DEPARTMENT OF FOREST RESOURCES AND ENVIRONMENTAL CONSERVATION

ANNUAL REPORT 2017

VT COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
VIRGINIA TECH

Department of
Forest Resourcs
and Environmental
Conservation
2017
Annual Report

Jay Sullivan........ Department Head

Mary Williams........... Administrative
Assistant to the
Department Head

Tracey Sherman............Layout and
Design

Kathryn Hollandsworth.........Editing

Cheatham Hall Rm 313
Virginia Tech, MC 0324
310 West Campus Drive
Blacksburg, VA 24061
(540) 231-5483
FREC@vt.edu

IN THIS ISSUE

From the
Department Head

Keeping the forest land in the land grant

Over the recent break, while I was preparing for an upcoming faculty retreat, I had the opportunity to read about the land grant mission that was the basis for the establishment of Virginia Tech and many other state universities around the country. The fundamental concept of that important mission is to provide "practical education" for all people "in the several pursuits and professions of life" (Morrill Act of 1862). But reading more deeply into Representative Justin Morrill's motivations, I found it noteworthy from his impassioned 1858 speech where he was first advocating for his "Bill Granting Lands for Agricultural Colleges" that he believed we never should be complacent about two things: 1) that we ever continue to build on what has been passed down to us, and 2) that "we present our land better than we found it." It strikes me that all of us who work in FREC, as well as our alums and friends, would do well to be measured positively according to Morrill's land grant ideals; always building on what we ourselves have received, and passing on the land about which we study, and on which we practice and we play as "better than we found it." What a two-fold challenge for those of us impassioned by this profession and its resources, and for me personally his sentiments sum up what I see as the responsibilities of being a part of our program and being in our profession.

In FREC, we are given so many opportunities to build on not only an extraordinary program that has been handed down to us, but even more importantly the opportunity to build into the lives and career paths of the students who come our way the professional skills and ethics that will serve them well, and which will well serve our communities, our Commonwealth, and likely far beyond. And for all of us who teach about, conduct research on, and practice on our land and natural resources, we carry the legacy for future generations to demonstrate what it truly means to ensure that our forests and environment indeed are passed on in an even better condition than we received them.

In his speech, Morrill went on to express his desire that we would "have such colleges as may rightfully claim the authority of teachers to announce facts and fixed laws, and to scatter broadcast that knowledge which will prove useful in building up a great nation—great in its resources of wealth and power, but greatest of all in its intelligence and virtue." I find it difficult to argue with that vision, and we in FREC at Virginia Tech invite and appreciate your partnership with us in pursuing these important goals, and in keeping forest land in the "land grant."

FREC Ranked Number One Among Best Colleges and Universities for Earning a Forestry Degree

According to College Factual, Virginia Tech's FREC program is ranked number one among the best colleges and universities in the United States for earning a forestry degree. Their ranking methodology takes into account factors such as education quality, average earnings of graduates, accreditation, and other relevant factors.

USA Today College, also using College Factual, has ranked Virginia Tech as the nation's best for studying natural resources and conservation for the third year in a row. Our FREC department is a strong component of Virginia Tech's College of Natural Resources and Environment. USA Today College started ranking natural resources and conservation programs in 2015. There are only about 50 universities across the United States with comprehensive natural resources programs, and we in FREC are proud to be associated with the number one-ranked college.

FREC Faculty Part of Team to Forecast Water Quality with National Science Foundation Support

Thanks to a team of scientists with the Global Change Center at Virginia Tech, predicting drinking water quality will be a reality for public utility managers.

A $1 million National Science Foundation (NSF) grant was awarded to the team, led by Cayelan Carey in the Department of Biological Sciences, to develop a system that can create a real-time water forecast similar to weather forecasts and that will be used at the Falling Creek Reservoir near Roanoke. The system will collect multiple real-time environmental datasets along with local weather predictions and a state-of-the-art reservoir model forecasting future water quality.

Quinn Thomas is leading the design and implementation of the computer modeling system that will forecast water quality based on sensor data collected at the reservoir. The forecasting approach is a similar technique developed by Thomas that forecasts the growth of loblolly pine forests in order to better inform land management in light of global change.

Michael Sorice is working with water managers to understand how the new scientific data and technology could best be implemented into their daily routine. In addition, he will examine public perceptions of this new technology and its effect on public trust in the water authority.

The team found that pumping additional oxygen into the bottom water of reservoirs can keep high levels of iron and manganese in sediment safely locked up in the sediment, even if temperatures warm. Key to these findings were team members Madeline Schreiber, Virginia Tech College of Science, and John Little, Virginia Tech College of Engineering.

The team of research ecologists, social scientists, geologists, and engineers also includes the project leader, Cayelan Carey in the College of Science at Virginia Tech, and partners at North Carolina State University and the University of Florida.

FREC Hosts 19th Biennial Southern Silvicultural Research Conference

The Department of Forest Resources and Environmental Conservation hosted the 19th Biennial Southern Silvicultural Research Conference March 14-16, 2017. This conference brought together 180 scientists and professionals from the Southeastern U.S. The conference was a joint effort between participating universities and the USDA Forest Service, and included student presentations, panel sessions, and field tours.

John Seiler and **Mike Aust** served as co-chairs of the local arrangements committee, organizing housing, food, and other details for conference attendees. The field tour focused on hardwood silviculture and forest best management practices used to protect water quality. Personnel from the U.S. Forest Service assisted in many of the field trip stops.

FREC graduate students **Ed Russell**, a Ph.D. student in tree physiology and ecological climatology, and **Sheng-I Yang**, a dual-enrolled Ph.D. student in forest biometrics and M.S student in statistics, received awards for presentations in the student oral and poster presenter contests. Students are judged on research methods and presentation skills, and receive plaques and monetary awards. According to Seiler, Virginia Tech students do well historically in the conference's contest, having taken almost 30 percent of the awards to date. "It's a very friendly conference for students giving their first talk," he said. "It's a testament to the strength of our program."


Ed Russell received an award for his presentation on the interaction between intensive management practices and water limitation expected in the near future in established loblolly pine plantations. "One of the best things about this particular conference is the opportunity to see what a variety of researchers and practitioners are currently investigating. It's an opportunity to survey a broad swath of the intellectual forestry world and gain insight from both production and ecological perspectives," he said.

Sheng-I Yang explained that this opportunity marked his first professional conference presentation. He accepted an award for his work using statistical analysis to determine the maximum population sizes of loblolly pine crops. "It was my first time doing this and I got to meet so many people from different universities and exchange ideas. I really appreciated the question-and-answer sessions at the end of each talk," he recalled.

Drones Help to Map and Reforest a Virginia Tech Property
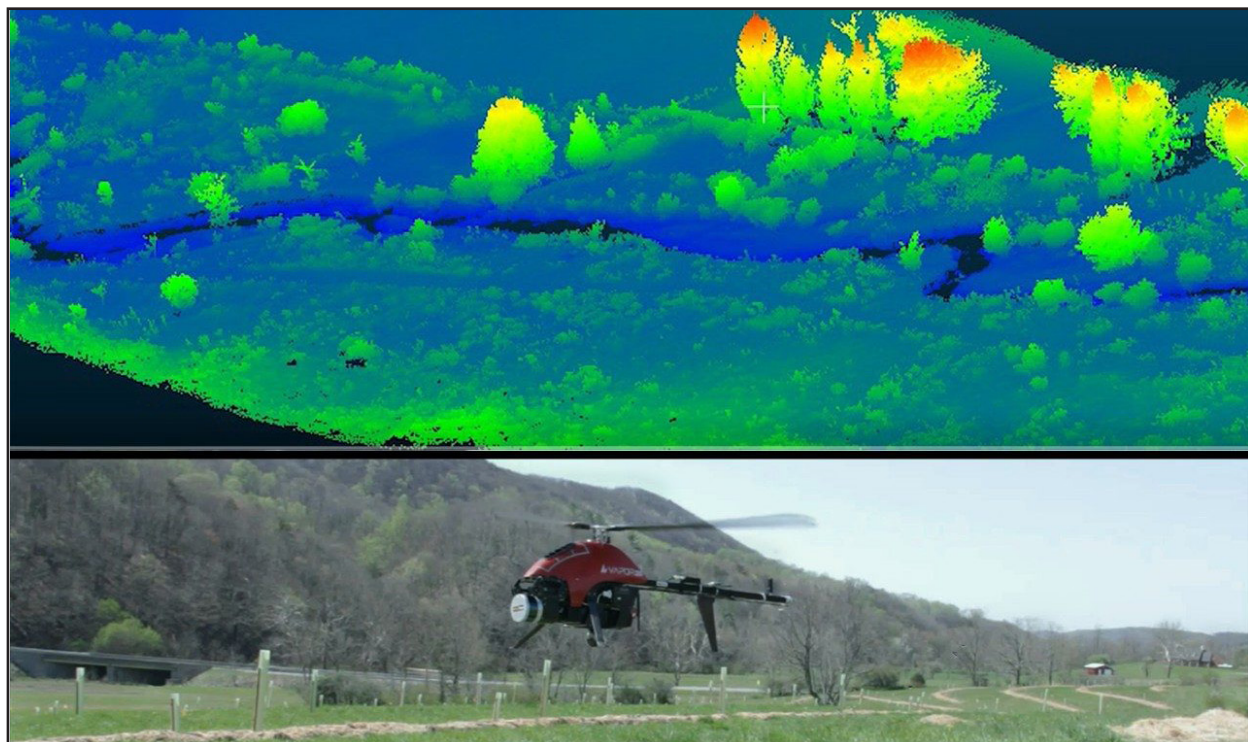
Even as the lure of mastering agroforestry practices inspires Virginia Tech students by the dozens to plant trees on Virginia Tech's 377-acre Catawba Sustainability Center, sky-high drones complement the earthbound digging.

More than four separate research projects involving drones and LIDAR technology touch on water-quality protection, food harvests from fruit and nut trees, wetlands restoration, and more.

Faculty members central to the projects include **John Munsell,** who leads $1.4 million in grants to expand uses of agroforestry to produce farm-and-forest products while practicing conservation, Cully Hession of the College of Agriculture and Life Sciences, and Nicholas Polys of the College of Engineering.

Entities underwriting the research include the National Fish and Wildlife Foundation, USDA Natural Resources Conservation Service, Virginia Department of Forestry, USDA National Agroforestry Center, the Dominion Foundation, and Outreach and International Affairs at Virginia Tech.

Teaching and Research Faculty

Jay Sullivan - *Professor and Head*

Greg Amacher - *Julian N. Cheatham Professor of Forestry*

W. Michael Aust - *Professor*

Scott Barrett - *Assistant Professor and Extension Specialist*

M. Chad Bolding - *Associate Professor*

Amy Brunner - *Associate Professor*

Harold Burkhart - *University Distinguished Professor*

T. Adam Coates - *Assistant Professor*

Kelly Cobourn - *Assistant Professor*

Carolyn Copenheaver - *Associate Professor*

Susan Day - *Associate Professor*

Stella Schons DoValle - *Assistant Professor*

Jason Holliday - *Associate Professor*

Bruce Hull - *Professor*

Jeff Marion - *Unit Leader/Scientist, Cooperative Park Studies Unit, USGS Patuxent Wildlife Research Center*

John McGee - *Professor and Geospatial Extension Specialist*

Kevin McGuire - *Associate Professor*

Daniel McLaughlin - *Assistant Professor*

John Munsell - *Associate Professor and Extension Specialist*

Philip Radtke - *Associate Professor*

Stephen Schoenholtz - *Professor and Director of the Virginia Water Resources Research Center*

John Seiler - *Alumni Distinguished Professor*

Michael Sorice - *Associate Professor*

Marc Stern - *Associate Professor*

Brian Strahm - *Associate Professor*

R. Quinn Thomas - *Assistant Professor*

Valerie Thomas - *Associate Professor*

Eric Wiseman - *Associate Professor*

Randolph Wynne - *Professor*

Fieldwork on the Pacific Crest Trail (PCT) in California

l-r: Jeff Marion, Jeremy Wimpey, Fletcher Meadema, Johanna Arredondo, and Mitch Rosen

National Park. Their investigations were focused on areas of particularly high camping use and impact to examine problems such as campsite proliferation, expansion, and vegetation loss.

