating vegetation performance into complex engineered environments in urban watersheds (Susan Day).
- FREC celebrated the United Nations International Year of Forests 2011 on October 13. Over 250 students, staff, faculty, and members of the public participated in an event at Squires Student Center, which included a panel discussion on *Local Forests in a Global Context*, a poster session, and a presentation of the movie *Green Fire: Aldo Leopold and a Land Ethic for Our Time*, with an introduction by Dr. Stan Temple, Senior Fellow at the Aldo Leopold Foundation.

There were several personnel changes during 2011. Dr. Richard Oderwald retired as Professor of Forest Biometrics and Associate Dean of Academic Programs. Dr. Michael Sorice and Dr. Frank Merry were hired as Assistant Professor of Natural Resource Recreation and Human Dimensions and Research Associate Professor, respectively. A number of special research faculty also joined the department during 2011: Dr. Lecong Zhou, Senior Research Associate; Dr. Raj Shrestha, Research Scientist; Dr. Charles Sabatia and Dr. Christopher Kiser, Postdoctoral Associates; Ms. Xiaoyan Sheng, Mr. Andrew Laviner, and Ms. Colleen Carlson, Research Associates; and Mr. John Kidd, Project Associate.

The department's educational programs continue to thrive. There were 602 undergraduates in the College of Natural Resources and Environment in Fall Semester 2011; of these, 191 students—or approximately 32%—were in options associated with the Department of Forest Resources and Environmental Conservation. There were 78 graduate students (39 Ph.D. and 39 master's) in our department Fall Semester 2011. We continue to have more qualified applicants to our graduate program every year than we have faculty, funds, and space to accommodate.

Employment opportunities remain favorable for our graduates. Surveys taken each fall of individuals who graduated during the preceding academic year have consistently shown that the majority of our graduates are employed in professional positions or enrolled in graduate programs. In total, graduate students in the Department of Forest Resources and Environmental Conservation and undergraduates in FREC majors completed requirements for 9 doctoral degrees, 9 master's degrees, and 38 bachelor's degrees during calendar year 2011.

We deeply appreciate the solid support received from students, faculty, and administrators at Virginia Tech, as well as our alumni, friends, and clientele groups throughout the forestry community, and we look forward to the challenges and opportunities ahead.

## NEW FACES IN FREC



**Dr. Michael Sorice** joined the Department of Forest Resources and Environmental Conservation in August, 2011, as an Assistant Professor of Natural Resource Recreation and Human Dimensions.

Dr. Sorice's research program focuses on individual and group behavior as it relates to environmental stewardship, with an emphasis on enhancing ecosystem services. His current work focuses on best management practices and the role of incentive programs in enhancing their adoption.

Dr. Sorice received his B.A. in Zoology from Miami University, an M.S. in Recreation, Park and Tourism Sciences at Texas A&M University, and his Ph.D. in Wildlife and Fisheries Sciences from Texas A&M University. Prior to joining the faculty at Virginia Tech, he served as a postdoctoral research associate in the Department of Ecosystem Science & Management at Texas A&M University.

**Dr. Frank Merry** joined the department in September, 2011, as a Research Associate Professor working with Professor Gregory Amacher on a grant from the Gordon and Betty Moore Foundation to establish a sustainable forest business model in Amazonia. Dr. Merry is a well-known researcher in the area of international forest policy and forest economics. He has worked in several regions of the world and has focused on broad problem areas, including smallholder farmer and forest user behavior, as well as forest policy design and instruments aimed at slowing forest and natural resource degradation and exploitation.

Dr. Merry received a B.S. in Food and Resource Economics from the University of Florida, an M.S. in Agricultural and Applied Economics from Virginia Tech, and a Ph.D. in Forest Resources and Conservation from the University of Florida.



**Dr. Lecong Zhou** joined the department in April, 2011, as a Senior Research Associate specializing in poplar genomics. His interests are related to genomics and bioinformatics of plant biotic and abiotic stresses. Dr. Zhou's current work is focused on integrating whole-genome association mapping and landscape genomics to understand climate adaption in *Populus*. Dr. Zhou received his Ph.D. in plant pathology from China Agricultural University.

**Dr. Raj Shrestha** joined the department in May, 2011, as a Research Scientist. His interests include greenhouse gas emissions, carbon sequestration, integrated plant nutrient management, soil fertility, non-point source pollution, and soil quality. His current research is focused on greenhouse gas fluxes and ammonia volatility following nitrogen fertilization in managed forests of the southeastern and northwestern United States. Dr. Shrestha received his Ph.D. in soil science from the University of the Phillipines.



## NEW FACES IN FREC



**Dr. Charles Sabatia** joined the department in May, 2011, as a Postdoctoral Associate after earning his Ph.D. at Virginia Tech under the direction of Harold Burkhart. Dr. Sabatia's current focus is on modeling the growth and yield of genetically enhanced and clonal stands of loblolly pine.

**Dr. Christopher Kiser** joined the department in September, 2011, as a Postdoctoral Associate. He completed his Ph.D. at Virginia Tech, working with Tom Fox on forest soils and plantation silviculture. Dr. Kiser will concentrate on a Virginia Tech/USDA Forest Service cooperative project investigating the sustainability of harvesting Appalachian hardwood forests for biomass energy.



**Xiaoyan Sheng** joined FREC in January, 2011, as a Research Associate supporting the functional genomics and biotechnology lab. She has master's degrees from Hunan Agricultural University and the University of Saskatchewan.

**Andrew Laviner** joined the department in May, 2011, as a Research Associate working with Thomas Fox. He will focus on loblolly pine plantation response to induced drought with and without supplemental nutrition. Mr. Laviner received his M.S. in forestry from North Carolina State University.



## NEW FACES IN FREC



**Colleen Carlson** was a Research Associate in FREC from 2005 to 2009. After spending two years with the Forest Research Institute of New Zealand, she rejoined the department in July, 2011, to work with the Forest Productivity Cooperative as a database manager and data analyst. Ms. Carlson has a Master of Science from the University of the Witwatersrand, South Africa.

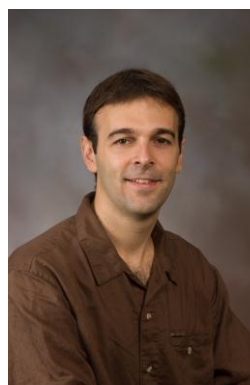
**John Kidd** joined the department in August, 2011, as a Project Associate. He is the Coordinator for the PINEMAP Intern Program. Mr. Kidd received an M.S. in forest resources from the University of Arkansas at Monticello and an M.Ed. in secondary biology education from Auburn University.



## PROMOTIONS & RETIREMENTS



Associate Professor **Amy Brunner** was granted tenure on July 1, 2011. Dr. Brunner's research focuses on molecular genomics of tree development, and she is currently working on identifying poplar regulatory genes that act as major genetic control points for tree growth, development, and responses to the environment and demonstrating how this information can be used to produce trees with modified qualities important to carbon sequestration.



**Marc Stern** was promoted to Associate Professor and granted tenure on July 1, 2011. Dr. Stern conducts research in the area of human dimensions of natural resource policy and management. He teaches undergraduate courses in environmental interpretation and environmental education service learning and a graduate class in social science research methods.



**Eric Wiseman** was promoted to Associate Professor and granted tenure on July 1, 2011. Dr. Wiseman has research interests in the areas of tree physiological responses to arboricultural treatments, urban forest ecophysiology, and urban forest inventory and assessment. He teaches an arboriculture field skills course, an urban forestry and arboriculture course, and senior- and graduate-level urban forest management and policy courses.



**Richard Oderwald**, Professor of Forest Biometrics and Associate Dean of Academic Programs, retired in December, 2010. A member of the Virginia Tech community since 1975, Dr. Oderwald made significant contributions to the understanding of forest biometrics through his work in forest inventory and sampling. He taught a wide variety of undergraduate and graduate courses ranging across the forestry and natural resources curricula, placing strong emphasis on standards and student learning. Dr. Oderwald has been conferred the title of Professor Emeritus by the Virginia Tech Board of Visitors.

## PERSONNEL

TENURE-TRACK FACULTY	POSITION	TERMINAL DEGREE	SPECIAL INTERESTS
<b>Alavalapati, Janaki R. R.</b>	Professor and Department Head	Ph.D., University of Alberta	Exploring market solutions for natural resources, energy, and environmental problems and issues at local, regional, and international levels
<b>Amacher, Gregory S.</b>	Julian N. Cheatham Professor of Forestry	Ph.D., University of Michigan	Natural resource and environmental economics; public economics and policy design; econometrics; international forest development
<b>Aust, W. Michael</b>	Professor	Ph.D., North Carolina State University	Impacts of forestry operations on soil and hydrology; ecology and management of forested wetlands and riparian areas; development and implementation of forestry best management practices
<b>Bolding, M. Chad</b>	Assistant Professor	Ph.D., Oregon State University	Forest operations; harvesting; wood supply chain efficiency; biomass utilization
<b>Brunner, Amy M.</b>	Associate Professor	Ph.D., Oregon State University	Genomics of tree development, ecophysiology, and adaptation; molecular genetics of tree maturation, flowering, and crown architecture; epigenetic mechanisms and small RNAs in trees; long-distance signaling in trees; tree biotechnology
<b>Burkhart, Harold E.</b>	University Distinguished Professor	Ph.D., University of Georgia	Development of growth and yield prediction techniques; application of statistical methods to forest measurement problems
<b>Copenheaver, Carolyn A.</b>	Associate Professor	Ph.D., Pennsylvania State University	Dendrochronology; land-use history; vegetation distribution; stand dynamics
<b>Day, Susan D.</b> (Joint appointment with Department of Horticulture)	Assistant Professor	Ph.D., Virginia Tech	Urban forestry, including urban runoff mitigation, urban soils (rehabilitation and modeling effects on urban forest canopy), construction damage, buried root systems, urban rhizosphere
<b>Fox, Thomas R.</b>	Professor	Ph.D., University of Florida	Forest fertilization and tree nutrition; forest soils; silviculture of southern pine plantations and Appalachian hardwoods; silvicultural practices to restore productivity and health of forest ecosystems; sustainability of managed forests
<b>Holliday, Jason A.</b>	Assistant Professor	Ph.D., University of British Columbia	Understanding the genetic basis for complex adaptive traits in widely distributed tree species, as well as molecular studies of abiotic stress and conservation genetics.
<b>Hull, R. Bruce</b>	Professor	Ph.D., Virginia Tech	Public ecology and sustainability; human dimensions of natural resource management; negotiation of acceptable environmental quality; forest fragmentation and urbanization; recreation
<b>McGee, John A.</b>	Associate Professor and Geospatial Extension Specialist	Ph.D., University of Massachusetts-Amherst	Natural resource management; geospatial applications; technology transfer
<b>Munsell, John F.</b>	Assistant Professor and Forest Management Extension Specialist	Ph.D., SUNY College of Environmental Science and Forestry	Forest management extension; private forest stewardship; collaborative conservation; integrated natural resources problem solving
<b>Prisley, Stephen P.</b>	Associate Professor	Ph.D., Virginia Tech	Quantitative and spatial analysis of natural resources for management planning, including spatial harvest scheduling, inventory projection, and forest carbon modeling
<b>Radtke, Philip J.</b>	Associate Professor	Ph.D., University of Minnesota	Assessment and modeling of forest resources; evaluating models used in forestry and ecology; acquisition, management, and analysis of data