The study is developing new guidance for improving sustainable camping management practices along the PCT. Some of the work was conducted in the popular Mt. Whitney portal zone and surrounding areas, so the crew had an opportunity to summit Whitney.

Adjunct Professor **Jeff Marion** and co-investigator and past FREC Ph.D. student Jeremy Wimpey conducted fieldwork on the Pacific Crest Trail (PCT) in California during the summer of 2017 with graduate students **Johanna Arredondo** and **Fletcher Meadema** and undergraduate assistant **Mitch Rosen**.

They investigated camping impacts and sustainability through fieldwork conducted along the PCT near the Mexican border and in the Inyo National Forest, Sequoia-Kings Canyon National Park, and Yosemite

Virginia Tech as an Observer Organization at the United Nations Framework Convention on Climate Change (UNFCCC) - COP 23

The 2017 Climate Change Conference (COP 23) was hosted by the government of Fiji, in Bonn, Germany, from November 6-18. Virginia Tech was granted observer status at the United Nations Framework Convention on Climate Change, and, for the first time, participated in the climate change negotiations as an observer organization.

The observer status at the climate change negotiations gave Virginia Tech the opportunity to showcase its work in climate change through side events and panels; make technical submissions, based on expertise, to guide policy; and participate in open sessions. Furthermore, Virginia Tech was able to take students and expose them to high-level global climate change policy making, present their research, network, and access potential future work opportunities.

Carol Franco and **Randy Wynne** from FREC participated in the climate change negotiations in Bonn, together with two Virginia Tech students from the Climate Change and the International Policy Framework course (FREC 5984). Hannah Wynne, a sophomore student working on a Bachelor's degree in Arts and English, and Katherine Bland,

a Master of Science student in Biological Systems Engineering, had the opportunity to experience first-hand the climate change negotiation process and followed the topics of gender and climate change and renewable energy.

Some of the main outcomes of COP 23:

- Talanoa Dialogue: Initiative to accelerate climate action in order to meet the goal of the Paris Agreement (PA) of limiting the increase in global average temperature. In order to achieve this, the 1st stocktake – inventory will be held at COP 24 in Poland to report and assess current National Determined Contributions and increase their ambition.

Virginia Tech at COP 23

- The goal to increase and strengthen more ambitious actions pre-2020: Urgency to focus on advancing pre-2020 adaptation and mitigation actions to achieve the temperature goal.
- The commitment by developed countries to mobilize US$100 billion per year by 2020 to mitigate GHG was reiterated.
- The Green Climate Fund (GCF) announced the Simplified Approval Process for access to financing to carry out mitigation and/or adaptation actions with a cap of US$10 million.
- America's Pledge on Climate Change: California Governor Jerry Brown launched this initiative at COP 23, which aims to quantify the GHG emissions reduction efforts of states, cities, businesses, and other stakeholders.
- The role of cities local approach: Mayors of 25 cities of the world (including Boston, Los Angeles, New York, Philadelphia, and Portland) committed to the goal of producing zero net emissions by 2050, supported by the "C40 Cities" network, a network of cities committed to addressing the impacts of climate change.
- Platform for indigenous peoples and local/traditional knowledge: This platform was created with the aim of "strengthening the knowledge, technologies, practices, and efforts of local communities and indigenous peoples" to confront the impacts of climate change and thus facilitate the exchange of experiences, best practices, and lessons learned on mitigation and adaptation in a holistic manner."
- The Ocean Pathway Strategy: This initiative calls for the integration of the oceans in the UNFCCC process due to their importance for climate change. It highlights the inclusion in the NDCs of adaptation and mitigation actions in the oceans.

Research and Extension Faculty

Research Faculty

Timothy Albaugh - *Research Associate*

Ralph Amateis - *Senior Research Associate*

Hua Bai - *Postdoctoral Associate*

Evan Brooks - *Research Scientist*

Carol Franco - *Senior Research Associate*

Andrew Laviner - *Research Associate*

Kyle Peer - *Senior Research Associate & Superintendent, Reynolds Homestead Forest Resources Research Center*

Jay Raymond - *Postdoctoral Associate and Interim Co-Director of Forest Productivity Cooperative*

Xiaoyan Sheng - *Research Associate*

Kirsten Silvius - *Senior Research Associate*

Matthew Sumnall - *Postdoctoral Associate*

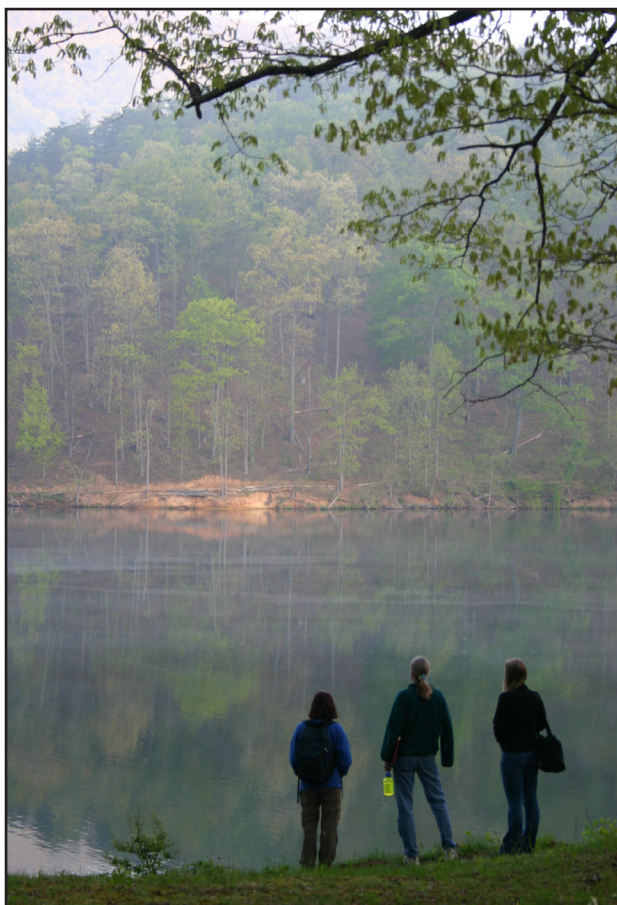**Rita Teixeira -** *Research Scientist*

David Walker - *Research Associate*

Extension Faculty

Jennifer Gagnon - *Coordinator, Virginia Forest Landowner Education Program*

Michelle Prysby - *Virginia Master Naturalist Director*

Andrew Vinson - *Project Associate*

Historic Log Dating Project

Photo by Mike Pulice, Virginia
Department of Historic Resources

Graduate students in associate professor **Carolyn Copenheaver's** Advanced Forest Ecology class helped uncover mysteries of the past that have important implications for forestry and history, thanks to a partnership between Virginia Tech's College of Natural Resources and Environment and the Virginia Department of Historic Resources.

In the winter of 2016, two historic structures, a kitchen and a slave dwelling located on the site of Greenfield Plantation near Fincastle, were moved from their original locations to a new site approximately 3,500 feet away. An opportunity to learn more about the structures and history came when the contractor discovered some of the lower logs were too deteriorated to survive the move.

According to Mike Pulice, an architectural historian with the Virginia Department of Historic Resources, log structures are often difficult to date because most were built using the same techniques for hundreds of years and dendrochronology (tree-ring dating) is an absolute tool to precisely determine when a structure was built.

Originally believing the structures were built in the 1830s, dendrochronology work done by Copenheaver and her students helped pinpoint that the kitchen was built in late 1844 or early 1845, and the slave quarters were built in 1864.

Copenheaver said, "The cabins are what we call a 'floating chronology.' We don't know where they fit in time. But by looking at the tree-ring patterns, we can match them with trees that have already been dated."

Copenheaver and her team sanded the log samples, which are roughly the size of a milkshake straw, until they could clearly see the tree's annual growth rings. From there, they ran the tree-ring measurements through a software program that compared the ring patterns against other samples to determine their exact age.

According to Copenheaver, the tree rings from the log structures tell the story of European settlement in the area. "There were two waves of European settlement," she said. "When settlers arrived in the area in the late 1730s and 1740s, they cleared the forests to create agricultural land. Then, when the settlers were pushed back eastward during the French and Indian War, that agricultural land was abandoned and actually reforested."

Westward European settlement resumed after the French and Indian War ended in 1763. More trees were felled to build villages, and, with more space and access to sunlight, the trees that were left standing experienced an increase in growth. "We can see all of this activity reflected in the tree-ring records," Copenheaver said.

Adjunct and Emeritus Faculty

Adjunct Faculty

Janaki Alavalapati - *Professor*

Christopher Anderson - *Professor*

Scott Bailey - *Research Geologist*

Gwenlyn Busby - *Research Associate*

David Chojnacky - *Unit Leader (retired)*

John Coulston - *Research Forester*

Alex Finkral - *Senior Forester*

Jennifer Knoepp - *Research Soil Scientist*

William Lakel - *Water Quality Program Supervisor*

Christopher Maier - *Research Biological Scientist*

Rafael Rubilar - *Associate Professor*

Erik Schilling - *Senior Research Scientist*

David Soucek - *Associate Research Program Leader*

Jared Westbrook - *Assistant Professor*

Emeritus Faculty

Robert E. Adams

Gregory N. Brown

Gregory J. Buhyoff

James A. Burger

Harry L. Haney, Jr.

John F. Hosner

J. Michael Kelly

Jeffrey L. Kirwan

W. David Klemperer

William A. McElfresh

Robert L. McElwee

Richard G. Oderwald

Marion R. Reynolds, Jr.

Joseph W. Roggenbuck

Robert M. Shaffer

David Wm. Smith

Harold W. Wisdom

News from Reynolds Homestead

K2C: Kindergarten 2 College

The Henry County schools Stem Camp was hosted by the Reynolds Homestead.

The College Access Collaborative at Virginia Tech sponsored a two-day college awareness and interactive STEM experience in June 2017 at Reynolds Homestead for 70 Henry County students in grades 4-8.

On the first day of the camp, students experienced an Intro to College presentation followed by STEM activities led by Reynolds Homestead staff, Forestry Department staff, and partners such as the Institute for Advanced Learning & Research. The second day included a trip to Blacksburg to tour Virginia Tech's campus, where students visited the Ware lab, the Cube, and explored the Game Changineer software.

Virginia Tech's College Access Collaborative is an organizational unit dedicated to college access. Consistent with Virginia Tech's land-grant mission, institutional motto (Ut Prosim, That I May Serve), and InclusiveVT initiative, the university is committed to supporting and enhancing a more diverse undergraduate student body. Currently, Virginia Tech serves the commonwealth through partnerships with communities in low high school attainment and low matriculation to post-secondary education.

Learning Lessons From Nature: Research Center Helps People Understand the Forest

The Forest Resources Research Center at the Reynolds Homestead, located deep within Patrick County, is almost 800 acres of land dedicated to helping people understand trees and forests. **Kyle Peer** is the superintendent.

The Forest Resources Research Center is one of 11 agricultural and research extension centers of Virginia Tech, Peer said. The center at the Homestead is part of the College of Natural Resources and Environment, and the other 10 are under the College of Agriculture. The purposes of the center are: to help maintain the 780 acres there; to assist with the research of any faculty or staff from Virginia Tech; and to distribute the results of forestry research "to the commonwealth and the folks who can use it," ranging from forest landowners to scientists to schoolchildren, Peer said.

News from Reynolds Homestead

The center has active research projects going on and the number of projects changes based on the needs of the students. Also, groups of students are hosted from the local area schools and the center caters its programs to match the state Standards of Learning. Students learn about habitats, forest management, wildlife and water.

The center also offers workshops for the general public. Peer leads forestry and wildlife tours and conducts training sessions for Virginia Master Naturalists. The center is also used to teach and train loggers in Virginia under Virginia Tech's SHARP Logger Program. The SHARP logger program's purpose is to "train every logger and forester in the Commonwealth in the principles of sustainable forestry, environmental protection and workplace safety."

Some of the current projects in the woods at Reynolds Homestead include work on how to reduce erosion on roads, how to cross streams with the least damage to the streams and surrounding areas, and how to reintroduce trees along waterways after bridge construction. A Forest Productivity Cooperative (FPC) study looks at why loblolly pines grow better in Brazil than in their native central North Carolina – and in Virginia, where climate and soil conditions are similar. The FPC study is being conducted by researchers from Virginia Tech and other southern universities, universities in Brazil and Chile, and some industry cooperators.