<b>Schoenholtz, Stephen H.</b>	Professor and Director of the Virginia Water Resources Research Center	Ph.D., Virginia Tech	Forest management impacts on water and soil quality; restoration of degraded ecosystems; ecology and management of forested wetlands and riparian zones; biogeochemistry; criteria and indicators of sustainable forest management
<b>Seiler, John R.</b>	Alumni Distinguished Professor	Ph.D., Virginia Tech	Forest tree physiology; physiological applications in silviculture; multimedia, computer innovations for teaching forestry
<b>Sorice, Michael G.</b>	Assistant Professor	Ph.D., Texas A&M University	Natural resource recreation; human dimensions of natural resource management; conservation on private lands; research methods
<b>Stern, Marc J.</b>	Associate Professor	Ph.D., Yale University	Human dimensions of natural resource policy and management; environmental communications; protected areas management; international conservation; natural resource management effectiveness; attitudes vs. actions; public responses to natural resource management; evaluation of environmental education and other outreach programs; research methods
<b>Strahm, Brian D.</b>	Assistant Professor	Ph.D., University of Washington	Understanding relationships between soil properties and processes in order to better predict how external forces (e.g., forest management, land use, or global change) affect soil/ecosystem function (e.g., carbon sequestration, forest productivity)
<b>Sullivan, Jay</b>	Professor	Ph.D., University of California, Berkeley	Forest resource economics and management; regional economics; forest landowner behavior and incentives
<b>Thomas, Valerie A.</b>	Assistant Professor	Ph.D., Queen's University	Remote sensing of forest canopy structure and function using lidar and hyperspectral technology; integration of these data with micrometeorological measurements to model canopy-scale photosynthesis; evaluation of the impact of local heterogeneity on estimates of carbon exchange
<b>Wiseman, P. Eric</b>	Associate Professor	Ph.D., Clemson University	Landscape tree establishment and maintenance; tree physiological responses to arboricultural treatments; urban soils; urban forest ecophysiology
<b>Wynne, Randolph H.</b>	Professor	Ph.D., University of Wisconsin-Madison	Application of remote sensing to forestry, natural resource management, environmental monitoring, carbon management, ecosystem services, and earth systems modeling
<b>Zedaker, Shepard M.</b>	Professor	Ph.D., Oregon State University	Regeneration silviculture; chemical silviculture; vegetation management; quantitative ecology and stand dynamics

RESEARCH PROFESSORS	POSITION	TERMINAL DEGREE	SPECIAL INTERESTS
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<b>Marion, Jeffrey L.</b>	Adjunct Faculty*	Ph.D., University of Minnesota	Recreation resources management; recreation ecology; park and wilderness management; ecotourism management  *Unit Leader/Scientist, Cooperative Park Studies Unit, USGS Patuxent Wildlife Research Center
<b>McGuire, Kevin J.</b>	Research Assistant Professor	Ph.D., Oregon State University	Watershed, hillslope, and forest hydrology; runoff generation processes; tracer and isotope applications in hydrology; land use and climate change effects on watershed processes and water quality; forest watershed management; interactions between hydrology and biogeochemistry
<b>Merry, Frank D.</b>	Research Associate Professor	Ph.D., University of Florida	International forest policy and economics

RESEARCH FACULTY	POSITION	TERMINAL DEGREE	SPECIAL INTERESTS
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<b>Amateis, Ralph L.</b>	Senior Research Associate	M.S., University of Florida	Statistical techniques applied to forestry problems; growth and yield modeling
<b>Blinn, Christine E.</b>	Research Scientist	Ph.D., Virginia Tech	Remote sensing; geographic information systems; statistical applications for natural resource inventory and management



<b>Carlson, Colleen A.</b>	Research Associate	M.Sc., University of Witwatersrand	Manipulation and optimization of growth and timber quality in plantation systems, with emphasis on nutritional influences
<b>Kiser, L. Christopher</b>	Postdoctoral Associate	Ph.D., Virginia Tech	Forest management effects on nutrient cycling and soil biological, chemical, and physical properties; biogeochemistry; pedogenesis; plantation and natural forests; forest biomass bioenergy
<b>Laviner, M. Andrew</b>	Research Associate	M.S., North Carolina State University	Resource management in plantation forestry; silviculture, ecophysiology, and forest management
<b>Peer, Kyle R.</b>	Research Associate and Superintendent, Reynolds Homestead Forest Resources Research Center	M.S., University of Maine, Orono	Vegetative propagation; clonal forestry; nursery and greenhouse production; tree breeding
<b>Sabatia, Charles O.</b>	Postdoctoral Associate	Ph.D., Virginia Tech	Modeling forest growth and yield under varying silviculture; stand genotypic composition and climate
<b>Sheng, Xiaoyan</b>	Research Associate	M.S., University of Saskatchewan	Functional genomics in forestry; biotechnology and molecular breeding of biomass forest trees
<b>Shrestha, Raj K.</b>	Research Scientist	Ph.D., University of the Philippines	Greenhouse gas fluxes and ammonia volatility following nitrogen fertilization in managed forests of the southeastern and northwestern United States
<b>Zhou, Lecong</b>	Senior Research Associate	Ph.D., China Agricultural University	Genomics and bioinformatics of plant biotic and abiotic stresses

<b>EXTENSION ASSOCIATES</b>	<b>POSITION</b>	<b>TERMINAL DEGREE</b>	<b>SPECIAL INTERESTS</b>
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<b>Barrett, Scott M.</b>	Coordinator, Virginia SHARP Logger Program	M.S., Virginia Tech	Logger training and education
<b>Brinckman, Matthew D.</b>	Extension Associate	M.S., Virginia Tech	Forest management survey research
<b>Gagnon, Jennifer L.</b>	Coordinator, Virginia Forest Landowner Education Program	M.S., University of Florida	Landowner education; shortleaf and longleaf pine silviculture; uneven-aged management
<b>Kidd, John B.</b>	Coordinator, PINEMAP Intern Program	M.S., University of Arkansas; M.Ed., Auburn University	Education and extension for secondary students and the general public
<b>Prysbj, Michelle D.</b>	Coordinator, Virginia Master Naturalist Program	M.S., University of Minnesota	Citizen science; long-term ecological monitoring; monarch butterfly ecology; science education

<b>ADJUNCT FACULTY</b>			
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<b>Busby, Gwenlyn M.</b>	Research Associate	School of Engineering and Applied Science, University of Virginia, Charlottesville, VA	
<b>Eisenbies, Mark H.</b>	Research Hydrologist	USDA Forest Service, Southern Research Station, Mississippi State University, Mississippi State, MS	
<b>Horcher, Andy T.</b>	Natural Resource Operations Manager	USDA Forest Service, Savannah River Site, Aiken, SC	
<b>Lakel, William A.</b>	Water Quality Program Supervisor	Virginia Department of Forestry, Charlottesville, VA	
<b>Lawson, Steven R.</b>	Senior Project Consultant	Resource Systems Group, Inc., White River Junction, VT	

<b>Mei, Chuansheng</b>	Scientist II	Institute for Advanced Learning and Research, Danville, VA
<b>Mortimer, Michael J.</b>	Director, Natural Resources Programs	Virginia Tech, National Capitol Region, Falls Church, VA
<b>Schilling, Erik B.</b>	Senior Research Scientist	National Council for Air and Stream Improvement, Inc., Newberry, FL
<b>Sucre, Eric B.</b>	Sustainability Scientist	Weyerhaeuser NR Company, Vanceboro, NC

#### EMERITUS FACULTY

Robert E. Adams	John F. Hosner	Richard G. Oderwald
Gregory N. Brown	J. Michael Kelly	Marion R. Reynolds, Jr.
Gregory J. Buhyoff	Jeffrey L. Kirwan	Joseph W. Roggenbuck
James A. Burger	W. David Klemperer	Robert M. Shaffer
Otis F. Hall	William A. McElfresh	David Wm. Smith
Harry L. Haney, Jr.	Robert L. McElwee	Harold W. Wisdom

#### TECHNICAL STAFF

Deborah H. Bird  
Samuel A. Frye  
David O. Mitchem  
John A. Peterson  
E. Talcott Roberts, Jr.  
B. Clay Sawyers

#### OFFICE SUPPORT STAFF

Tiffany N. Brown  
Kathryn C. Hollandsworth  
Stacey A. Kuhar  
Tracey S. Sherman  
Suzanne C. Snow

#### 2011-12 DEPARTMENTAL COMMITTEES

<b>Budget &amp; Planning:</b> A. Brunner (Chair) S. Day C. Gillin S. Prisley T. Sherman V. Thomas	<b>Facilities:</b> A. Brunner J. Peterson P. Radtke (Chair) J. Seiler B. Strahm	<b>Graduate Affairs:</b> C. Bolding C. Copenheaver (Chair) B. Morris S. Schoenholtz R. Wynne	<b>Promotion &amp; Tenure:</b> G. Amacher (Chair) M. Aust C. Copenheaver T. Fox B. Hull S. Prisley R. Wynne	<b>Undergraduate Affairs:</b> M. Aust M. Stern (Chair) J. Sullivan E. Wiseman S. Zedaker
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#### 2012 FREC ADVISORY BOARD

Michael Cerchiaro, Forest Investment Associates, Atlanta, GA  
Brad Fuller, Huber Engineered Woods LLC, Crystal Hill, VA  
Daniel Henry, Roanoke Parks and Recreation, Roanoke, VA  
Franklin Jackson, Virginia State University, Petersburg, VA  
Ronald Jenkins, Virginia Department of Forestry, Charlottesville, VA  
Alan Jones, Bartlett Tree Experts, Charlottesville, VA  
Brent Keefer (Chair), Hancock Timber Resource Group, Charlotte, NC  
Brian Keilling, Dabney S. Lancaster Community College, Clifton Forge, VA  
Ollie Kitchen, MeadWestvaco, Covington, VA  
James Kuykendall, Glatfelter Pulp Wood Company, Spotsylvania, VA  
Greg Meade, The Nature Conservancy, Abingdon, VA  
Ed Milhous (Chair-Elect), TreesPlease, Haymarket, VA  
Ken Morgan, Morgan Lumber Company, Inc., Red Oak, VA  
Chuks Ogbonnaya, Mountain Empire Community College, Big Stone Gap, VA  
Danette Poole, Department of Conservation and Recreation, Richmond, VA  
Steven Resh, Allegany College of Maryland, Cumberland, MD  
Paul Revell, Virginia Department of Forestry, Charlottesville, VA  
Greg Scheerer, MeadWestvaco, Appomattox, VA  
Kevin Sigmon, Appalachian Power, Glade Spring, VA  
Marvin Tinsley, Amherst, VA (retired from Greif)  
Harrell Turner, CHT Forestry LLC, Branchville, VA  
Bud Watson, Virginia Forest Watch, Ashland, VA

#### Ex-Officio Members

- State Forester of Virginia, Virginia Department of Forestry:  
Carl Garrison
- Executive Vice President, Virginia Forestry Association:  
Paul Howe
- Supervisor, USDA Forest Service-George Washington & Jefferson National Forests:  
Position currently vacant
- Station Director, USDA Forest Service-Southern Research Station:  
Robert Doudrick

## SELECTED HONORS AND AWARDS

**JANAKI ALAVALAPATI** was named Senior Fellow in the Energy and Climate Partnership of the Americas Program of the Bureau of Western Hemisphere Affairs at the U.S. Department of State. As a Senior Fellow he will promote the Americas program, addressing issues such as clean energy, sustainable landscapes, and climate-change adaptations. Fellows also visit Western Hemisphere countries to share best practices and expertise in research and development with assistance from U.S. embassies.