"The money is pooled. We can answer the

Kyle Peer, Superintendent of the Forestry Research Center at Virginia Tech.

question together and share the answer," Peer said. Much of the work is by the U.S. Forest Service, he said, and the equipment belongs to them: "They are the primary researchers. We are here to assist."

Many people do not understand foresters and what motivates them, Peer said. "Foresters truly do care about the environment. It's the reason we went into this, forestry. When people drive by a clearcut, they see it as damage to the environment. Clearcut is just one of the tools to manage a forest. "We use tools and science when we do what we do" to create different types of habitats and to protect the environment and nature, he continued. "We do it because we're passionate about nature and forests, and our goal is always to leave the forest better than we found it."

While part of the goal is to protect nature, he said, he hopes that people "also understand that the world needs natural resources, (such as) timber and fiber." Foresters "create a balance for future generations of recreation, nature and wood."

Administrative and Technical Staff

Administrative Staff

Tiffany Brown
Program Administrator

Kathryn Hollandsworth
Program Support Technician

Stacey Kuhar
Office Support Specialist

Tracey Sherman
Web and Program Support Technician

Mary Williams
Assistant to the Department Head

Technical Staff

Deborah Bird
Forest Research Assistant

Reilly Henson
Project Technician

David Mitchem
Senior Laboratory Specialist

John Peterson
Laboratory Specialist Advanced

E. Tal Roberts, Jr.
Laboratory Mechanic

Clay Sawyers
Forestry Research Manager

Selected Honors and Awards for Faculty, Staff, and Graduate Students

Faculty

Mike Sorice was promoted to the rank of associate professor with tenure. He joined the department in August 2011 as an assistant professor in outdoor recreation and human dimensions. Sorice received his Ph.D. in 2008 from the Department of Wildlife & Fisheries Sciences at Texas A&M University and worked as a post-doctoral research associate in Texas A&M's Department of Ecosystem Science and Management from 2008 to 2011.

Susan Day received the L.C. Chadwick Award for Research from the International Society of Arboriculture (ISA) in 2017. An ISA Award of Distinction is an international award that recognizes career impact on the professions of arboriculture and urban forestry through research.

Jeff Marion was named the 2017 recipient of the Philmont Staff Association (PSA) Distinguished Staff Alumni Award. The award is presented annually to a current or former Philmont staff member to recognize "distinguished or exceptional personal success or achievement on a national or international level that brings honor and credit to the legacy of the Philmont staff."

Brian Strahm was named a Research Fellow of the Organization for Economic Co-operation and Development (OECD; oecd.org), an international body of ~35 member countries designed to promote economic growth, prosperity, and sustainable development across the globe. Specifically, this fellowship was awarded under the OECD's Co-operative Research Programme for Biological Resource Management for Sustainable Agricultural Systems, with the stated objective to "strengthen scientific knowledge and provide relevant scientific information and advice that will inform future policy decisions related to the sustainable use of natural resources, in the areas of food, agriculture, forests and fisheries."

Selected Honors and Awards for Faculty, Staff, and Graduate Students

(continued)

Faculty *(continued)*

Eric Wiseman received the Outstanding Service Award from the Virginia Tech Program in Real Estate for serving on the program's steering committee from its inception in 2010 to 2017. He served as the representative of the College of Natural Resources and Environment on the committee and concluded his service in May 2017. Wiseman also received the Paul F. Revell Scenic Trees Award. This was awarded by Scenic Virginia to the Virginia Big Tree Program.

Randy Wynne received the annual Award in Forest Science from the Society of American Foresters for his research in remote sensing applications at the SAF national convention in 2017.

This award recognizes distinguished individual research in any branch of the quantitative, economic, managerial, and/or social sciences that has resulted in substantial advances in forestry.

Staff

Tiffany Brown received the 2017 College of Natural Resources and Environment Dean's Award. This award is given each year to a staff employee in recognition of exemplary performance and service to their department, college, and the university.

Graduate Students

Catherine Bukowski was one of four doctoral program students who have displayed outstanding academic, scientific, and professional leadership. She was recognized at the Graduate Education Week awards banquet on March 30, 2017, and received the A.B. Massey Award. Alumni and friends established this award in 1965 to honor the outstanding contributions of Professor A.B. Massey.

Selected Honors and Awards for Faculty, Staff, and Graduate Students

(continued)

Jill Derwin was presented the Outstanding Teaching Assistant award for FREC. The award is presented to recognize a graduate student within each department of the college who has demonstrated excellence as a teaching assistant and significantly contributed to the instructional program within the department.
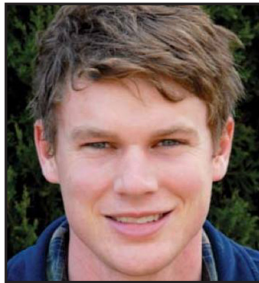
Corey Green was awarded a 2017 Forest Landowner Foundation Scholarship at the Annual Convention of the Forest Landowners Association held in Asheville, North Carolina, in May 2017. The Forest Landowner Foundation annually recognizes high-potential students by awarding scholarships to selected individuals pursuing an undergraduate or graduate degree in forestry. These scholarships require high academic standing, demonstrated leadership, and an interest in working with private, non-industrial landowners.

Edward Russell received an award at the 19th Biennial Southern Silvicultural Research Conference held at The Inn at Virginia Tech in March 2017. The award was one of four given for outstanding graduate student presentation.

Tony Timpano received the 2017 Karen P. DePauw Outstanding Interdisciplinary Presentation Award at the Interfaces of Global Change (IGC) Graduate Research Symposium.

Kriddie Whitmore was awarded FREC's H.E. Burkhart Outstanding Master's Student Award. This award honors Dr. Burkhart's years of dedicated graduate student research and mentoring. The award is presented to four Master's program students, one in each of the academic departments of the college, and is based on academic, scientific, and professional achievement.

Graduate Research

Troy Frensley is a fourth-year Ph.D. student in the Forestry program. His research has involved developing novel methods for examining how different pedagogical approaches influence student outcomes in environmental education programs. His work is on the cutting edge of the field, not only methodologically, but also in terms of theoretical development and practical implications – with lessons for enhancing the environmental literacy of school-aged children throughout the United States.

Troy is currently working with **Marc Stern** and another principal investigator from Clemson University to extend what he has been learning to a national study of similar programs across the United States. He has been instrumental in methods development and in training our research team. He has also served as a kind and knowledgeable mentor to current Master's students in his field.

Carrie Jensen is a fourth-year Ph.D. student in the Geospatial and Environmental Analysis program. She is the first Cunningham Fellow awardee from the Graduate School in FREC since 1996. She has received local, state, and national level grants to support her Ph.D. research. Carrie was a Presidential Scholar at the University of Georgia, where she completed her B.S. and M.S. degrees. She dual majored in Geography and Spanish, graduating summa cum laude in 2011.

Carrie's project focuses on characterizing and predicting the spatial dynamics of stream network expansion/contraction and connection/disconnection in the Appalachian Highlands. This work has important implications for how temporary streams are defined and is directly related to the recent US policy regarding Clean Water Act jurisdiction.

Graduate Research *(continued)*

Raymond Ludwig is a second-year Master's student in the Forestry program. His work focuses on the Great Dismal Swamp, a 45,000 ha National Wildlife Refuge in southeastern Virginia and northeastern North Carolina.

The Great Dismal Swamp has been ditched and drained since colonial times, and Ray's work seeks to inform current large-scale management efforts to restore both hydrologic regime and historical forested wetland communities. To do so, Ray has spent long, arduous days in the field for over two years, exploring rarely seen areas across all corners of the swamp. This has required swimming canals, full-day hikes, and full-body bug nets; Ray smiles through it all!

Ray's findings are providing important insights into variation and drivers of forest composition, peat soils, and associated function, with implications for on-the-ground management decisions.

Kiandra Rajala is a second-year Master's student. She currently studies how private landowners perceive changes to the landscape and respond through the use of varied management practices. This work is part of a larger multi-disciplinary project studying the social-ecological dynamics of grassland conversion to woodlands in the Southern Great Plains. As a master's student, she is pioneering a new way to think about one of the well-studied concepts in the field of human dimensions of natural resources.

Kiandra has also presented on other topics, receiving an "Outstanding Graduate Student Poster Presentation" award at a regional conference for a project that examined visitor preferences for accessing Virginia state forest land. And, she is the well-deserved second author of a recently published paper on the role of absenteeism and landowner involvement in private land management.

Graduate Research *(continued)*
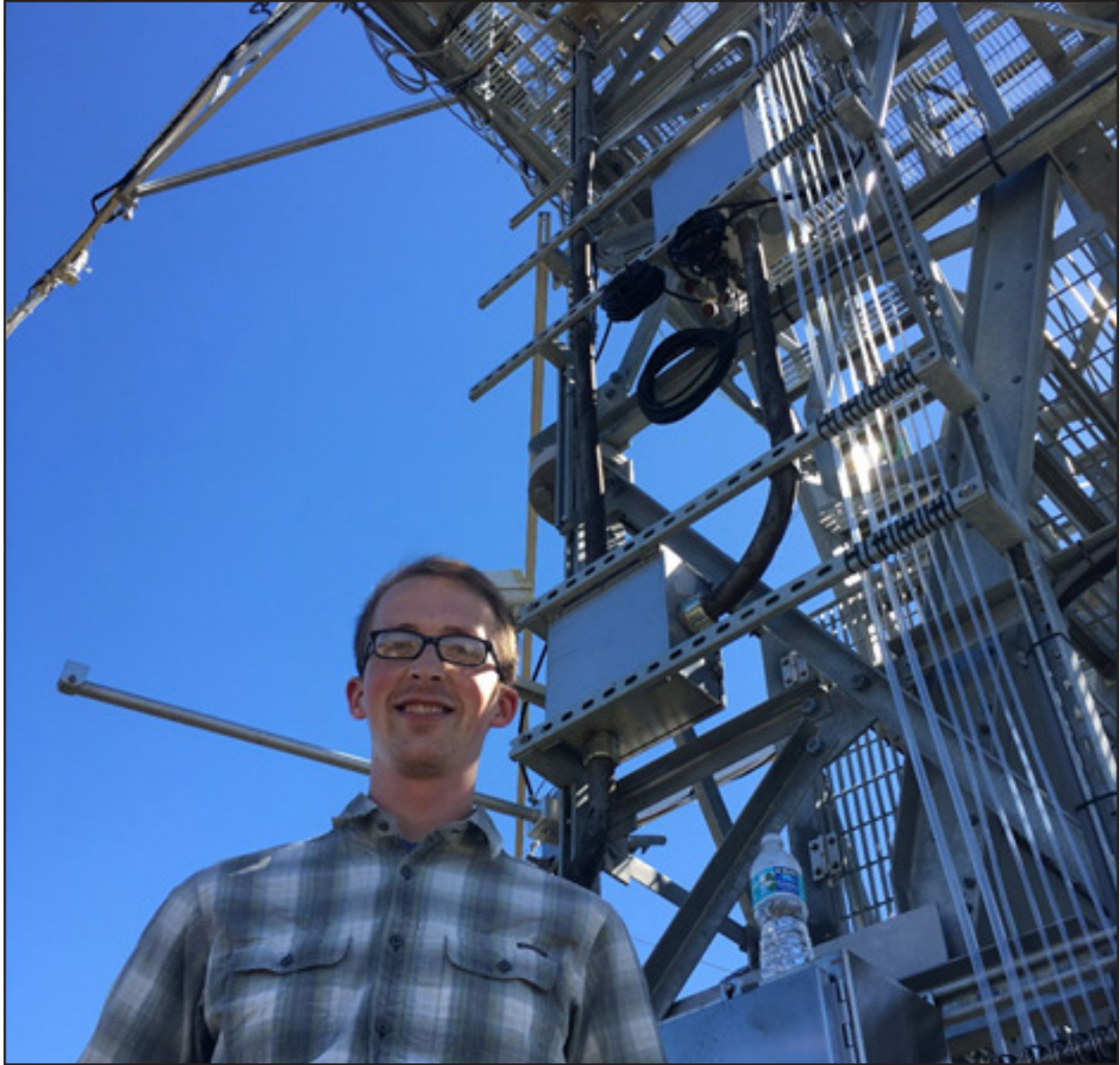
Tyler Weiglein is a first-year Master's student. He is working on an NSF MacroSystems Biology supported project to leverage the National Ecological Observatory Network (NEON; http://www.neonscience.org) to understand continental scale controls on soil carbon stabilization and its potential vulnerability to land use and climate change. As soils represent the largest active terrestrial carbon pool (more than all of the atmosphere and global vegetation combined), this work will be critical in improving carbon management and modeling.
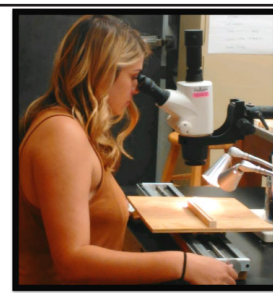
Undergraduate Research
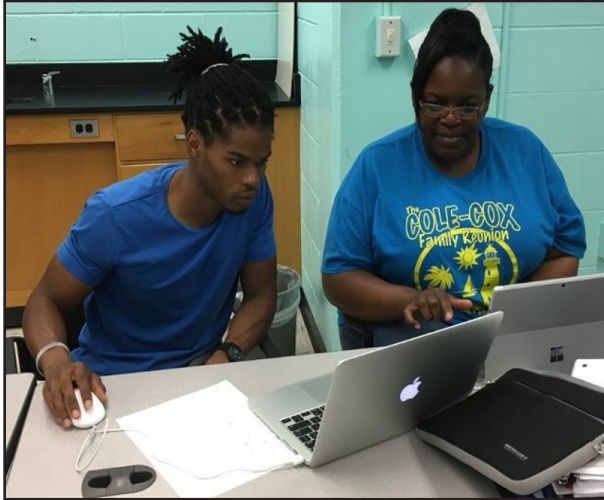
Isaiah Byrd, Abigail Coley, and **Laura Fowler** were summer interns through the Multicultural Academic Opportunity Program (MAOP) working with **Carolyn Copenheaver**. They participated in a 10-week program in which they participated in professional development workshops, GRE-practice sessions, and undergraduate research. They were all biology or environmental science majors at the University of West Alabama, and Dr. Ketia Shumaker, faculty member from the University of West Alabama, helped mentor these undergraduates on their projects. They collected samples of eastern hemlock and sugar maple in Wisconsin and Michigan to address three different research hypotheses that they had developed with guidance from their faculty advisers.

Abigail Coley focused on radial growth response of coniferous and deciduous trees to late growing season frosts in Michigan. Isaiah Byrd focused on differences in frequency and intensity of canopy disturbances across the range of eastern hemlock. Extreme climatic events, such as late frost, may have a greater impact on long-term tree growth than previously realized. They tested whether late frost reduced tree-ring growth in coniferous and deciduous trees. To observe differences in tree-ring width during frost and non-frost years, they used superposed epoch analysis and a t-test to analyze tree-ring data from three coniferous (eastern hemlock, white pine, and red pine) and three deciduous (red maple, red oak, and bigtooth aspen) trees. The frost years had significantly narrower ring widths than non-frost years ($t = -4.261$, $P = 0.004$). There was no evidence that deciduous trees had a greater reduction in tree-ring width than coniferous trees during frost years. Therefore, late frosts reduce growth in both coniferous and deciduous trees.

Undergraduate Research

(continued)

Laura Fowler focused on dendroclimatic response of eastern hemlock at lakeshore and interior sites in Michigan. Climate varies between Michigan's interior and lakeshore environments, creating different growing conditions for trees. The hypothesis was that there would be fewer significant correlations between tree-ring width and climate at the lakeshore compared to the interior. Eastern hemlock trees were cored from two sites in Michigan. Tree rings at the interior site had more significant correlations to climate than tree rings at the lakeshore site. Thus, growth in eastern hemlock trees growing in the interior of Michigan are more affected by climate.

Angie Green and **Haleigh Martin** participated in an independent study with **Mike Sorice** to help Virginia State Parks understand millennial engagement with state parks. They integrated ethnographic research methods to record experiences with research on millennials to provide the state parks leadership team with insights on enhancing their appeal to this demographic.

Landry Horner, an Environmental Resource Management Major, has been an undergraduate researcher in the **Amy Brunner** lab since October 2016. She has been helping to produce and study genome-edited aspens to identify genes involved in phenology (seasonal growth and dormancy transitions). Landry is characterizing trees under controlled photoperiod and temperature regimes by monitoring the timing of growth cessation, bud set and bud flush. She is using microscopy to monitor the activity of the wood-producing vascular cambium during the environmental treatments. She also used histological methods to study tension wood development in an aspen genotype with unusual horizontal, curved branches.

Undergraduate Research

(continued)

Sara Cerv, an Environmental Informatics major, and **Coy Lemmert,** a Forestry major, put their interests in environmental informatics and forest resource management and modeling to work conducting research on three-dimensional measurement and modeling of tree crowns and forest canopies at the Harvard Forest and in Virginia Tech's Fishburn School Forest in August and September 2017. The work, part of a collaborative effort with researchers from Australia, Europe, and North America, addressed questions spanning several disciplines including forest biometrics and ecology, remote sensing, and computer science. The goal of the work was to test newly-emerging technologies based on laser scanning to construct highly realistic 3D virtual models of standing trees. By working with virtual models instead of real trees, research that previously relied on expensive and time-consuming destructive sampling -- such as determining the amount of biomass in wood, branches, or leaves -- can now be done non-destructively, much faster, and at a fraction of the cost. Tools like these are already giving foresters and scientists new ways to look at trees compared with what was possible in the past.

Laura Puckett, an Environmental Informatics major, is working with **Quinn Thomas** on examining how calibration of an ecosystem model using diverse observation of forest ecosystems (diameters, eddy-covariance fluxes, sap flow, leaf area index) influences parameter values and the associated forecast of how ecosystems respond to elevated CO_2 and climate change.

2017 FREC Advisory Board Members

2017 Chair: Mike Hincher - The Forestland Group, LLC, Abingdon, VA

2017 Chair-Elect: Danette Poole - Virginia Department of Conservation and Recreation, Richmond, VA

Michael P. Cerchiaro - Forest Investment Associates, Atlanta, GA

Keith W. Cline - Department of Public Works and Environmental Services, Fairfax, VA

Ethan Crockett - Bartlett Tree Experts, Richmond, VA

Chris Davidson - Corporate Sustainability WestRock, Richmond, VA

Kyle Dingus - Virginia Department of Forestry, Warrenton, VA

Brad Fuller - Huber Engineered Woods, LLC, Crystal Hill, VA

Brent Keefer - Hancock Timber Resource Group, Boston, MA

James Kuykendall - Glatfelter Company, Spotsylvania, VA

Easton Loving – WestRock, Appomattox, VA

Ed Milhous – TreesPlease, Haymarket, VA

Chuks Ogbonnaya - Mountain Empire Community College, Big Stone Gap, VA

Greg Scheerer – WestRock, Appomattox, VA

Lauren Stull - USDA Forest Service, Natural Bridge Station, VA

Darrel Williams - Global Science & Technology, Inc., Greenbelt, MD

Ex-Officio Members

Bill Burkman - USDA Forest Service Southern Research Station

Bettina Ring - Virginia Secretary of Agriculture and Forestry, Richmond, VA

Paul Howe - Virginia Forestry Association, Richmond, VA

Billy Newman - Dabney S. Lancaster Community College, Clifton Forge, VA

Joby Timm, George Washington and Jefferson National Forest, Roanoke, VA

Robert L. Doudrick - USDA Forest Service Southern Research Station

Marcus Comer - Virginia State University, Petersburg, VA

Extension

Virginia Forest Landowner Education Program

Over 900 woodland owners, who owned over 82,000 acres of land, attended one or more of these programs. In addition, VFLEP conducted 4 trainings for 79 natural resource professionals, and 22 presentations on woodland-management related topics were given across Virginia.

The Virginia Forest Landowner Education Program (VFLEP) develops and delivers educational programs and materials about sustainable forest management to over 10,000 Virginia forest owners annually. This program is coordinated through Virginia Tech's Department of Forest Resources and Environmental Conservation.

Specific goals of VFLEP include providing woodland owners with the knowledge and tools they need to practice sustainable forest management, increasing the health and productivity of Virginia's 10.1 million acres of privately-owned woodlands, generating public understanding and support for the management of Virginia's vast forest resources, and conserving Virginia's woodland base.

In 2017, VFLEP offered 23 landowner programs. These included Beginning Landowner Weekend Retreats (3), On-line Woodland Options for Landowners, Fall Forestry & Wildlife Field Tours (4), and Tree Farmer Dinners (4).

Landowner education materials included 4 print issues of the quarterly Virginia Forest Landowner Update that were sent out to over 7,100 landowners, and 11 e-newsletters that were sent out to over 4,400 subscribers. These newsletters contain current woodland and wildlife management information, as well as descriptions of upcoming landowner education programs.

In 2017 VFLEP began a strategic planning process that included a needs assessment of 10,000 woodland owners across Virginia. The results of this assessment are being analyzed and will be available later in 2018.

The VFLEP Team includes **Jennifer Gagnon**, Coordinator, and **Andrew Vinson**, Extension Associate, as well as **Adam Downing, Neil Clark, Jason Fisher,** and **Bill Worrell**, District Forestry & Natural Resources Extension Agents. In addition, most of our work is conducted in collaboration with the Virginia Department of Forestry, the Virginia SFI State Implementation Committee, the Virginia Tree Farm Foundation, and other natural resources partners in Virginia.

Extension

(continued)

Virginia SHARP Logger Program

The Virginia SHARP Logger program (http://sharplogger.vt.edu/) has been a Virginia Tech Forestry Extension Program since 2002. The SHARP Logger program provides training in the principles of sustainable forestry, environmental protection, and workplace safety. The program receives support from Sustainable Forestry Initiative (SFI) program participants operating in Virginia through the Virginia SFI State Implementation Committee (http://virginiasfi.org/), coordinated by **Scott Barrett**. The vast majority of all logging businesses in Virginia have received training through the Virginia SHARP Logger program. The SHARP Logger program offers a three-part "core" program for participants to become SHARP Loggers, and then there is a continuing education (CE) requirement to maintain their SHARP Logger status. In 2017, there were a total of 6 core programs and 17 CE classes offered across

Virginia. Over 700 individuals attended at least one training to receive credit through the SHARP Logger program in 2017.

In addition to traditional classes offered across Virginia, the SHARP Logger program also has a total of eight online CE trainings. At the beginning of 2017, **Andrew Vinson** was hired as an Extension Associate to assist with implementation of SHARP Logger programs across Virginia. He works with the District Forestry and Natural Resources Extension Agents and others to provide training opportunities to loggers across Virginia.

Extension (continued)

Virginia Master Naturalist (VMN) Program

The Virginia Master Naturalist (VMN) program is a statewide corps of volunteers providing education, outreach, and service dedicated to the beneficial management of natural resources and natural areas within their communities. The program aims to extend the capacities of both state and local natural resource agencies and organizations to be able to achieve their missions in new ways, engage new audiences, and work towards creating a citizenry more informed about and involved in natural resource conservation and management.

The VMN program currently has 1,845 active volunteers who reported service in 2017. These volunteers contributed significant service in the areas of education (38,842 hours), citizen science (54,420 hours), stewardship (36,516 hours), and chapter administration (28,214 hours). These hours amount to more than $3.8 million in contributions to natural resource conservation in Virginia (based on IndependentSector. org value of a volunteer hour.) Volunteers improved local natural resource conditions at more than 300 sites through invasive plant management in parks, planting of habitats for pollinators and other wildlife, and trail maintenance of hundreds of miles of trails. They also contributed to citizen science studies of birds, phenology, mammals, butterflies, stream health, and more. Among these studies were several new statewide projects that documented distributions of spotted skunks, investigated ecology of mason bees, and measured firefly populations. Volunteers also made more than 125,000 contacts through educational programs in their communities. These programs included day camps and afterschool programs for youth in partnership with 4-H, talks for local community groups, and activities at numerous special events, such as local Earth Day celebrations.