**MIKE AUST** was the recipient of a CNRE Outstanding Faculty Award for 2010-11. The college curriculum clubs annually honor a faculty member from each department in recognition of dynamic teaching ability, excellent professional attitude to teaching, and outstanding student relationships.

**SCOTT BARRETT** received the Forest Resources Association Technical Writing Award-First Place, Appalachian Region, for *Using Online Training in a Logger Education Program*.

**JENNIFER GAGNON** was presented with the Appalachian Society of American Foresters (APSAF) Young Forester Leadership Award at the 90th Annual APSAF Winter Meeting. She was also co-recipient, along with Bill Worrell and Craig Kadervack, of the Black Diamond RC&D Council Forestry Program of the Year Award for the 34th Annual Fall Forestry & Wildlife Field Tour in Russell and Dickenson Counties.

**BRUCE HULL** was nominated as Engaged Scholar of the Month by the Office of Outreach and International Affairs for his efforts to develop conservation methods "that heal land fractured by urbanization and globalization."

**JOHN MCGEE** received the Outstanding Service Award, AmericaView Technical Committee, AmericaView, Inc.

**MICHELLE PRYSBY** received the Governor's Environmental Excellence Award-Gold Level for the Virginia Master Naturalist Program.

**MARC STERN** was named Scholar of the Institute for Parks at Clemson University.

FREC faculty members and their associates garnered top awards from the Association of Natural Resources Extension Professionals, a national organization that represents extension professionals in the disciplines of environmental education, fisheries, forestry, wood sciences, range, recreation, waste management, water, and wildlife.

**SCOTT BARRETT** won the Individual Program Leadership Gold Award for the Virginia SHARP Logger Program.

**JENNIFER GAGNON** received the Newsletter/Series of Articles Gold Award for her quarterly newsletter, the *Virginia Forest Landowner Update*.

**ADAM DOWNING** was part of a team recognized with the Video/DVD/CD Gold Award for a video titled *Four Minutes to a Better Back Yard*.

FREC faculty won six out of 20 Awards for Excellence from the Southern Regional Extension Forestry program, which assists natural resource educators and technology transfer specialists in 13 states to facilitate more efficient programming.

**SCOTT BARRETT** and **JENNIFER GAGNON**, along with James Parkhurst of the VT Department of Fish and Wildlife Conservation, received the Extension Publication Gold Award for *Guide to Threatened and Endangered Species on Private Lands in Virginia*.

**SCOTT BARRETT**, **CHAD BOLDING**, and **JOHN MUNSELL** won a Journal Publication Gold Award for *Virginia SHARP Logger Survey: Characteristics of Virginia's Logging Businesses*.

**JOHN MUNSELL** and **THOMAS FOX** won a Journal Publication Gold Award for *An Analysis of the Feasibility for Increasing Woody Biomass Production from Pine Plantations in the Southern United States*.

**MATTHEW BRINCKMAN** and **SCOTT BARRETT** were recognized with the Computer Software and/or Website Silver Award for *A Search Indeed: How to Conduct a Property Deed Search*.

**JENNIFER GAGNON** received the Extension Newsletter Silver Award for *Virginia Forest Landowner Update*.

The National/International Project Silver Award was awarded to **JOHN MUNSELL**, **CHAD BOLDING**, and John Ignosh (College of Agriculture and Life Sciences) for *Wood Bioenergy Assessments in Support of the Department of Energy's Federal Energy Management Program*.

## FREC GRADUATE RESEARCH SYMPOSIUM

The third annual FREC Graduate Research Symposium was held on March 30, 2011. Student participation was strong, with 5 Ph.D. oral presentations, 5 M.S. oral presentations, and 11 poster presentations. Many of the FREC faculty were involved as moderators and judges. The keynote speaker was Dr. Richard Hirsh, Professor of History of Technology and Science & Technology Studies at Virginia Tech.

### 2011 Symposium Winners



Joseph Conrad  
Ph.D. Oral Presentation



Charles Sabatia  
Ph.D. Oral Presentation



Adam Watson  
M.S. Oral Presentation



Nina Craig  
Poster Presentation

FREC is very grateful to the Symposium Committee members who invested so much time and effort to make the symposium a grand success:

Courtney Reijo (Chair)  
Patricia Brousseau  
Yujuan Chen  
Katie Hoover

Kevan Minick  
Beth Stein  
Katie Trozzo  
Amy Werner

The FREC Graduate Affairs Committee also provided valuable assistance and guidance.

## TEACHING

The College of Natural Resources and Environment (CNRE) is firmly committed to excellence in teaching. Our stated educational goals are: (1) to educate high-quality professionals who can function effectively in entry-level positions and assume positions of ever-increasing responsibility throughout their careers; (2) to provide graduate programs that combine (a) a high-quality faculty, (b) a student body selected from the best undergraduate degree recipients in this country and abroad, and (c) courses offering the most advanced knowledge in order to produce outstanding researchers, educators, and practitioners; (3) to provide students not enrolled in the college's majors with an understanding of renewable natural resources so they can assume leadership roles and foster a rational conservation ethic within the general public; (4) to effectively disseminate knowledge and to provide a new program of public service to the college's constituencies, which will enhance the benefits, goods, and services obtained from natural resources of the state and surrounding region.



Obviously, teaching is an extremely important part of the mission of the Department of Forest Resources and Environmental Conservation, and students—defined in the broadest sense—are a principal constituent. All members of the faculty participate in the teaching program, which includes formal undergraduate and graduate on-campus instruction and a variety of extension courses, including continuing education for professionals. Evaluations of these educational efforts continue to be outstanding. The overall evaluation for all formal courses taught by full-time FREC teaching faculty in Fall Semester 2011 was 5.4 out of a possible 6.0.

The Department of Forest Resources and Environmental Conservation now has three majors and eight options:

### FORESTRY MAJOR

Forest Resource Management Option  
Forest Operations and Business Option  
Urban Forestry Option

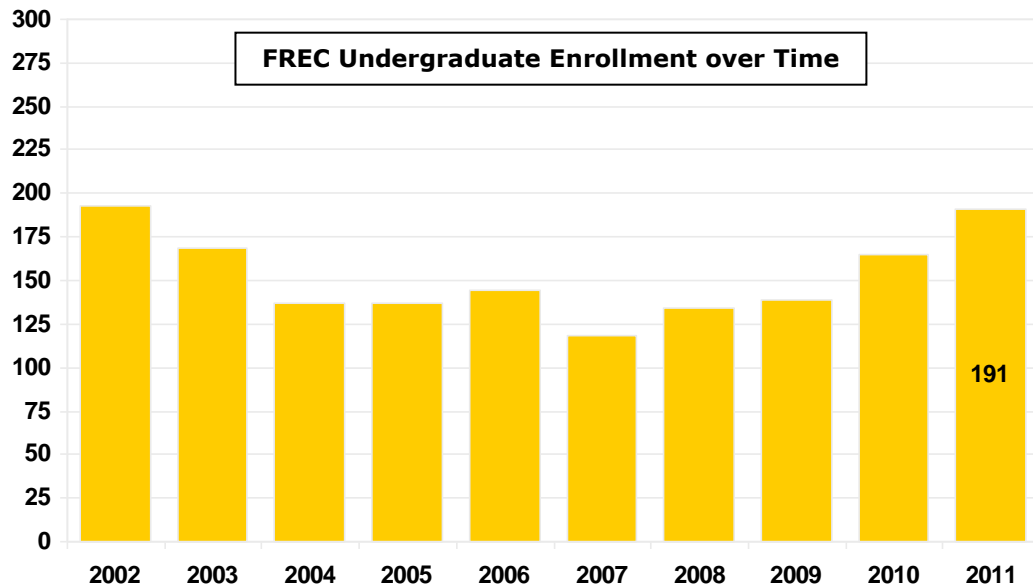
### NATURAL RESOURCES CONSERVATION MAJOR

Conservation and Recreation Management Option  
Environmental Education Option  
Natural Resources Science Education Option

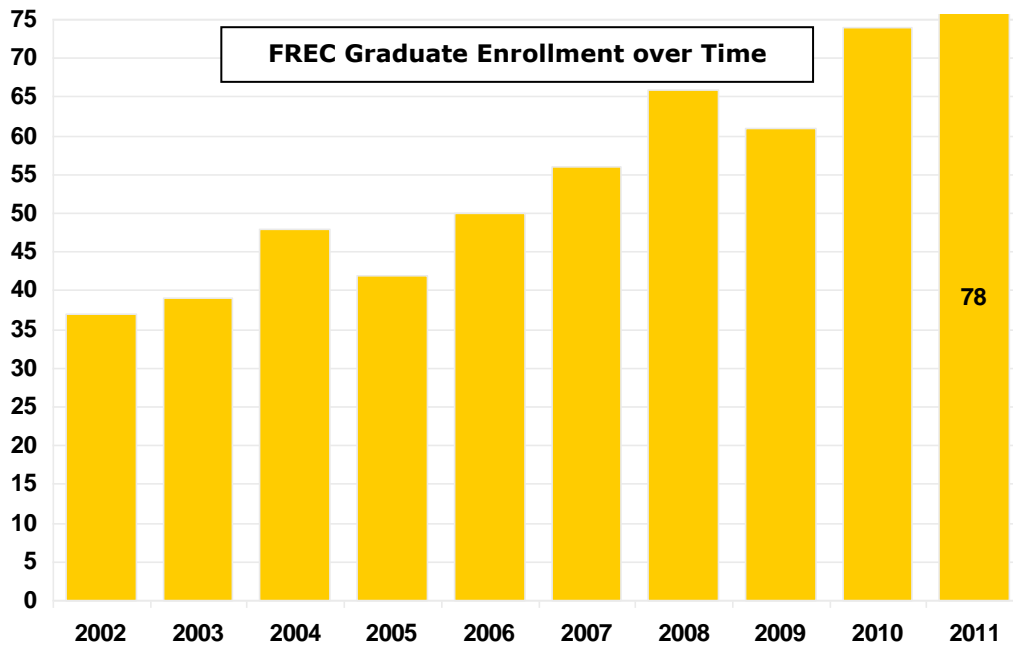
### ENVIRONMENTAL RESOURCES MANAGEMENT MAJOR