Our program team includes **Michelle Prysby** (VMN Program Director and FREC Extension faculty), **Tiffany Brown** (VMN project assistant and FREC administrative staff), and **Terri Keffert** (VMN volunteer coordinator and part-time FREC staff).

Virginia Master Naturalist volunteers help to restore habitat at a local park by planting native plants. (Photo by VMN-Arlington Regional Chapter)

A Virginia Master Naturalist volunteer collects a water sample to monitor water quality in a local stream. (Photo by VMN-Arlington Regional Chapter)

Virginia Master Naturalist (VMN) Program

(continued)

Some of the significant initiatives for the program in 2017 were:

- A series of regional Leadership Days, at which we provided training in volunteer management, effective communication, and other leadership skills to 117 volunteer leaders in local Virginia Master Naturalist chapters. Ninety-five percent of participants stated that participating in a Leadership Day made them feel more likely to want to continue serving as a board member, and 97% stated that their participation gave them new ideas that they plan to implement within their chapters.
- VMN Statewide Conference, an annual gathering of VMN volunteers from across the state at which we provide continuing education to build the volunteers' skills and knowledge. In 2017, we held our largest conference to date, with more than 200 attendees coming together to attend dozens of different concurrent sessions at the Northern Virginia 4-H Center and neighboring natural areas.
- Development and release of VMN basic training curriculum on Citizen Science and Research Skills.
- A successful crowdfunding campaign in partnership with the Virginia Tech Foundation, through which we raised needed funds to continue our program efforts in 2018.
- Successful engagement of the seven state agencies that co-sponsor and co-fund the project, resulting in renewals of their funding for the program for an additional three years.

Geospatial Extension Program

Geospatial Technician Education - Unmanned Aircraft Systems (GeoTEd-UAS)

The Virginia Geospatial Extension Program (VGEP) continued working on a multi-year NSF project called Geospatial Technician Education Program for Unmanned Aircraft Systems (GeoTEd-UAS). Through GeoTEd-UAS, the VGEP developed a curriculum chart of the major tasks and duties required by the drone industry. This chart now forms a foundation for Small Unmanned Aircraft System (sUAS) curriculum development for various colleges and universities across Virginia. The VGEP hosted educational opportunities on drone operation, safety, and data processing. The GeoTEd-UAS Institute, for example, is a six-day intensive "sUAS boot camp."

National Extension Webmapping Tool (NEWT)

The Geospatial Extension Program received funding from the eXtension foundation to design and develop a national web mapping tool to support the needs of the Cooperative Extension System (CES). The National Extension Webmapping Tool (NEWT) was developed in partnership with University of New Hampshire and through the VT Center for Geographic Information Technology (CGIT). This online mapping tool supports the reporting, training, and program planning needs of Extension agents, specialists, and administrators.

sUAS Operations

Small Unmanned Aircraft System (sUAS) operations continue to be conducted across Virginia. Through an eXtension Innovation Grant, the VGEP is working with small cattle operations in Southwest Virginia to identify the opportunities and challenges associated with sUAS implementation.

Wintermester

Each January, a select group of Virginia Tech students embark to Panama for a two-week Wintermester experience in Panama. Through this course, students explore the intersection of culture, economy, and ecology. Students explore historic Panama City, "the canal," live among the indigenous Guna, and camp in a remote rain forest. Students are active learners at the Cocobolo Research Station and work with scientists from Panama, Colombia, the Netherlands, and the United States.

International Activities

Harold Burkhart was an invited speaker at the Brazilian Region of the International Biometric Society meeting in Lavras where he addressed the topic of Data-driven versus Model-based Predictions.

Susan Day hosted a Ph.D. candidate, Luis Orozco from the University of Melbourne, Australia, for a one month Urban Forest Research Internship in August 2017.

Carol Franco and Virginia Tech were granted observer status at the United Nations Framework Convention on Climate Change in 2017 and for the first time, participated in the climate change negotiations as an observer organization. Franco led this initiative.

Carol Franco and **Randy Wynne** from FREC participated in the climate change negotiations in Bonn, Germany, and led the Virginia Tech delegation, together with two Virginia Tech students from the "Climate Change and the International Policy Framework (FREC 5984)" course. Hannah Wynne, a sophomore student doing a Bachelor in Arts and English and Katherine Bland, a Master of Science student from the Biological System Engineering Department, had the opportunity to experience firsthand the climate change negotiation process and followed the topics of gender and climate change and renewable engergy.
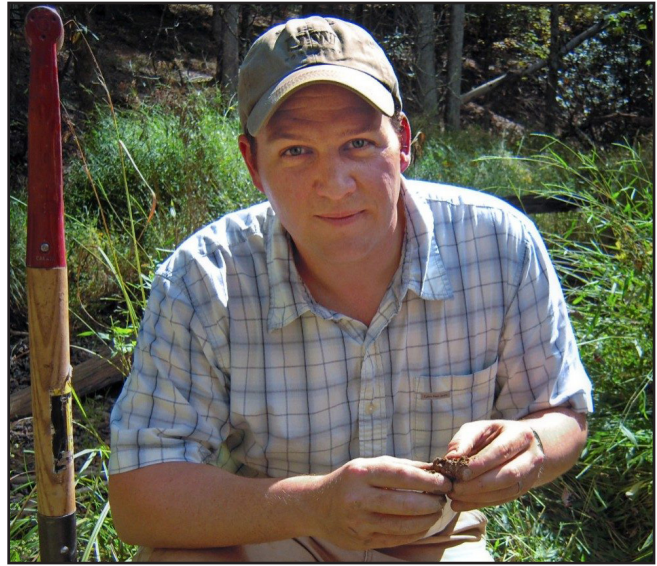
Kevin McGuire served as Chair of International Conference: Gordon Research Conference on Catchment Science: Interactions of Hydrology, Biology & Geochemistry.

Daniel McLaughlin was an invited participant in the North American Wetland Connectivity Workgroup, supported by the USGS Powell Center. This workgroup includes researchers from the United States and Canada and focuses on wetland connectivity at continental scales, which is relevant to both U.S. and Canadian environmental policy.

Marc Stern conducted the NR 5114 Global Issues in Sustainability course in Summer/Fall, which culminated in an immersion in Bali, Indonesia, in August 2017 for Master's students in the MNR program.

International Activities

(continued)

Brian Strahm was named a Research Fellow of the Organization for Economic Co-operation and Development (OECD; oecd.org), an international body of ~35 member countries designed to promote economic growth, prosperity, and sustainable development across the globe. Specifically, this fellowship was awarded under the OECD's Co-operative Research Programme for Biological Resource Management for Sustainable Agricultural Systems, with the stated objective to "strengthen scientific knowledge and provide relevant scientific information and advice that will inform future policy decisions related to the sustainable use of natural resources, in the areas of food, agriculture, forests and fisheries."

Under the aegis of the OECD, Strahm partnered with Scion (scionresearch.com), the New Zealand Crown Research Institute for forestry. Specifically, he partnered with Dr. Peter Clinton, the Science Team leader of Scion's Forest Systems group, and the Programme Leader of the Growing Confidence in Forestry's Future (GCFF; gcff.nz) programme, a six-year, ~$30 million effort to improve the productive capacity, economic vitality, and environmental sustainability of New Zealand's forestry sector.

Strahm's work through the OECD with Scion focuses on the acute national need to optimize nitrogen management for the simultaneous improvement of forest productivity and environmental (especially water) quality. The forestry sector in New Zealand has set the ambitious goal of doubling productivity by 2022. An important component of achieving this goal is increased forest nitrogen fertilization. Concerns about nitrogen fertilization include economic inefficiencies associated with low confidence in predicting growth response of individual stands, and environmental concerns of the negative impact of leached nitrogen on water quality. His work uses nitrogen stable isotope analysis to predict forest stands that retain and respond to added nitrogen. This work is based on similar studies across managed forest ecosystems in the United States and will leverage existing New Zealand-wide trials with the ultimate goal of providing the information needed to improve decision support frameworks and inform ongoing policy discussions regarding land use change and intensification impacts on water quality across New Zealand. As a result, he was invited to address this issue in a keynote address to research, industry, and government interests at the annual GCFF conference.

Refereed Publications

Ahlswede, B.J., and **R.Q. Thomas**. 2017. Community earth system model simulations reveal the relative importance of afforestation and forest management to surface temperature in eastern North America. *Forests* 8:499.

Albaugh, T.J., R.A. Rubilar, C.A. Maier, E.A. Acuña, and R.L. Cook. 2017. Biomass and nutrient mass of *Acacia dealbata* and *Eucalyptus globulus* bionergy plantations. *Biomass Bioenerg*. 97:162-171. DOI: 10.1016/j.biombioe.2016.12.025.

Albaugh, T.J., **T.R. Fox**, R.A. Rubilar, R.L. Cook, **R.L. Amateis**, and **H.E. Burkhart.** 2017. Post-thinning density and fertilization affect *Pinus taeda* stand and individual tree growth. *For. Ecol. Manage*. 396:207-216. DOI: 10.1016/j.foreco.2017.04.030.

Arias -Rodil, M., U. Dieguez-Aranda, and **H.E. Burkhart.** 2017. Effects of measurement error in total tree height and upper-stem diameter on stem volume prediction. *For. Sci.* 63:250-260.

Barrett, S.M., **M. C. Bolding**, and **J.F. Munsell.** 2017. Characteristics of logging businesses across Virginia's diverse physiographic regions. *Forests* 8:468. Special Issue: Forest Operations, Engineering and Management. DOI: 10.3390/f8120468.

Benettin, P., S.W. Bailey, A. Rinaldo, G.E. Likens, **K.J. McGuire**, and G. Botter. 2017. Young runoff fractions control streamwater age and solute concentration dynamics. *Hydrol. Proc.* 31:2982-2986. DOI: 10.1002/hyp.11243.

Bourgault, R.R., D.S. Ross, S.W. Bailey, **K.J. McGuire**, and J.P. Gannon. 2017. Redistribution of soil metals and organic carbon via lateral flowpaths at the catchment scale in a glaciated upland setting, *Geoderma* 307:238-252. DOI: 10.1016/j.geoderma.2017.05.039.

Brooks, E.B., Z. Yang, **V.A. Thomas**, and **R.H. Wynne**. 2017. Edyn: Dynamic signaling of changes to forests using exponentially weighted moving average charts. *Forests* 8:304. DOI:10.3390/f8090304.

Browning, M.H.E.M., **M.J. Stern**, N.M. Ardoin, J.E. Heimlich, R. Petty, and C. Charles. 2017. Investigating the sets of values that community members hold toward local nature centers. *Environ. Educ. Res.* 23:1291-1306.

Refereed Publications

(continued)

Brunner, A.M., E. Varkonyi-Gasic, and R.C. Jones. 2017. Phase change and phenology in trees. pp. 227-274 *In:* Comparative and Evolutionary Genomics of Angiosperm Trees. Groover, A., and Q. Cronk (Eds.). Cham, Switzerland: Springer. DOI: 10.1007/7397_2016_30.

Burkhart, H.E., **A.M. Brunner**, B.J. Stanton, R.A. Shuren, **R.L. Amateis**, and J.L. Creighton. 2017. An assessment of potential of hybrid poplar for planting in the Virginia Piedmont. *New Forests* 48:479-490.

Burkhart, H.E., **E.B. Brooks**, H. Dinon-Aldridge, C.O. Sabatia, N. Gyawali, **R.H. Wynne**, and **V.A. Thomas**. Regional simulations of loblolly pine productivity with CO2 enrichment and changing climate scenarios. *For. Sci.* (in press).

Chance, E., **K. Cobourn**, **V. Thomas**, B. Dawson, and A. Flores. 2017. Erratum: Chance, E.W., et al. Identifying irrigated areas in the Snake River Plain, Idaho: Evaluating performance across compositing algorithms, spectral indices, and sensors. *Remote Sens.* 2017, 9, 546. *Remote Sens.* 9:738. DOI:10.3390/rs9070738.

Chance, E.W., **K.M. Cobourn**, **V.A. Thomas**, B.C. Dawson, and A.N. Flores. 2017. Identifying irrigated areas in the Snake River Plain, Idaho: Evaluating performance across compositing algorithms, spectral indices, and sensors. *Remote Sens.* 9:546.