Environmental Resources Management Option  
Watershed Management Option





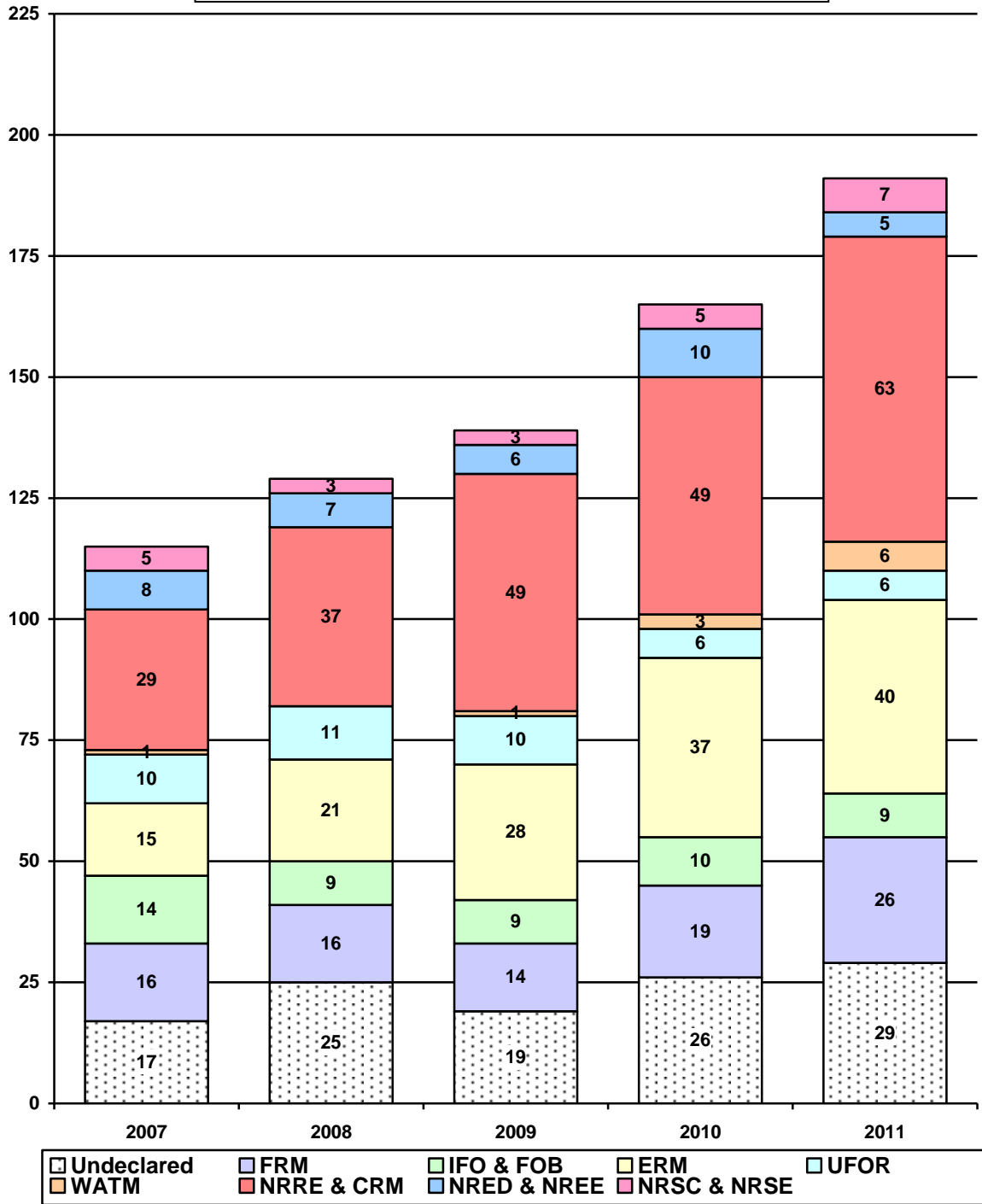
The department's educational programs continue to thrive. There were 602 undergraduates in the College of Natural Resources and Environment in Fall Semester 2011; of these, 191 students—or approximately 32%—were in options associated with the Department of Forest Resources and Environmental Conservation.



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**FREC Undergraduate Enrollment by Option  
2007-11**



## Graduate Degrees Awarded During 2011

Master of Forestry (3)	Graduate Chair	Title of Paper
Chandler, Joshua L.	Chad Bolding	Biomass harvesting effects on soil physical properties in the Coastal Plain of North Carolina
Sawyers, B. Clay	Mike Aust Chad Bolding	Effectiveness and implementation costs of overland skid trail closure techniques in the Virginia Piedmont
Wyatt, Jonathan D.	Carolyn Copenheaver	Reconstruction of historical vegetation in Nevada from 1869-1889 public land survey records

Master of Science (6)	Graduate Chair(s)	Title of Thesis
Bernier, Robert M.	Steve Prisley Shepard Zedaker	Pilot validation of VSMOKE with implications for smoke management regulations
Groover, Miles C.	Chad Bolding	A comparison of chipper productivity, chip characteristics, and nutrient removals from two woody biomass harvesting treatments
McKee, Scott E.	Mike Aust John Seiler	Long-term (24-year) effects of harvest disturbances on ecosystem productivity and carbon sequestration in tupelo-cypress swamps in the Mobile-Tensaw River delta
Vaughan, Ritchie C.	John Munsell	Group analysis of collaborative conservation partnerships
Watson, Adam C.	Jay Sullivan	Cost share payment and willingness to participate in Virginia's Pine Bark Beetle Prevention Program
Wright, G. Tyler	Eric Wiseman	An assessment of the potential impacts of emerald ash borer ( <i>Agilus planipennis</i> Fairmaire) on Virginia's municipal street trees

Doctor of Philosophy (9)	Graduate Chair(s)	Title of Dissertation
Banskota, Asim (GEA)	Randy Wynne	The discrete wavelet transform as a precursor to leaf area index estimation and species classification using airborne hyperspectral data
Conrad, Joseph L.	Chad Bolding	Anticipated impact of a vibrant wood-to-energy market on the U.S. South's wood supply chain
Kimmel, Courtney E.	Bruce Hull	Integrated conservation strategies for sustainable development in the United States
Kiser, L. Christopher	Thomas Fox	Nutrient retention and cycling in southeastern U.S. loblolly pine ( <i>Pinus taeda</i> L.) and sweetgum ( <i>Liquidambar styraciflua</i> L.) plantations

<b>Doctor of Philosophy (9)</b>	<b>Graduate Chair(s)</b>	<b>Title of Dissertation</b>
Peduzzi, Alicia	Randy Wynne	Estimating forest attributes using laser scanning data and dual-band, singlepass interferometric aperture radar to improve forest management
Sabatia, Charles O.	Harold Burkhart	Stand dynamics, growth, and yield of genetically enhanced loblolly pine ( <i>Pinus taeda</i> L.)
Sen, Susmita (GEA)	Randy Wynne Carl Zipper (CSES)	Characterizing impacts of and recovery from surface coal mining in Appalachian forested landscapes using Landsat imagery
Shrestha, Rupesh	Randy Wynne	Inventoring trees in an urban landscape using small-footprint discrete return imaging lidar
Waiswa, Daniel	Steve Prisley	Dynamics of forest cover extent, forest fragmentation, and their drivers in the Lake Victoria Crescent, Uganda, from 1989 to 2009

## RESEARCH

The Department of Forest Resources and Environmental Conservation at Virginia Tech undertakes research in a number of focus areas. These include:

- forest biometrics and geomatics
- forest biology, ecology, and soils
- forest economics and policy
- forest operations and business
- molecular genetics, genomics, and biotechnology
- human dimensions
- natural resource recreation
- urban forestry.



Funding from contracts and grants generated by the faculty totaled \$4.06 million in fiscal year 2011. Eighteen students completed graduate programs in the Department of Forest Resources and Environmental Conservation during 2011; three M.F., six M.S., and nine Ph.D.s were awarded. Twenty-seven new students entered our graduate program during 2011.

Highlights of research activities during 2011 are contained on the following pages.



## Biometrics and Geomatics

Research and outreach in forest biometrics and geomatics at Virginia Tech is focused on applying cutting-edge science and information technologies to address critical questions related to the measurement, modeling, management, and monitoring of natural resources. We aim to expand the frontiers of forest resources management through powerful new applications that merge remote sensing, computer and statistical modeling, and field studies, often synthesizing results and delivering them to policymakers and the public via geographic information systems (GIS) and internet technology.

Research in the biometrics and geomatics area falls into three broad categories: growth modeling and simulation, forest inventory and sampling, and remote sensing and geographic information systems.

### **Growth Modeling and Simulation**

Growth and yield modeling consists of a continuous cycle of data collection, analysis, and interpretation. The Forest Modeling Research Cooperative (FMRC) is an outgrowth of the Loblolly Pine Growth and Yield Research Cooperative that was founded at Virginia Tech in 1979 for the purpose of developing growth and yield models for intensively managed loblolly pine plantations.

Although loblolly pine remains a primary research thrust, we are addressing an expanded array of growth and yield modeling projects that span diverse species and production objectives both in the United States and South America.



### **Forest Inventory and Sampling**

Work is ongoing on developing improved methods for forest inventories, including methods to improve forest carbon estimates for the U.S. and methods for assessing small diameter timber resources in the eastern United States.



### **Remote Sensing and Geographic Information Systems**

Net ecosystem productivity is being modeled for a wide range of management intensities using both *in situ* and remotely sensed data. Efforts are continuing to develop remote sensing applications needed to improve the statistical efficiency and spatial specificity of carbon monitoring and management in Virginia's timberland and urban forests. Geospatial analysis involves the combination of multiple sources of spatial data, each with differing source scale, timeliness, and reliability.

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## Economics and Policy

The faculty of the forest and natural resources economics section of the Department of Forest Resources and Environmental Conservation is engaged in a comprehensive research and teaching program that revolves around understanding use and exploitation of natural resources, both domestically and internationally, and designing policies to achieve a sustainable and socially-best use of forest and land resources. Concurrent with these objectives is to model and understand the behavior of forest landowners and users with multiple objectives and of agencies involved in public policy.

Some specific projects include:

- the economics of forest risks (fire, invasive species)
- the optimal design of ecosystem restoration, the development of woody-based alternative energy sources, and the design and implementation of natural resource policies to achieve various goals in the United States, Africa, Latin America, and Asia
- modeling developing country forest exploitation at community and regional levels
- understanding the implications of corruption and illegal logging along with design of better enforcement systems
- modeling the spatial nature of forest landowner and policy maker cooperation.

We visit these problems using a variety of quantitative methods drawn from economic theory, econometrics, and operations research. Our graduate students are trained in these quantitative methods while having freedom to tailor their programs to suit their specific interests.

Department faculty members in our section either currently serve or have served on editorial boards of a number of important scholarly journals in the field, including *Forest Science*, *Forest Policy and Economics*, *Journal of Forestry*, *Journal of Environmental Economics and Management*, *Natural Resource Modeling*, and *Journal of Forest Economics*, and serve on several advisory committees.

We have secured funding for projects from sponsors including the U.S. Departments of Agriculture and Energy, the National Science Foundation, the USDA Forest Service, and other international and national donors. Faculty teach graduate and undergraduate courses in forest economics, natural resource and environmental economics, forest management, and natural resource policy. Previous graduate students now hold positions in academia, private research think tanks, forest industry, the financial sector, international organizations, and government agencies.

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## Forest Ecology

Forest ecology at Virginia Tech focuses on community ecology, dendroecology, historical ecology, and disturbance ecology. The research projects are directed towards examining human impacts on the environment, quantifying natural variation in ecosystems, and identifying detectable growth responses to climate. Some current research projects include:



- reconstructing stand dynamics in old-growth forests from tree-ring widths
- comparing the climatic response of sugar maples that have been repeatedly tapped for maple syrup production with untapped sugar maples
- monitoring invasive shrub species on Natural Area Preserves
- mapping historical vegetation from public land survey records
- identifying the response of eastern hemlock to infestation by hemlock woolly adelgid
- integrating wood anatomy and dendrochronology to identify historical frost patterns, insect outbreaks, and periods of drought.

Funding sources to support these research projects include Bureau of Land Management, Environmental Protection Agency, National Fish and Wildlife Foundation, United States Department of Agriculture, and Sustainable Engineered Materials Institute.

Results of our research are regularly presented at national and international conferences, including the International Tree-Ring Conference; Ecological Society of American Annual Meeting; Tree Rings Archeology, Climatology, and Ecology; and North American Forest Ecology Workshop.



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## Forest Operations

The Virginia Tech forest operations team works in four major research areas related to forest management activities:

- Evaluating operations with regard to safety, productivity, planning, and logistics
- Creating tools to improve the efficiency and profitability of forest operations
- Analyzing forest business issues such as supply chain management/biomass utilization
- Evaluating the environmental impacts of forest operations.



### ***Effects of Forestry Streamside Management Zones on Stream Water Quality, Channel Geometry, Soil Erosion, and Timber Management in the Virginia Piedmont***

The major study objectives included determining if 50-foot streamside management zones (SMZs) are sufficient to protect stream water quality. Sixteen forested watersheds were clearcut for commercial timber production. Four SMZ treatments were installed across four experimental blocks during harvest. Each of the 16 watersheds was subsequently site prepared with prescribed burning and planted with loblolly pine. Within the watersheds the established treatments were a 100-foot width with no thinning, a 50-foot width without thinning, a 50-foot width with thinning, and a 25-foot "stringer." After a two-year post-harvest monitoring period, it was determined that the SMZ treatments had no significant effect on water quality, channel geometry, or soil erosion in and around the streams. There was no apparent water quality degradation as a result of harvesting timber, and larger SMZs did not have an impact on any of the parameters studied.

### ***The Effects of Stream Crossings and Associated Road Approaches on Water Quality in the Virginia Piedmont***

Stream crossings and their associated approaches are often the most critical point of concern for water quality along forest roads. Several types of stream crossings are used for extracting timber, but limited studies actually compare different types of stream crossings with regard to their effect on water quality. The objectives of this study were to examine four different stream crossing structures—steel bridges, pole bridges (pipe with poles), standard culverts, and reinforced fords (with GeoWeb or Geotextile)—to determine the influence of stream crossing type on water quality

and to evaluate erosion associated with stream crossing approaches. Overall, the steel skidder bridges were generally the best crossing type, but any of the crossings can be used effectively with minimal impact under specific site conditions and with judicious installation, use, and closure. Road/skid trail location and adherence to existing road grade, water control, cover, and closure best management practices are critical for protection of water quality at stream crossings.



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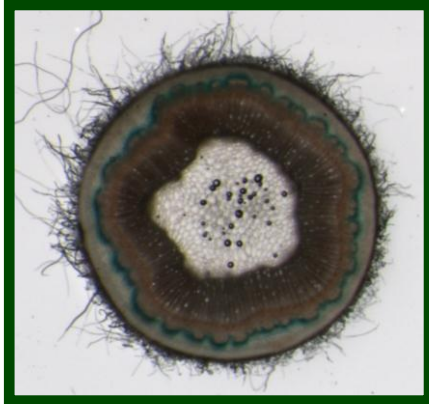
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## Genomics and Biotechnology

The genomics and biotechnology program focuses on identifying and characterizing genes and their regulatory interactions that control economically and ecologically important traits in forest trees. An ultimate goal is to translate fundamental tree biology research into tools and methods that can accelerate tree improvement for various end uses, including traditional wood products, bioenergy, and biomaterials. Our state-of-the-art laboratories are located in Latham Hall, and we also participate in the interdepartmental Molecular Plant Sciences Graduate Program (<http://www.molplantsci.org.vt.edu/>) based in Latham Hall. Our program is supported by grants from the National Science Foundation, U.S. Department of Energy, USDA National Institute of Food and Agriculture (NIFA), and the Virginia Tobacco Indemnification Commission.

### **Populus (Poplar) Functional Genomics and Field Testing**

The structure, arrangement, and relative proportions of the specialized xylem cell types that constitute wood and the composition of their secondary cell walls determine the physical and chemical properties of wood and, hence, its suitability for specific commercial applications. Research in Amy Brunner's lab studies the regulation of wood formation in poplar using a variety of techniques. Funded by the DOE/USDA Plant Feedstock Genomics for Bioenergy Program, a collaborative project with Eric Beers in the Horticulture Department, Richard Helm in Biochemistry, and Allan Dickerman in the Virginia Bioinformatics Institute is continuing to map a large number of protein-protein interactions that occur during wood formation (<http://xylome.vbi.vt.edu/>). In addition to the mapping, doctoral students Isaac Jia and Earl Petzold are studying how these interacting proteins affect wood development in order to ultimately guide design of new strategies for molecular breeding of woody biomass crops.



Tree crown architecture determines light interception and photosynthesis; thus, it has a major influence on wood production. Researchers in Dr. Brunner's lab and collaborators at West Virginia University are using various approaches to identify genes controlling shoot phenology and tree form and how these genes can be manipulated to breed optimal crown structures. A high level of sylleptic branching is often associated with high biomass yield. Research Associate Xiaoyan Sheng and undergraduate researcher Joe Edwards identified a poplar gene that regulates sylleptic branching in response to soil nitrogen levels, suggesting the possibility that the MAX1 gene could be used to optimize biomass production under specific environmental conditions (e.g., lower fertilization).

In collaboration with Harold Burkhart, Carl Zipper (Crop and Soil Environmental Sciences), and Greenwood Resources, Inc., 100 hybrid poplar clones were field tested on Piedmont and Appalachian reclaimed mine land sites. The top 12 performing clones from the screening trials will be validated in yield-verification trials on Appalachian mine land and at the Reynolds Homestead Forest Resources Research Center in Patrick County. The ultimate goal is to develop hybrid poplar as a bioenergy crop for Virginia that could also be grown for pulp, paper, and wood products.

### **Genomics of Climatic Adaptation**

The capacity of the world's forests to provide ecosystem and economic services requires that adaptive traits of local populations track optimums enforced by their respective climatic conditions. With anthropogenic climate change substantially altering adaptive landscapes, local populations will be forced to adapt, migrate, or be extirpated. In order to determine the potential for adaptation under climate change, we must first have a comprehensive understanding of the genomic basis for variation in climate-related phenotypic traits. A technological revolution is currently underway that is rapidly making the genomics tools once reserved for model species available for use in trees. The research of Jason Holliday focuses on understanding the causes and consequences of natural genetic variation in complex adaptive traits in trees and in applying this knowledge to improve forest health and productivity. A better understanding of adaptive genetic variation facilitates genome-enabled breeding for the sustainable production of wood biomass, enables predictions of

carbon sequestration in future forests under climate change, and enhances the adaptive potential of local populations through conservation of ecologically relevant genetic variation.

The population genomics group led by Dr. Holliday focuses primarily on the genera *Populus* (poplar), *Picea* (spruce), and *Pinus* (pine), which contain the most economically and ecologically important tree species in the United States and for which extensive genomic tools have been developed. Our primary interest is in the genomic dissection of complex traits using association mapping and landscape genomics, which employ large natural populations to finely map adaptive genes. To these ends we employ contemporary high-throughput sequencing to address the above questions on a genome-wide scale. A significant current focus is the genus *Populus*, for which the National Science Foundation has funded a study aimed at elucidating the genomic architecture of climatic adaptation. We are using a recently developed sequence capture technology to retrieve exons and regulatory sequences for all expressed genes in *P. trichocarpa* (black cottonwood), which will be sequenced in a replicated mapping population developed for this project. In addition to encompassing the wide latitudinal range of poplar, this population includes collections along altitudinal transects, which will allow us to better understand adaptation at coarse versus fine spatial scales. Associations will be sought with key adaptive traits (e.g., growth, bud phenology, cold hardiness, drought tolerance, etc.), as well as with climate variables that represent the principle selective constraint related to these traits. Having planted our mapping population in two contrasting environments (Virginia and southwest British Columbia), we will be able to identify genotype-by-environment interactions, and using data provided by collaborators, comparative studies of adaptation will be undertaken in both *P. tremuloides* (trembling aspen) and *P. deltoides* (eastern cottonwood).

In addition to our work on poplars, we are involved in collaborations that have resulted in funded projects focused on spruce and pine. Loblolly pine is the preeminent softwood timber species in the United States, and the Holliday lab is part of the successful USDA NIFA Climate Change CAP (Coordinated Agricultural Project) proposal aimed at developing management strategies to mitigate and adapt loblolly pine forestry practices to climate change. We also recently collaborated on a successful proposal to Genome Canada to use association and landscape genomics to facilitate predictions of climate change outcomes for two economically and ecologically important western tree species, lodgepole pine (*Pinus contorta*) and interior spruce (*Picea glauca* x *Engelmanii*).