Chandler, H. C., **D.L. McLaughlin**, T.A. Gorman, **K.J. McGuire,** J.B. Feaga, and C.A. Haas. 2017. Drying rates of ephemeral wetlands: Implications for breeding amphibians. *Wetlands* 37:545-557. DOI: 10.1007/s13157-017-0889-1.

Coates, T.A., A.T. Chow, D.L. Hagan, G.G. Wang, W.C. Bridges, and J.H. Dozier. 2017. Frequent prescribed fire as a long-term practice in longleaf pine forests does not affect detrital chemical composition. *J. Envir. Qual.* 46:1020-1027.

Cohen, W.B., S.P. Healey, Z. Yang, S.V. Stehman, C.K. Brewer, **E.B. Brooks**, N. Gorelick, C. Huang, M.J. Hughes, R.E. Kennedy, T.R. Loveland, G.G. Moisen, T.A. Schroeder, J.E. Vogelmann, C.E. Woodcock, L. Yang, and Z. Zhu. 2017. How similar are forest disturbance maps derived from different Landsat time series algorithms? *Forests* 8:98.

Conrad, J.L. IV, M.M. Vokoun, S.P. Prisley, and **M.C. Bolding**. 2017. Barriers to logging production and efficiency in Wisconsin. *Intl. J. For. Eng.* 28:57-65.

Refereed Publications

(continued)

Copenheaver, C.A., D.E. Dawson, M.N. Garza, and D.G. Nemens. 2017. Dendroclimatic responses of sugar maple tapped for maple syrup: A case study from Pennsylvania. *Tree-Ring Res.* 73:1-7.

Copenheaver, C.A., J.D. Matiuk, L.J. Nolan, M.E. Franke, P.R. Block, W.P. Reed, K.R. Kidd, and G. Martini. 2017. False ring formation in bald cypress (*Taxodium distichum*). *Wetlands* 37:1037-1044.

Copenheaver, C.A., M.J. Pulice, N.J.W. Lawrence, C.H. Raso, E.C. Cankaya, H. Wan, and B.T. Poling. 2017. Dendroarchaeology reveals influence of early-European settlement on forest disturbance regimes in the Appalachian Mountains, USA. *Ecoscience* 24:33-40.

Creed, I.F., C.R. Lane, L. Alexander, N.B. Basu, A. Calhoun, M.J. Cohen, C. Craft, E. D'Amico, E. DeKeyser, L. Fowler, H.E. Golden, J.W. Jawitz, P. Kalla, L.K. Kirkman, M. Lang, S.G. Leibowitz, D.B. Lewis, J. Marton, **D.L. McLaughlin,** H. Raanan-Kiperwas, M.C. Rains, L. Smith, and J.N. Serran. 2017. Enhancing protections for vulnerable waters. *Nat. Geosci.* 10:809-815. DOI: 10.1038/NGEO3041.

Cristan, R., **W.M. Aust, M.C. Bolding, S.M. Barrett, J.F. Munsell**, and E. Schilling. 2017. National status of state developed and implemented forestry best management practices for protecting water quality in the United States. *For. Ecol. Manage.* (in press). DOI: 10.1016/j. foreco.2017.07.002.

Day, S.D., and J. R. Harris. 2017. Improving soil quality for urban forests. pp 309-322 *In*: The Routledge Handbook of Urban Forestry. Konijnendijk van den Bosch, C., F. Ferrini, and A. Fini (Eds.). London: Routledge. 540 pp.

Day, S.D., and J. R. Harris. Improving soil quality for urban forests. 2017. pp 309-322. *In:* The Routledge Handbook of Urban Forestry. C. Konijnendijk van den Bosch, F. Ferrini, and A. Fini (Eds.). Routledge, London. 540pp.

De la Mota Daniel, F.J., **S.D. Day**, J.S. Owen, and R.D. Stewart. 2017. Porous pavement effects on rooting depth and development of newly planted trees in sidewalk cutouts. *Acta Hortic.* 1189:371-376. DOI: 10.17660/ActaHortic.2017.1189.71.

Refereed Publications

(continued)

Franz, N.K, **J.F. Munsell, T.N. Brown,** and **H.K. Chittum**. 2017. Evaluate naturally and quickly with Just-in-Time program evaluation. *J. Extension* 55(1).

Frensley, B.T., A.W. Crall, **M.J. Stern**, R. Jordan, S. Gray, **M. Prysby**, G. Newman, C.E. Hmelo-Silver, D. Mellor, and J. Huang. 2017. Bridging the benefits of online and community supported citizen science: A case study on motivation and retention with conservation-oriented volunteers. *Citizen Sci.: Theory and Pract.* 2(1):1-14. DOI: 10.5334/cstp.84.

Frensley, T., A. Crall, **M. Stern**, R. Jordan, S. Gray, **M. Prysby**, G. Newman, C. Hmelo-Silver, D. Mellor, and J. Huang. 2017. Bridging the benefits of online and community supported citizen science: A case study on motivation and retention with conservation-oriented volunteers. *Citizen Sci.*: Theor. Pract. 2:4. DOI:10.5334/cstp.84.

Gannon, J.P., **K.J. McGuire**, S.W. Bailey, R.R. Bourgault, and D.S. Ross. 2017. Lateral water flux in the unsaturated zone: A mechanism for the formation of spatial soil heterogeneity in a headwater catchment. *Hydrol. Proc.* 31:3568-3579. DOI: 10.1002/hyp.11279.

Golden, H.E., I.F. Creed, G. Ali, N.B. Basu, B. Neff, M.C. Rains, **D.L. McLaughlin**, L.C. Alexander, A.A. Ameli, J.R. Christensen, **G.R. Evenson**, C.N. Jones, C.R. Lane, and M. Lang. 2017. Scientific tools for integrating geographically isolated wetlands into land management decisions. *Front. Ecol. Environ.* 15:319-327. DOI: 10.1002/fee.1504.

Gray, S., R. Jordan, A. Crall, G. Newman, C. Hmelo-Silver, J. Huang, W. Novak, D. Mellor, T. Frensley, and **M.D. Prysby**. 2017. Combining participatory modelling and citizen science to support volunteer conservation action. *Biol. Conserv.* 208:76-86. DOI: 10.1016/j.biocon.2016.07.037.

Harris, J.R., and **S.D. Day**. 2017. Navigating the establishment period—A critical period for new trees. pp 390-404 *In*: The Routledge Handbook of Urban Forestry. Konijnendijk van den Bosch, C., F. Ferrini, and A. Fini (Eds.). London: Routledge. 540 pp.

Harris, J.R., and **S.D. Day**. Navigating the establishment period—A critical period for new trees. 2017. pp. 390-404. *In:* The Routledge Handbook of Urban Forestry. C. Konijnendijk van den Bosch, F. Ferrini, and A. Fini (Eds.). Routledge, London. 540pp.

Refereed Publications

(continued)

Healey, S.P., W.B. Cohen, Z. Yang, C.K. Brewer, **E.B. Brooks**, N. Gorelick, A.J. Hernandez, C. Huang, M.J. Hughes, R.E. Kennedy, T.R. Loveland, G.G. Moisen, T.A. Schroeder, S.V. Stehman, J.E. Vogelmann, C.E. Woodcock, L. Yang, and Z. Zhu. 2018. Mapping forest change using stacked generalization: An ensemble approach. *Remote Sens. Environ.* 204:717-728.

Hensley, R.T., **D.L. McLaughlin**, M.J. Cohen, and P.H. Decker, P.H. 2017. Stream phosphorus dynamics of minimally impacted coastal plain watersheds. *Hydrol. Proc.* 31:1636-1649. DOI: 10.1002/hyp.11132.

Holliday, J.A., S.N. Aitken, J.E.K. Cook, B. Fady, S.C. Gonzalez-Martinez, M. Heuertz, J.P. Jaramillo-Correa, C. Lexer, M. Staton, R.W. Whetten, and C. Plomion. 2017. Advances in ecological genomics in forest trees and applications to genetic resources conservation and breeding. *Mol. Ecol.* 26:706-717.

Hurst, K., C. P. Ramsdell, and **M. G. Sorice**. 2017. A life course approach to understanding social drivers of rangeland conversion. *Ecol. Soc.* 22:19.

Hwang, W.H., **P.E. Wiseman**, and **V.A. Thomas**. 2017. Enhancing the energy conservation benefits of shade trees in dense residential developments using an alternative tree placement strategy. *Landscape Urban Plan.* 158:62-74. DOI:10.1016/j.landurbplan.2016.09.022.

Jensen, C.K., **K.J. McGuire**, and P.S. Prince. 2017. Headwater stream length *dynamics across four physiographic provinces of the Appalachian Highlands. Hydrol. Proc.* 31:3350-3363. DOI: 10.1002/hyp.11259.

Jones, C.N., **D.L. McLaughlin**, K. Henson, C.A. Haas, and D.A. Kaplan. 2018. From salamanders to greenhouse gases: Does upland management affect wetland function? *Front. Ecol. Environ.* 16:14-19. DOI: 10.1002/fee.1744.

Jones, C.N., **G.R. Evenson**, **D.L. McLaughlin**, M. Vanderhoof, M. Lang, G. McCarty, H. Golden, C. Lane, and L. Alexander. 2017. Estimating restorable wetland water storage at landscape scales. *Hydrol. Proc.* 32:305-313. DOI: 10.1002/hyp.11405.

Refereed Publications

(continued)

Kim, S., M.A. Nussbaum, A.L. Schoenfisch, **S.M. Barrett**, **M.C. Bolding**, and D.E. Dickerson. 2017. Occupational safety and health concerns in logging: A cross-sectional assessment in Virginia. *Forests* 8:440. Special Issue: Forest Operations, Engineering and Management. DOI: 10.3390/f8110440.

Kuusela, O.P., **G.S. Amacher**, and K. Moeltner. 2017. Enforcing the rules in timber concessions: Performance bonding in the presence of corruption risk. *Forest Policy Econ.* 85:52-64. DOI: 10.1016/j.forpol.2017.08.016.

Lang, A.J., **W.M. Aust**, **M.C. Bolding**, **K.J. McGuire**, and E.B. Schilling. 2017. Forestry best management practices for erosion control in haul road ditches near stream crossings. *J. Soil Water Cons.* 72:607-618. DOI: 10.2489/jswc.72.6.607.

Lang, A.J., **W.M. Aust.**, **M.C. Bolding**, **K. McGuire**, and E.B. Schilling. 2017. Comparing sediment trap data with erosion models for evaluation of haul road stream crossing approaches. *Trans. ASABE* 60:393-408. DOI: 10.13031/trans.11859.

Maier, C.A., **T.J. Albaugh**, R.L. Cook, K. Hall, D. McInnis, K.H. Johnsen, J. Johnson, R.A. Rubilar, and J.M. Vose. 2017. Comparative water use in short-rotation *Eucalyptus benthamii* and *Pinus taeda* trees in the southern United States. *For. Ecol. Manage.* 397:126-138. DOI: 10.1016/j.foreco.2017.04.038.

McElligott, K.M., **J.R. Seiler**, and **B.D. Strahm**. 2017. The impact of water content on sources of heterotrophic soil respiration. *Forests* 8:299-313. DOI:10.3390/f8080299.

Minick, K.J., Z.H. Leggett, E.B. Sucre, **T.R. Fox**, and **B.D. Strahm**. 2017. Soil and aggregate-associated carbon in a young loblolly pine plantation: Influence of bioenergy intercropping. *Soil Sci.* 182:233-240. DOI: 10.1097/SS.0000000000000215.

Munsell, J.F., A. Ares, **S.M. Barrett**, B.H. Bond, and **J.L. Gagnon**. 2017. Forest certification perspectives in the wood products supply chain in Virginia, USA. *Forests* 8(10):364. Special Issue: Sustainable Forest Management and Forest Certification. DOI: 10.3390/f8100364.

Munsell, J.F., B.J. Addlestone, C.J Bukowski, L. Nkembi, N. Kingsly, and E.A. Moore. In press. Relationships between agroforestry and community development according to practitioners. *Agrofor. Syst.* DOI: 10.1007/s10457-017-0084-7.

Refereed Publications

(continued)

Nash, S.E., and **C.A. Copenheaver**. 2017. Revival of dendroarchaelogy in the eastern United States. *Dendrochronologia* 43:1-3.