Extensive sequencing will be carried out in both natural populations and seed orchards (used for reforestation) to map adaptive loci and better understand the adaptive genomic portfolio of current deployment populations. In addition the results of this study will be used to develop new seed transfer policies aimed at maximizing productivity and adaptability of reforested lands.

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## Human Dimensions of Natural Resources

Natural resource problems are created and solved by people. Our program emphasizes human organization and behavior as they relate to natural resources. We address a wide range of contexts, including land change, land management agency practices and policies, urbanization, conservation movements, environmental education, outdoor recreation visitor behavior and experience, collaborative community-based conservation, and sustainable development. We work both domestically and internationally on issues regarding the interactions between people, their environments, and the multiple competing interests associated with natural resource use.



The Human Dimensions faculty employ a variety of qualitative and quantitative methods, often using mixed-methods approaches. We work at different scales of social organization—from individuals to institutions. We collaborate with experts from sociology, ecology, economics, political science, anthropology, communications, social psychology, urban planning, and public administration disciplines.

Current research is addressing:

### ***How can web-based technologies support agroforestry education and outreach?***

Forest farming is an agroforestry practice that intentionally cultivates edible, floral, medicinal, and craft products that grow underneath a forest canopy. Forest farming is an alternative to wild gathering that can tap into existing markets while also enhancing product consistency and resource sustainability. John Munsell is leading a national group of academics, agency personnel, and forest farmers that is developing web-based methods to support on-the-ground application. The project also includes a joint venture with the USDA Forest Service Southern Research Station to create procedures for a non-timber product output system that will provide market information to forest farmers via public reports and maps.

### ***How can agroforestry be used to support refugee settlements?***

Elizabeth Moore is a master's student working under the direction of John Munsell. She is studying preferences and procedures for agroforestry projects in support of refugees from the Central African Republic (CAR) that have crossed into Cameroon's East and Adamaoua provinces. The Diaspora, referred to as the hidden Darfur, is comprised predominantly of Mbororo, a tribe of nomadic cattle herders that has fled its villages due to violence, insecurity, and frequent kidnappings. Elizabeth's work uses illustrations and focus group data, along with land availability, to develop a decision-support framework for agroforestry projects.

### ***What drives visitor outcomes in interpretive experience in National Parks?***

Marc Stern and a colleague at Clemson University are collaborating to test long-held assumptions in the field of interpretation. Their graduate students attended nearly 400 ranger programs across 24 units of the National Park Service, tracking in detail multiple attributes of the ranger, the context, the visitors, and the program's delivery. Through visitor surveys immediately following these programs, the study examines the characteristics that lead to enhancing visitor experiences and inspiring stewardship. The study is the first of its kind and will inform both training and monitoring across all 394 units of the U.S. National Park Service.



**What makes for better outcomes in natural resource management planning processes?**

Marc Stern's research is addressing this question through survey research covering nearly 500 planning processes and qualitative case studies in the USDA Forest Service. The research has uncovered key lessons about leadership and the internal dynamics of interdisciplinary teams, approaches to public involvement, risk assessment, and compliance with the National Environmental Policy Act. Dr. Stern has collaborated with colleagues to publish ten peer-reviewed journal articles on this work, and key findings are now being incorporated in agency-wide training.

**What makes one conservation grant more successful than another?**

Marc Stern has partnered with colleagues from Clemson University and Stanford University on a five-year study to examine the key drivers of success in conservation granting programs. The research involves examining the characteristics and outcomes of 400 conservation grants provided through the TogetherGreen Conservation Initiative of National Audubon Society and Toyota. The study aims to uncover key lessons about training, community engagement strategies, partnerships, and adaptive management for achieving conservation success.

**How do we empower local communities to engage in conservation?**

Faculty and graduate students in our section support the national Landcare program through our website [www.landcare.central.org](http://www.landcare.central.org) and by participation in numerous national steering committees and organizations. An example of our local Landcare research and outreach efforts can be found in Catawba Valley, which lies between Blacksburg and Roanoke and is the headwaters to several national watersheds, including the Chesapeake Bay. One of our doctoral students, Courtney Kimmel, facilitated community meetings and community actions promoting the triple bottom line of economic development, community vitality, and environmental sustainability.



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## Urban Forestry

Virginia is a rapidly urbanizing state, which creates challenges and opportunities for managing forest resources. Faculty in the Department of Forest Resources and Environmental Conservation conduct research and outreach in a variety of urbanized landscapes, from densely populated cities to rural woodlots at the urban fringe. Our mission is to produce information and technology about urban forests that citizens, professionals, and policy makers can use to create sustainable cities and improve quality of life. We work to address urban forestry technical challenges at the state, regional, and national levels through research collaborations within the university and beyond. Our research sponsors include private industry, foundations, and state and federal government. In the Commonwealth we envision urban forests that are planned and managed based on sound principles and science to create safe, sustainable communities.

### ***Bringing the Forest to the City through Innovative Site Design***

Urban forests and greenways have always been important parts of any city or suburb, but the accelerated pace of urbanization is increasing pressure on our environmental resources. Now we recognize the important role this green infrastructure plays in protecting our environment, including water supplies and the water quality in our rivers and coastal regions. Urban forests, like rural



forest land, play a pivotal role in stormwater mitigation, but developing approaches that exploit the ability of trees to handle stormwater is difficult in highly built city cores or in urban sprawl where asphalt can be the dominant cover feature. Urban forestry faculty are exploring creative ways to enhance the ability of urban sites to support large trees while simultaneously providing specific ecosystem services—such as stormwater mitigation—for society. A new technology has been developed that places stormwater reservoirs beneath pavement in a special soil mix that supports tree roots and pavement and water storage simultaneously. This stormwater best management practice can be employed in dense urban cores or sprawling suburban parking lots.

Canopy is declining in many cities and towns, but with innovative approaches to creating sustainable urban landscapes, we can bring the green back to the city. Projects have been supported by the USDA Forest Service's Urban and Community Forestry Grants Program and the TreeFund. For more information see [www.urbanforestry.frec.vt.edu/stormwater](http://www.urbanforestry.frec.vt.edu/stormwater).

### ***Assessing the Structure, Function, and Value of Virginia's Urban Forests***

Urban forests have tangible value to communities—this notion has been well documented throughout the United States and is increasingly appreciated by the citizens of Virginia. However, an urban forest's value can only be fully realized when it is properly planned, established, and maintained. To be successful in these aspects of stewardship, a community must first understand the extent, location, and composition of its urban forest. Urban forestry faculty and the Virginia Geospatial Extension Program have collaborated with the Virginia Department of Forestry and numerous municipalities and agencies throughout the state to assess urban forests using geospatial and field inventory techniques to improve our understanding of this critical resource. With this knowledge Virginia communities are drafting effective urban forest policy and management plans. In addition to assisting Virginia





communities, FREC researchers are also advancing the technology of urban forest assessment to help improve urban forest assessment nationally. For more information on the Virginia Urban Tree Canopy project, visit [http://cnre.vt.edu/gep/va\\_utc.html](http://cnre.vt.edu/gep/va_utc.html). To learn how Virginia Tech is assisting communities with urban forest assessment, visit <http://urbanforestry.frec.vt.edu/eco.html> and <http://urbanforestry.frec.vt.edu/streets>.

### **Soil Rehabilitation to Improve Urban Tree Growth and Soil Function**

Urbanization typically damages soils because of construction activities such as heavy equipment use and grading. These activities produce compacted soils with low organic matter, even in the lower soil horizons. These unfavorable conditions result in decreased tree health and life expectancy, as well as decreasing stormwater infiltration. This long-term experiment is assessing the effects of a subsoil rehabilitation technique on soil carbon dynamics, greenhouse gas emissions, infiltration, and root growth, as well as canopy growth. Results will be used to improve tree ordinances and land development practices. See <http://urbanforestry.frec.vt.edu/SRES/> for more information.

### **Exurban Forest Landcare**

Virginia and the southeastern United States, like many other regions of the country and world, are experiencing rapid rates of parcelization and fragmentation of private forestland. In particular, exurban and rural residential forms of development have the potential to improve or degrade the forest ecosystems that are an essential part of our nation's green infrastructure. FREC faculty have been working with numerous public and private partners at the local, state, national, and international levels to develop research, education, and community engagement projects that address these land use and land cover changes. For example, the Headwaters Forest Landcare Partnership, facilitated by Virginia Tech, has brought together local businesses, civic organizations, state agencies, and other stakeholders to develop local markets for sustainable forest products in the Blue Ridge region of Virginia, North Carolina, and neighboring states. Support for these exurban and wildland-urban interface activities has been provided by organizations such as the U.S. Department of Agriculture, U.S. Environmental Protection Agency, Conservation Fund, National Network of Forest Practitioners, Blue Ridge Forest Cooperative, Landcare International, Rainforest Alliance, National Association of Regional Councils, and National Association of Conservation Districts.



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## Forest Modeling Research Cooperative



The Forest Modeling Research Cooperative (FMRC) is an outgrowth of the Loblolly Pine Growth and Yield Research Cooperative that was founded at Virginia Tech in 1979 for the purpose of developing growth and yield models for intensively managed loblolly pine plantations. Although loblolly pine remains a primary research thrust, the FMRC is addressing an expanded array of growth and yield modeling projects both in the United States and South America.

### ***Growth Modeling and Simulation***

A wide range of research projects is being conducted to develop improved growth and yield models for intensively managed forests. These studies include:

- Quantification of site quality
- Tree and stand increment equations
- Mortality modeling
- Tree volume and taper modeling
- Quantification of stem quality
- Quantification of wood quality characteristics
- Incorporation of cultural practices (e.g., planting genetically improved and varietal stock, applying fertilizers, controlling competing vegetation, thinning) into growth and yield models
- Modeling environmental influences on forest growth.

Integration of models into prediction and projection systems and incorporation of these systems into decision support tools (including web-based applications) comprises a significant part of the work of the FMRC.

In addition to loblolly pine, the FMRC has developed models for mixed-species stands of Appalachian hardwoods and pure stands of yellow-poplar. Current work includes development of models for South American pine plantations and models for longleaf pine in the U.S. Work is also ongoing for developing models for short-rotation "bioenergy" plantations.



### ***Collaboration***

The FMRC has a long history of collaboration and maintains strong working relationships with other research cooperatives, the Forest Service, and—through the National Science Foundation's Center for Advanced Forestry Systems—industry-supported research programs at other universities. Staff of the Forest Modeling Research Cooperative consists of a Director (Harold Burkhart), an Associate Director (Ralph Amateis), cooperating faculty in forest biometrics and geomatics at Virginia Tech, and graduate research assistants and postdoctoral research associates.

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## Forest Productivity Cooperative

The Forest Productivity Cooperative (FPC) is an international partnership working to create innovative solutions to enhance forest productivity and value through the sustainable management of site resources. The partnership is led by faculty at Virginia Polytechnic Institute and State University (Thomas Fox), North Carolina State University (Jose Stape), and the Universidad de Concepción (Rafael Rubilar). The FPC conducts research in plantation silviculture, forest nutrition, ecophysiology, soils, plant community ecology, growth and yield modeling, remote sensing, spatial analysis and GIS, and statistics.



The goal of the FPC is to increase the productivity, profitability, and sustainability of plantation management in the United States and Latin America. We work with both pine and eucalyptus plantations throughout these regions. The approach of the FPC includes a mix of applied research, fundamental research, graduate and undergraduate education, technology transfer, continuing education, and consulting. This mix provides a productive environment for addressing questions and immediately incorporating research results into silvicultural practices for cost-effective and environmentally sustainable plantation management.

The FPC is one of the world's largest cooperative silviculture research and education programs. Partners include the three host universities, forest industry, timber management investment organizations, forestry consultants, governmental agencies, private landowners, and others interested in intensive plantation management. There are currently 55 members of the FPC who operate in the southern United States from Texas to Virginia and in Latin America in Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Uruguay, and Venezuela and collectively own or manage over 25 million acres of pine and eucalyptus plantations.

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## National Science Foundation Center for Advanced Forestry Systems

The Center for Advanced Forestry Systems (CAFS) is sponsored by the National Science Foundation (NSF) as part of the Industry/University Cooperative Research Centers (I/UCRC) Program within the Engineering Directorate. CAFS links existing cooperative forestry research programs at Virginia Tech, North Carolina State University, Oregon State University, University of Georgia, University of Florida, University of Washington, University of Maine, Purdue University, and the University of Idaho. At Virginia Tech this includes the Forest Productivity Coop led by Tom Fox and the Forest Modeling Cooperative led by Harold Burkhart. The NSF Center for Advanced Forestry Systems is designed to foster collaborative research between universities and forest industry that will increase the productivity, profitability, and sustainability of plantation forest management. The overall goal is to facilitate the development and application of forest science and technology needed by forest industry to remain globally competitive.

CAFS-sponsored research underway at Virginia Tech includes:

- Developing precision silvicultural regimes for clonal plantations of loblolly pine in the United States and South America
- Evaluating the potential productivity of loblolly pine in the southeastern United States and in Latin America across climatic-geologic-edaphic gradients
- Improving our understanding of the ecophysiology of loblolly pine and the responses in nutrient uptake, leaf area, light interception, photosynthesis, and respiration to silvicultural treatments in loblolly pine plantations
- Using stable isotopes of nitrogen to trace the fate of applied nitrogen fertilizers in forest plantations to evaluate fertilizer uptake efficiency
- Developing growth and yield predictions for diverse genotypes and silvicultural practices
- Developing improved understanding of stand response of loblolly pine to silvicultural treatments such as thinning and fertilization.



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## OUTREACH AND ENGAGEMENT

The outreach and engagement programs in the Department of Forest Resources and Environmental Conservation seek to strengthen and enhance the management of forest resources through educational programming and information transfer to all publics of our society. Programming is diversified to serve many audiences having varied objectives and interests.

Outreach programs are conducted in a variety of fields and using a host of methods. In the College of Natural Resources and Environment, outreach programs are organized into the following five categories:

- Cooperative and industrial Extension programs
- Continuing education programs
- Youth and teacher education programs
- Economic development programs
- International development programs

In the Department of Forest Resources and Environmental Conservation, faculty, staff, and students are actively involved in programs within all of these categories. Cooperative and industrial Extension programs are offered to a variety of audiences, such as forest landowners and loggers. Primary subject areas include forest management and economics, silvicultural applications, and timber harvesting. Educational programs are offered throughout the state in cooperation with the Virginia Department of Forestry, the Virginia Forestry Association, the State Implementation Committee of the Sustainable Forestry Initiative, and many other groups. One or more of the department's Extension specialists and associates generally coordinates Extension programs.

Continuing education (CE) programs are offered to professional audiences such as foresters, wildlife managers, certified public accountants, etc. These fee-based programs are conducted in cooperation with Virginia Tech's Office of Outreach Program Development and include several different types, such as open enrollment programs, contract programs, conference services, and research dissemination programs. The Department of Forest Resources and Environmental Conservation has an active CE program, involving both Extension and non-Extension faculty as coordinators and instructors. Programs are regularly offered in the areas of forest management and economics, silviculture, forest biometrics, and timber harvesting.

The Department of Forest Resources and Environmental Conservation is actively involved in educational programs to benefit youth and the teachers and adult leaders who work with school-aged children. Departmental faculty, staff, and students are actively involved through 4-H summer camp programs, 4-H in-school projects and judging programs, and middle school teacher and student projects.

In addition to educational programs and projects, faculty in the department are actively engaged in publishing educational bulletins, developing educational curriculum materials, producing newsletters and magazine columns, preparing videotapes, and developing and maintaining educational web sites.

The Department of Forest Resources and Environmental Conservation is committed to supporting economic development activities throughout the Commonwealth. Faculty and staff regularly consult and provide technical assistance to companies and other state agencies in support of broad-based economic development efforts. In addition, many of the continuing education and Cooperative Extension programs support the economic development mission.

International programs are an important component of the Department of Forest Resources and Environmental Conservation's outreach portfolio. Active involvement in international projects broadens the knowledge base of faculty, staff, and students and helps to connect the department with the rest of the world.

## Virginia Forest Landowner Education Program

The Virginia Forest Landowner Education Program's (VFLEP) services are designed to enable forest landowners to meet their ownership objectives through sound forest stewardship and sustainable forestry practices. VFLEP is a multi-agency educational initiative coordinated by Virginia Tech's Department of Forest Resources and Environmental Conservation.

Specific goals of VFLEP include:

- preserving Virginia's forest land base
- reducing exotic insects, plants, and diseases
- maintaining a diversity of game and non-game wildlife species
- promoting the production of quality wood and non-timber forest products
- generating public understanding and support for the management of Virginia's vast forest resources
- building relationships between experienced and less-experienced private forest landowners
- creating dialogue and cooperation within Virginia's natural resources community and among private forest landowners.



### **Real Forestry for Real Estate**

In the fall of 2010, VFLEP was awarded a \$10,000 Education Grant from the American Tree Farm System and American Forest Foundation for a new program, Real Forestry for Real Estate (RFRE). This two-part program was developed to address the approaching mass transfer of forestland ownership in Virginia. The first part of RFRE addresses providing sustainable forestry information to new forest landowners via New Landowner Packets, which contain a wide variety of information on forestry and wildlife management and resources. The second part of RFRE addresses how to get the New Landowner Packets into the hands of new landowners. To do this we offered RFRE continuing education classes to real estate professionals and Commissioners of the Revenue (COR). Since August, 2011, we have offered 15 RFRE classes to 265 participants (202 Realtors/appraisers, 36 CORs, and 27 others) and provided them with almost 1,200 New Landowner Packets for distribution. Maryland, North Carolina, South Carolina, and Mississippi are now considering adopting the RFRE program.

### **Landowner Short Courses**

VFLEP offered nine short courses in 2011, with 441 Virginia Forest Landowners attending.

### **Fall Forestry & Wildlife Field Tours**

In 2011 we celebrated the 35th anniversary of the Fall Forestry & Wildlife Field Tours with four tours (in Pittsylvania, Spotsylvania, Sussex, and Washington Counties). Over 149 forest landowners and natural resource professionals attended.

### **Virginia Forest Landowner Update (VFLU) Newsletter**

Four issues of this quarterly newsletter were published in 2011. The newsletter is sent out electronically to over 3,000 landowners, and paper copies are mailed out to more than 3,500 landowners. The VFLU received both regional and national recognition this year, receiving a Silver Award in the Extension Newsletter category from Southern Region Extension Forestry and a Gold Award in the Newsletter category from the Association of Natural Resource Extension Professionals.

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## Virginia Geospatial Extension Program

Geospatial tools include the application of geographic information systems (GIS), global positioning systems (GPS), and remote sensing. The Virginia Geospatial Extension Specialist (VGES) acts as a knowledge broker, or the two-way conduit, between geospatial research, applications development, and practice. The VGES has a national reach and leverages the expertise of Virginia Cooperative Extension agents and specialists.

VirginiaGeospatial  
EXTENSIONPROGRAM  
[cnre.vt.edu/gep](http://cnre.vt.edu/gep)



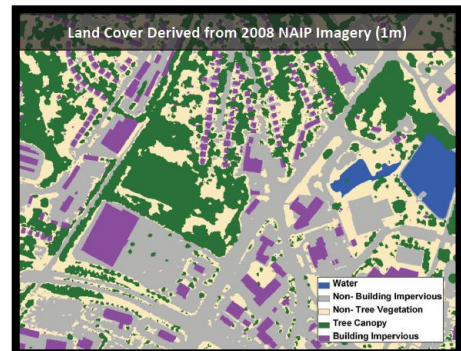
The program provides:

- hands-on geospatial technical training through workforce development initiatives
- strategic planning for local governments
- expertise to facilitate the integration of computer-aided tools with the planning and management needs of stakeholders.

In addition to working closely with extension agents and specialists, the program works closely with local, state, and federal government employees; Virginia's vibrant geospatial private sector; precollege educators; and faculty through Virginia's institutions of higher education.

Examples of programming efforts include:

- *Marketing in a Virtual World* – provides instruction to owners of small/rural businesses on how to include their businesses on location-based service applications (car navigation systems, smartphone applications, etc.)
- *Geospatial Technician Education through Virginia's Community Colleges* – provides VCCS faculty and high school educators with training and resources necessary to develop and implement a GIS program to support industry needs
- *The Urban Tree Canopy Project* – provides a baseline inventory of tree canopy for local jurisdictions
- *VirginiaView* – provides educators and other stakeholders across Virginia with access to remote sensing imagery and resources to support their educational and workforce development efforts
- *Map@syst* – an eXtension community of practice designed to develop a Wiki-based clearinghouse for geospatial information.



The Virginia Geospatial Extension Program has generated over 35 extension and outreach publications and secured over \$2.4 million in funding to support geospatial programs.

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## Virginia Master Naturalist Program

The Virginia Master Naturalist program is a volunteer training and service program providing education, outreach, and service to benefit natural resources and natural areas in Virginia. Volunteer training includes a minimum of 40 hours of classroom and field time in natural history and natural resource management. To become a Certified Virginia Master Naturalist, each volunteer must complete 40 hours of service in education, citizen science, or land stewardship. The program is sponsored jointly by Virginia Cooperative Extension, Virginia Department of Conservation and Recreation, Virginia Department of Environmental Quality, Virginia Department of Forestry, Virginia Department of Game and Inland Fisheries, and the Virginia Museum of Natural History, with additional support from the Virginia Tech College of Natural Resources and Environment and the Department of Forest Resources and Environmental Conservation. In addition the 29 program chapters across the state work with more than 300 local partners, including schools, nature centers,



nonprofits, and local governments. Currently the program has 1,100 active volunteers. Since the program's inception in 2006, these volunteers have contributed 229,558 hours of service—with a value of \$4.9 million—to the Commonwealth of Virginia.