Neaves, C. M. III, **W.M. Aust**, **M.C. Bolding**, **S.M. Barrett**, C.M. Trettin, and E.D. Vance. 2017. Soil properties in site prepared loblolly pine (*Pinus taeda* L.) stands 25 years after wet weather harvesting in the Lower Atlantic Coastal Plain. *Forest Ecol. Manage.* 404:344-353. DOI: 10.1016/j.foreco.2017.08.015.

Neaves, C., **W.M. Aust**, **M.C. Bolding**, **S.M. Barrett**, C. Trettin, and E. Vance. 2017. Loblolly pine (*Pinus taeda* L.) productivity 23 years after wet site harvesting and site preparation in the lower Atlantic Coastal Plain. *For. Ecol. Manage.* 401:207-214.

Parkhurst, B.M., **W.M. Aust**, **M.C. Bolding**, **S.M. Barrett**, and E.A. Carter. Soil response to skidder trafficking and slash application. *Intl. J. For. Eng.* (in press).

Petzold, H.E., S.B. Rigoulot, C. Zhao, B. Chanda, **X. Sheng**, M. Zhao, X. Jia, A.W. Dickerman, E.P. Beers, and **A.M. Brunner**. 2017. Identification of new protein-protein and protein-DNA interactions linked with wood formation in *Populus trichocarpa*. *Tree Physiol.* DOI: 10.1093/treephys/tpx121. [Epub ahead of print]

Powell, R.B., S.L. Vezeau, **M.J. Stern**, D.D. Moore, and B.A. Wright. 2017. Does interpretation influence elaboration and environmental behaviors? *Environ. Educ. Res.* DOI: 10.1080/13504622.2017.1339302.

Radtke, P., **D. Walker**, C. DeYoung, A. Weiskittel, J. Frank, D. MacFarlane, J. Coulston, J. Westfall, C. Domke, and C. Woodall. 2017. Improved accuracy of aboveground biomass and carbon estimates for live trees in forests of the eastern United States. *Forestry* 90:32-46.

Santo, A., K. Guillozet, **M.G. Sorice**, T.D. Baird, S.A. Gray, C.J. Donlan, and C.B. Anderson. 2017. Examining private landowners' knowledge systems of invasive species. *Human Ecol.* 45:449-462.

Sarr, M., **J.R. Seiler**, and **B.J. Sullivan**. 2017. Growth and physiology of *Senegalia senegal* (L.) Britton seedlings as influenced by seed origin and salinity and fertility treatments. *Forests* 8:388-403.

Refereed Publications

(continued)

Saulnier, W.J., **M.C. Bolding**, **S.M. Barrett**, and S.P. Prisley. 2017. Characteristics of Virginia's private forest landowners and their attitudes toward harvesting. *For. Prod. J.* 67:69-80. DOI: 10.13073/FPJ-D-15-00040.

Scharenbroch, B., **S. D. Day**, T.L.E. Trammell, and R.V. Pouyat. 2017. Urban soil carbon storage. *In:* Advances in Soil Science: Urban Soils. R. Lal and B.A. Stewart (Eds.). Taylor and Francis. 406pp.

Scolforo, H.F., J.R.S. Scolforo, C.R. Thiersch, M.F. Tiersch, J.P. McTague, **H.E. Burkhart**, A.C. Ferraz Filho, J.M. Mello, and J. Roise. 2017. A new model of tropical tree diameter growth rate and its application to identify fast-growing native tree species. *For. Ecol. Manage.* 400:578-586.

Scolforo, H.F., J.R.S. Scolforo, J.L. Stape, J.P. McTague, **H.E. Burkhart**, J. McCarter , F. Castro Neto, R.A. Loos, and R.C. Sartório. 2017. Incorporating rainfall data to better plan eucalyptus clones deployment in eastern Brazil. *For. Ecol. Manage.* 391:145-153.

Stern, M.J., B.T. Frensley, R.B. Powell, and N.M. ArDOIn. 2017. What difference do role models make? Investigating environmental education and positive youth development outcomes at a residential environmental education center. *Environ. Educ. Res.* DOI: 10.1080/13504622.2017.1313391.

Stern, M.J., N.M. ArDOIn, and R.B. Powell 2017. Exploring the effectiveness of outreach strategies in conservation projects: The case of the Audubon Toyota TogetherGreen program. *Soc. Nat. Resour.* 30:95-111.

Sumnall. M., **T.R. Fox**, **R.H. Wynne**, and **V.A. Thomas**. 2017. Mapping the height and spatial cover of features beneath the forest canopy at small scales using airborne scanning discrete return Lidar. *ISPRS J. Photogram.* 133:186-200. DOI: 10.1016/j.isprsjprs.2017.10.002

Sun, S., S. Li, B.A. Avera, **B.D. Strahm**, and B. Badgley. 2017. Soil bacterial and fungal communities show distinct recovery patterns during forest ecosystem restoration. *Appl. Environ. Microbiol.* 83:e00966-17. DOI: 10.1128/AEM.00966-17.

Refereed Publications

(continued)

Thomas, R.Q., **E.B. Brooks**, A.L. Jerslid, E.J. Ward, **R.H. Wynne**, **T.J. Albaugh**, H. Dinon-Aldridge, **H.E. Burkhart**, J.C. Domec, **T.R. Fox**, C.A. Gonzalez-Benecke, T.A. Martin, A. Noormets, D.A. Sampson, and R.O. Teskey. 2017. Leveraging 35 years of *Pinus taeda* research in the southeastern US to constrain forest carbon cycle predictions: Regional data assimilation using ecosystem experiments. *Biogeosciences* 14:3525-3547. DOI: 10.5194/bg-14-3525-2017.

Thomas, R.Q., **E. Brooks**, A. Jersild, E. Ward, **R. Wynne**, **T.J. Albaugh**, H.D. Aldridge, **H.E. Burkhart**, J-C Domec, **T.R. Fox**, C.A. Gonzalez-Benecke, A. Noormets, D.A. Sampson, and R.O. Teskey. 2017. Leveraging 35 years of *Pinus taeda* research in the southeastern US to constrain forest carbon cycle predictions: Regional data assimilation using ecosystem experiments. *Biogeosciences* 14:3525-3547.

Trammell, T.L.E., **S.D. Day**, R.V. Pouyat, C. Rosier, B. Scharenbroch, and I. Yesilonis. 2017. Drivers of urban soil carbon dynamics. *In:* Advances in Soil Science: Urban Soils. R. Lal and B.A. Stewart (Eds.). Taylor and Francis. 406pp.

Vezeau, S.L., R.B. Powell, **M.J. Stern**, D.D. Moore, and B.A. Wright. 2017. Development and validation of two scales to measure elaboration and behaviors associated with stewardship in children. *Environ. Educ. Res.* 23:192-213.

Vilarino, M.V., **C. Franco**, and C. Quarrington. 2017. Food loss and waste reduction as an integral part of a circular economy. *Front. Environ. Sci.* 5:21. DOI: 10.3389/fenvs.2017.00021.

Vinson, J.A., **S.M. Barrett**, **W.M. Aust**, and **M.C. Bolding**. 2017. Comparing the suitability of soil erosion models for the evaluation of bladed skid trail BMPs in the southern Appalachians. *Forests* 8:482. Special Issue: Forest Operations, Engineering and Management. DOI: 10.3390/f8120482.

Vinson, J.A., **S.M. Barrett**, **W.M. Aust**, and **M.C. Bolding**. 2017. Evaluation of bladed skid trail closure methods in the ridge and valley region. *For. Sci.* 63:432-440.

Warrington, B.M., **W.M. Aust**, **S. M. Barrett**, W.M. Ford, C.A. Dolloff, E.B. Schilling, T.B. Wigley, and **M.C. Bolding**. 2017. Forestry best management practices relationships with aquatic and riparian fauna: A review. *Forests* 8:331. Special Issue: Forest Operations, Engineering and Management. DOI: 10.3390/f8090331.

Refereed Publications

(continued)

Xu, Y., **G. Amacher**, and J. Xu. 2017. Village democracy and household welfare: Evidence from rural China. *Environ. Dev. Econ.* 22:351-372. DOI: 10.1017/S1355770X17000146.

Yanez, M., **J.R. Seiler**, and **T.R. Fox**. 2017. Growth and physiological response of loblolly pine clones and families to silvicultural intensity: Assessing the effect of crown ideotype. *For. Ecol. Manage.* 398:25-36.

Yanez, M., **J.R. Seiler**, and **T.R. Fox**. 2017. Within-crown acclimation of leaf-level physiological and morphological parameters in young loblolly pine stands. *Trees-Struct. Funct.* 31:1849-1857.

Yanez, M., **T.R. Fox**, and **J.R. Seiler**. 2017. Silvicultural intensity and site effects on stand uniformity of loblolly pine varieties and families. *For. Sci.* 63:606-613.

Yang, S., and **H.E. Burkhart**. 2017. Estimation of carrying capacity in loblolly pine (*Pinus taeda* L.). *For. Ecol. Manage.* 385:167-176.

Yang, S., and **H.E. Burkhart**. Application of height- and diameter-based relative spacing for estimation of stand basal area. *For. Sci.*, in press. DOI: 10.5849/FS-2016-075.

Yang, Y., M.C. Anderson, F. Gao, C.R. Hain, K.A. Semmens, W.P. Kustas, A. Noormets, **R.H. Wynne**, **V.A. Thomas**, and G. Sun. 2017. Daily Landsat-scale evapotranspiration estimation over a forested landscape in North Carolina, USA, using multi-satellite data fusion. *Hydrol. Earth Syst.* Sc. 21:1017-1037. DOI: 10.5194/hess-21-1017-2017.

Zhao, C., T. Lasses, L. Bako, D. Kong, B. Zhao, B. Chanda, A. Bombarely, A. Cruz-Ramirez, B. Scheres, **A.M. Brunner**, and E.P. Beers. 2017. XYLEM NAC DOMAIN1, an angiosperm NAC transcription factor, inhibits xylem differentiation through conserved motifs that interact with RETINOBLASTOMA-RELATED. *New Phytol.* 216:76-89.

Theses and Dissertations

Dissertations

Bawa, R.K. 2017. Evolutionary genomics of *Populus trichocarpa* (western poplar).
    Chair: J. Holliday.

Bilal, R.C. 2017. Soil CO_2 efflux, water and nutrient use efficiencies and litter decomposition across diverse cover types in Southern Appalachian hardwood forests.
   Chairs: J. Seiler, B. Strahm.

Gopalakrishnan, R. 2017. Large-area forest assessment and monitoring using disparate Lidar datasets.
    Chairs: V. Thomas, R. Wynne.

McElligott, K.M. 2017. Soil respiration and decomposition dynamics of loblolly pine (*Pinus taeda* L.) plantations in the Virginia Piedmont.
    Chairs: J. Seiler, B. Strahm.

Sarr, M.S. 2017. Morphological and physiological responses of *Senegalia Senegal* (L.) Britton provenances to drought, salinity and fertility.
    Chair: J. Sullivan.

Schons Do Valle, S. 2017. Forests and fisheries in the Brazilian Amazon: Understanding incentives to comply with conservation efforts.
    Chairs: G. Amacher, F. Merry.

Timpano, A.J. 2017. Toward improved assessment of freshwater salinization as a benthic macroinvertebrate stressor.
    Chairs: S. Schoenholtz, C. Zipper.
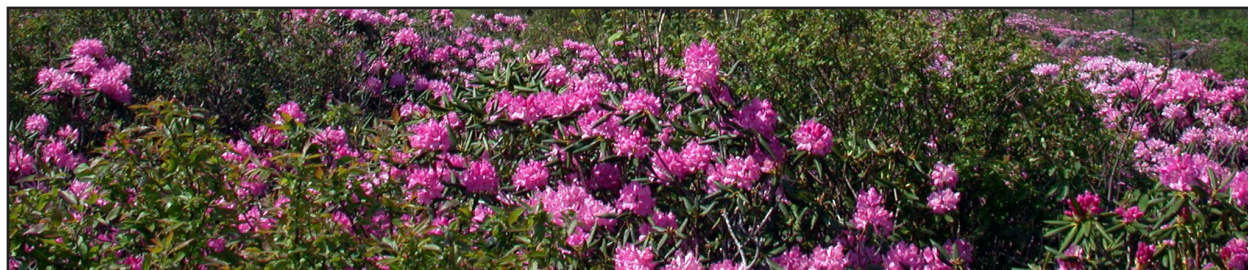
Theses and Dissertations

(continued)

Theses

Barker, E.J. 2017. Evaluating and improvement of tree stump volume prediction models in the eastern United States.
    Chair: P. Radtke.