In 2011 Virginia Master Naturalist volunteers completed more than 21,000 hours of service on projects to educate the public about natural resources. They made more than 84,000 youth and adult contacts through these educational efforts. For example several Master Naturalist chapters organized and led "Junior Naturalist" 4-H clubs that exposed youth to natural resources and local natural areas. Similarly, several other chapters organize or assist with afterschool nature programs for youth in their communities. Some of these programs specifically target underserved audiences such as inner-city youth and Spanish-speaking populations.

Virginia Master Naturalists completed more than 16,000 hours of service on stewardship projects, such as habitat restoration and trail maintenance, in 2011. Their efforts positively impacted more than 1,000 acres of land and more than 1,000 miles of trails in Virginia. Invasive species continued to be a particular area of focus for the program. The program co-organized a statewide Invasive Plant Removal Day on May 7, 2011. More than 550 volunteers, including Master Naturalists, scouting and other youth groups, neighborhood associations, and other community volunteers, helped to remove invasive plants at 38 field sites across Virginia. Together they contributed more than 1,700 hours of service and removed hundreds of bags of invasive plants that negatively affect Virginia's forests. They also improved sites by planting 285 new native plants and trees.

Also in 2011 Virginia Master Naturalists completed more than 18,000 hours of citizen science, collecting data on wildlife populations, urban forests, and aquatic habitats in their communities. This data will help natural resource agencies and scientists better understand the current status of and changes in plant and animal populations and their habitat quality in the Commonwealth.



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## Virginia SHARP Logger Program



Virginia's **SHARP** Logger Program (**SHARP** = **Sustainable Harvesting And Resource Professional**) provides training to loggers, foresters, and others throughout Virginia. This training focuses on the principles of sustainable forestry, environmental protection, and workplace safety. The SHARP Logger Program was implemented in 1996 as part of the nationwide Sustainable Forestry Initiative (SFI). Since 2002 the Virginia Tech Department of Forest Resources and Environmental Conservation has been responsible for the administration and coordination of the SHARP Logger Program as a Virginia Tech Forestry Extension Program. The SHARP Logger Program is a cooperative effort between the Department of Forest Resources and Environmental Conservation, the Virginia SFI Implementation Committee, Virginia Cooperative Extension District Forestry and Natural Resources Extension Agents, and many others in Virginia's forest industry.

In order to become a SHARP Logger, participants must complete a three-part core program consisting of classes on sustainable forestry, logging safety, and pre-harvest planning and BMPs. After completing the core program, SHARP Loggers must earn 12 hours of Continuing Education (CE) credits every three years to maintain their SHARP Logger status. Over 3,400 individuals have completed the core program requirements to become SHARP loggers.

In 2011 the core SHARP Logger Program was offered at five locations throughout the Commonwealth, and 98 "new" SHARP loggers completed the core program. Thirty-four continuing education classes approved for SHARP Logger CE credits were offered across Virginia, and 814 individuals attended at least one program to earn SHARP Logger CE credits. These SHARP Loggers received a combined total of over 6,200 hours of training in 2011. As of January 1, 2012, there were a total of 1,336 active SHARP Loggers. The goal of the SHARP Logger Continuing Education program is to offer a diverse mixture of classes with face-to-face training provided by experts in their fields. The program also offers five online courses available on the SHARP Logger website.



Examples of CE classes offered in 2011 include:

- Overview of biomass harvesting in Virginia
- BMP and water quality workshops
- Chainsaw safety
- GPS for loggers
- Basic timber cruising workshops
- Logging safety awareness workshop & OSHA refresher
- Invasive/exotic species and threatened and endangered species workshop
- Negotiating skills workshop

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## Virginia's Link to Education about Forestry



Virginia's Forest Landowner Education, SHARP Logger, Master Naturalist, and 4-H Programs—along with the Virginia Department of Forestry's (VDOP) Conservation Education Program and four Virginia Cooperative Extension (VCE) district-level forestry/natural resource agents—constitute a remarkable array of educational resources. Constituents

from the rural southwest to the populated north benefit from their efforts. While many regularly take advantage, the truth of the matter is that reaching new audiences is difficult. LEAF is making positive strides via a VCE/VDOP partnership that engages private and public entities to develop strategies that attract new audiences. To date efforts include establishing heritage-based outdoor classrooms and online education. LEAF has received support from the Virginia Sustainable Forestry Initiative (SFI) Implementation Committee, Ballyshannon Fund, Fred W. Scott, Jr., NRCS EQIP program, Powell River Project, College of Agriculture and Life Sciences, VDOP, VCE, Shenandoah RC&D Council, the Virginia Division and Skyline Chapter of the Society of American Foresters, Old Rag and Central Rappahannock Master Naturalists, and the Montpelier Foundation.

### **Heritage-Based Outdoor Classrooms**

The state's rich history offers important prospects for creating outdoor LEAF classrooms that provide venues for coordinated demonstration, engaging interpretation, and self-guided education. Projects are underway at James Madison's Montpelier, Appomattox-Buckingham State Forest, Cyrus McCormick Farm/Shenandoah Valley Agriculture Research and Extension Center, Conway-Robinson State Forest, Powell River Project, Reynolds Homestead, and Arlington County.

### **James Madison's Montpelier**

There are over 1,500 acres of forests at Montpelier. Two hundred acres house a relatively undisturbed old-growth deciduous forest. The Landmark Forest, as it is called, includes a trail system with educational signs and has long served as a backdrop for environmental education. To expand its program a forest management classroom has been developed in 28 acres of second-growth forest abutting the Landmark Forest.



### **Cyrus McCormick Farm/Shenandoah Valley Agriculture Research and Extension Center**

Beef production and forage regimes are being combined with forest management at the Cyrus McCormick Farm, a National Heritage Site, to exhibit economic and environmental quality opportunities on working farms. Most recently a restorative shelterwood cut was implemented. Long-term objectives include researching and demonstrating the importance of sustainable forest management. Aims are also to develop an interpretive kiosk for farm visitors.

### **Online Education**

Online learning is an increasingly viable mechanism if physical attendance at forestry education is constrained. It offers promise for reaching audiences that rely on or prefer computer-based education. LEAF is developing comprehensive online opportunities for foresters, loggers, private forest owners, and teachers. Content includes stand-alone learning modules and will house downloadable programs that correspond to LEAF's outdoor classrooms.

### **Summary**

As LEAF moves forward, existing partnerships will be strengthened, new collaborations formed, and impacts expanded. Classrooms will span the Commonwealth, and online learning will provide affordable and accessible opportunities.

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## INTERNATIONAL ACTIVITIES

**JANAKI ALAVALAPATI** was an invited participant at the Management of Greenhouse Gases of Agriculture Sectors in Taiwan meeting at the National University of Taiwan, Taipei, in December, 2011. He made a keynote presentation on *Forests and Bioenergy Markets and Policy for Mitigating Climate Change in the U.S.*

**AMY BRUNNER** gave a keynote presentation at the International Union of Forest Research Organizations (IUFRO) Tree Biotechnology 2011 Conference, Arraial d'Ajuda, Bahia, Brazil. In 2011 she began serving a three-term as a member of the Malaysian Rubber Board Scientific and Economic Advisory Council.

**HAROLD BURKHART** delivered the keynote presentation on *Research and Graduate Education* for the Faculty of Forestry and Environmental Management Graduate Research Symposium at the University of New Brunswick, Canada. He was a keynote speaker (*An Overview of Research on Growth and Yield of Loblolly Pine*) for "Seminario Internacional sobre Silvicultura y Monitoreo del Crecimiento de Plantaciones Forestales Comerciales" held in Santa Marta, Colombia, South America, and he made a second presentation at the seminar on *Growth and Yield of Loblolly Pine Following Thinning*.

**THOMAS FOX**, Co-Director of the Forest Productivity Cooperative (FPC), continues to expand his activities in Latin America. The FPC now operates in Mexico, Colombia, Venezuela, Brazil, Argentina, Uruguay, Chile, and Ecuador. The Coop held its Latin American Contact Meeting in Cali, Colombia, in 2011. This included a two-day forest productivity and silviculture workshop and a field tour of pine and eucalyptus plantations in collaboration with Smurfit Carton de Colombia. Dr. Fox also attended a IUFRO Working Group meeting on the genetic improvement and silviculture of eucalyptus in Porto Seguro, Brazil. He presented a paper on the results of a fertilization study with *Eucalyptus grandis* in Colombia.

As part of its expanded activities in Brazil, the Forest Productivity Cooperative recently established a partnership with the Instituto de Pesquisas e Estudos Florestais (IPEF) to work collaboratively on silviculture of pine and eucalyptus in Brazil. Exchanges of scientists and practicing foresters are an important part of this partnership. In 2011 Virginia Tech hosted a group of 15 foresters from companies in Brazil as part of a benchmarking tour they conducted on southern pine forestry in the U.S. A major area of research collaboration between the Forest Productivity Coop and Brazilian scientists working with IPEF is a study to determine the potential productivity of loblolly pine in Brazil. As part of this effort, an installation of one of the FPC RW20 studies on the interaction of spacing and intensive silviculture of clonal loblolly pine was established in Santa Catarina State in Brazil. This is the first time that the same clonal loblolly pine planted in a study in the U.S. has been moved to Brazil so that the processes controlling potential productivity can be compared in the two regions.

**JEFFREY MARION** traveled to Australia to participate in an International Meeting of Recreation Ecologists held at Griffith University on the Gold Coast. It included a two-day science symposium, where he was one of five featured speakers, and three days of meetings to spur international collaboration in research.

**KEVIN McGUIRE** is co-principal investigator on an international watershed inter-comparison study, Northern Watershed Ecosystem Response to Climate Change (NORTH-WATCH). The project is aimed at predicting the integrated consequences of climate change on the physical, chemical, and biological characteristics of water resources in experimental watersheds in sensitive northern climates. Dr. McGuire led the fourth NORTH-WATCH workshop in New Hampshire in April, 2011, for 13 participants from five countries. He also continues a second term co-leading a working group of the International Association of Hydrological Sciences Prediction in Ungauged Basins initiative on conceptualization of process heterogeneity in watersheds.

**MARC STERN**, in conjunction with Nabin Baral, a 2009 Ph.D. recipient in the Department of Forest Resources and Environmental Conservation, continued to publish research examining the resilience of different forms of community-based conservation in Nepal. The work has focused on how conservation institutions can weather times of political instability and violence and how local residents can provide valuable insights on ecotourism.

**SHEPARD ZEDAKER** continues to serve as coordinator for undergraduate student exchange programs with the University of Melbourne, Australia; the University of Canterbury, New Zealand; and the University of Stellenbosch, South Africa.



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