Chance, E.W. 2017. Irrigator responses to changes in water availability in Idaho's Snake River Plain.
    Chairs: K. Cobourn, V. Thomas.

Hoffman, B. 2017. Investigating personal learning in an ecotourism setting.
    Chair: M. Stern.

House, M.N. 2017. Identifying forest conversion hotspots in the Commonwealth of Virginia using multitemporal landsat data and known change indicators.
    Chair: R. Wynne.

Neaves, C. 2017. Long-term effects of wet site timber harvesting and site preparation on soil properties and loblolly pine (*Pinus taeda*) productivity in the Lower Atlantic Coastal Plain.
    Chairs: M. Aust, M.C. Bolding.

Schulte, M.L. 2017. Hydrologic controls on ecosystem structure and function in the Great Dismal Swamp.
    Chair: D. McLaughlin.

Alumni Highlights

Bettina Ring has been appointed the Virginia Secretary of Agriculture and Forestry by Governor Ralph Northam. She previously was appointed State Forester by Governor Terry McAuliffe in 2014.

Prior to that, Ring served as Senior Vice President of Family Forests at the American Forest Foundation where she was responsible for overseeing the American Tree Farm System®, the largest and oldest sustainable woodland program in America, supporting more than 80,000 family forest owners collectively managing 27 million acres of certified woodlands. Ring has a long history in the conservation and forestry sectors, having spent 14 years at the Virginia Department of Forestry, departing the agency in 2001 as Deputy State Forester. In her role, Ring was responsible for operations, and helped to develop and implement a new mission, vision, and strategic plan for the department. In the years following her Department of Forestry service, Ring held various leadership positions with nonprofit organizations focusing on natural resources management and conservation, including the Colorado Coalition of Land Trusts, The Wilderness Land Trust, and the Bay Area Open Space Council.

Ring holds a bachelor's degree in Forestry and Wildlife from Virginia Tech and a master's degree in Business Administration from James Madison University.

Robert Farrell has been appointed State Forester by Governor Ralph Northam. Farrell worked for VDOF for 18 years before becoming State Forester of Virginia. He began his VDOF career as an area forester, and then held the position of Assistant Director of Forestland Conservation before taking on the role of Deputy State Forester in 2012. Farrell also served as Acting State Forester of Virginia from January through April 2014. Prior to joining the VDOF, Farrell worked as an arborist and urban forester in Maryland and Virginia. He is a Certified Arborist and currently resides in Albemarle County where he serves on the Board of the Albemarle Conservation Easement program.
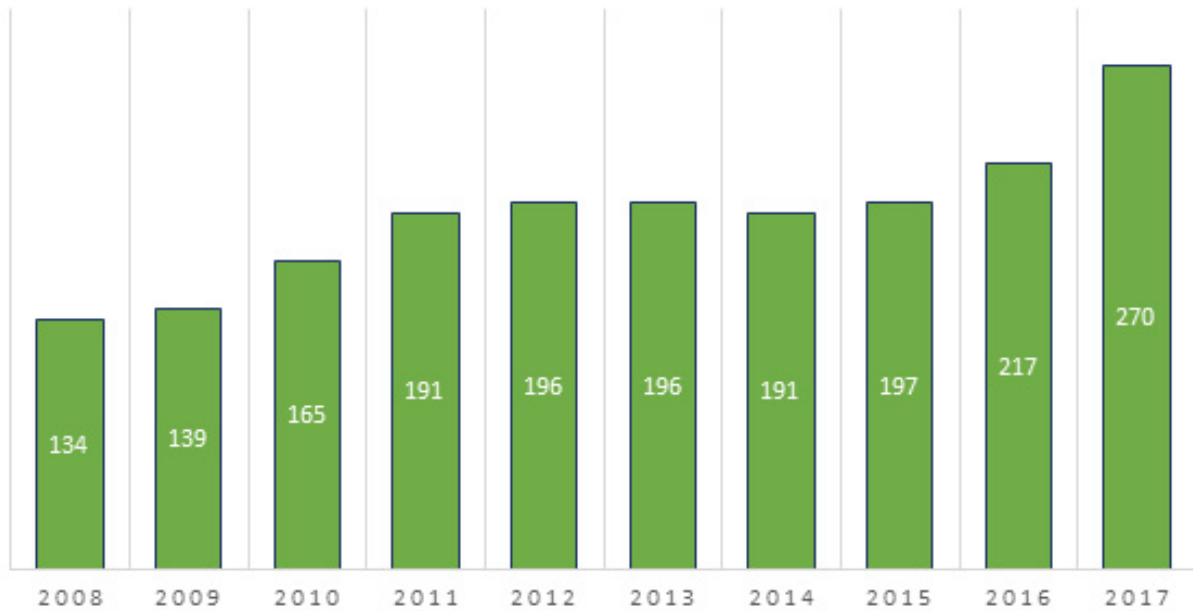
"Governor Northam has stressed the importance of collaboration amongst state agencies, the importance of clean air and clean water, and the need to balance economic development with environmental protection," Virginia Secretary of Agriculture and Forestry and outgoing State Forester of Virginia Bettina Ring said. "Rob has strong relationships and is well respected within the forestry community, among landowners and the VDOF's many conservation partners. Under his leadership, VDOF will continue to demonstrate the importance of working forests in our environment."

Farrell is a native Virginian and a graduate of Virginia Tech with a master's degree in Forestry. He was selected by the Virginia Forestry Association as its Outstanding Member of the Year in 2017.
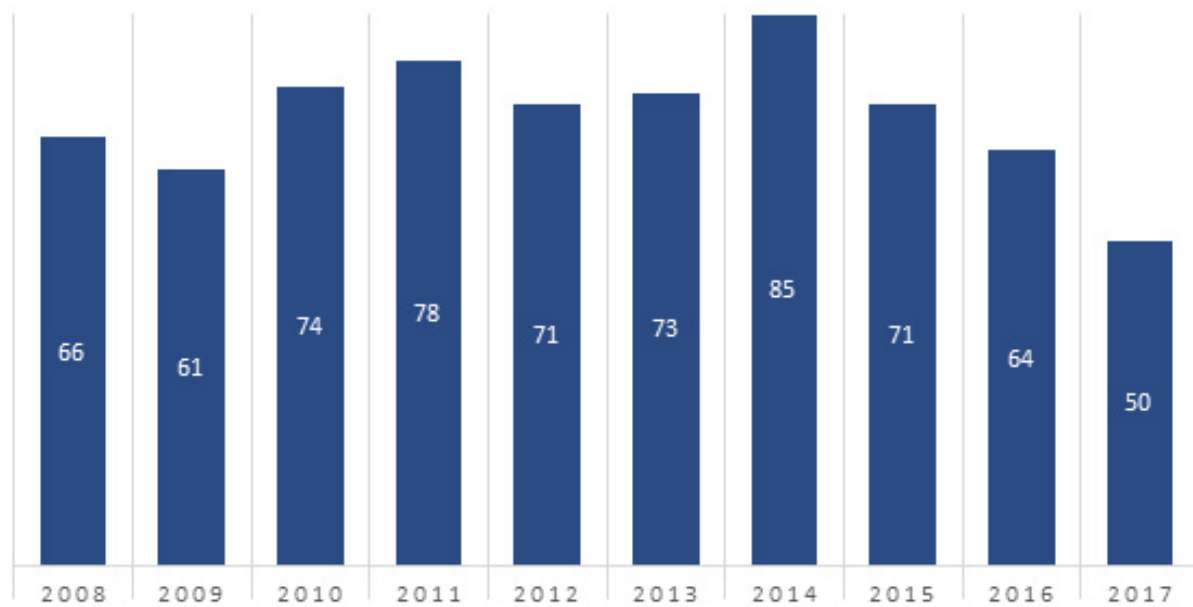
Statistics

FREC UNDERGRADUATE ENROLLMENT OVER TIME

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
134	139	165	191	196	196	191	197	217	270

FREC GRADUATE ENROLLMENT OVER TIME

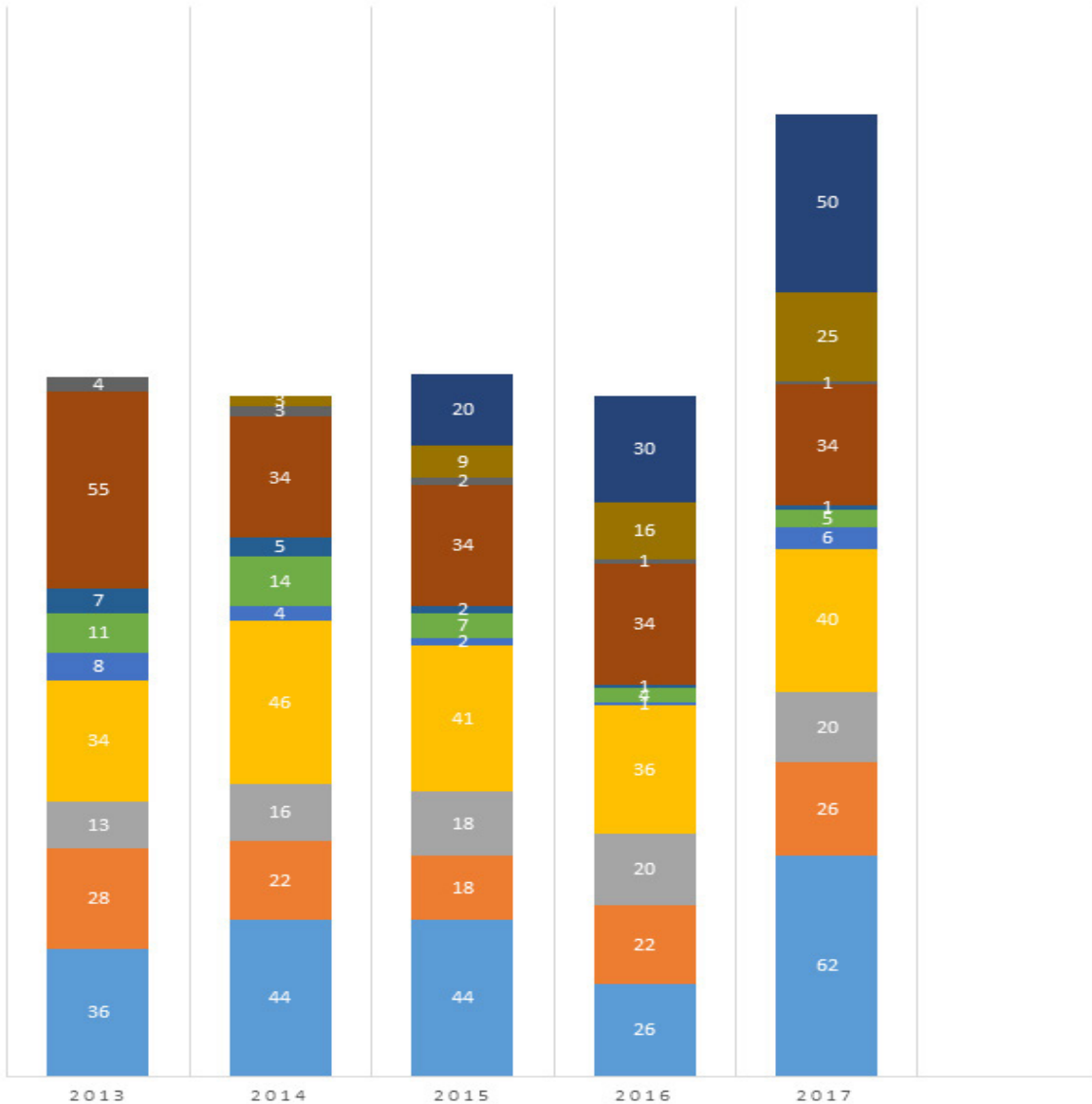| 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
66	61	74	78	71	73	85	71	64	50

Statistics

(continued)

FREC UNDERGRADUATE ENROLLMENT BY OPTION OVER LAST 5 YEARS

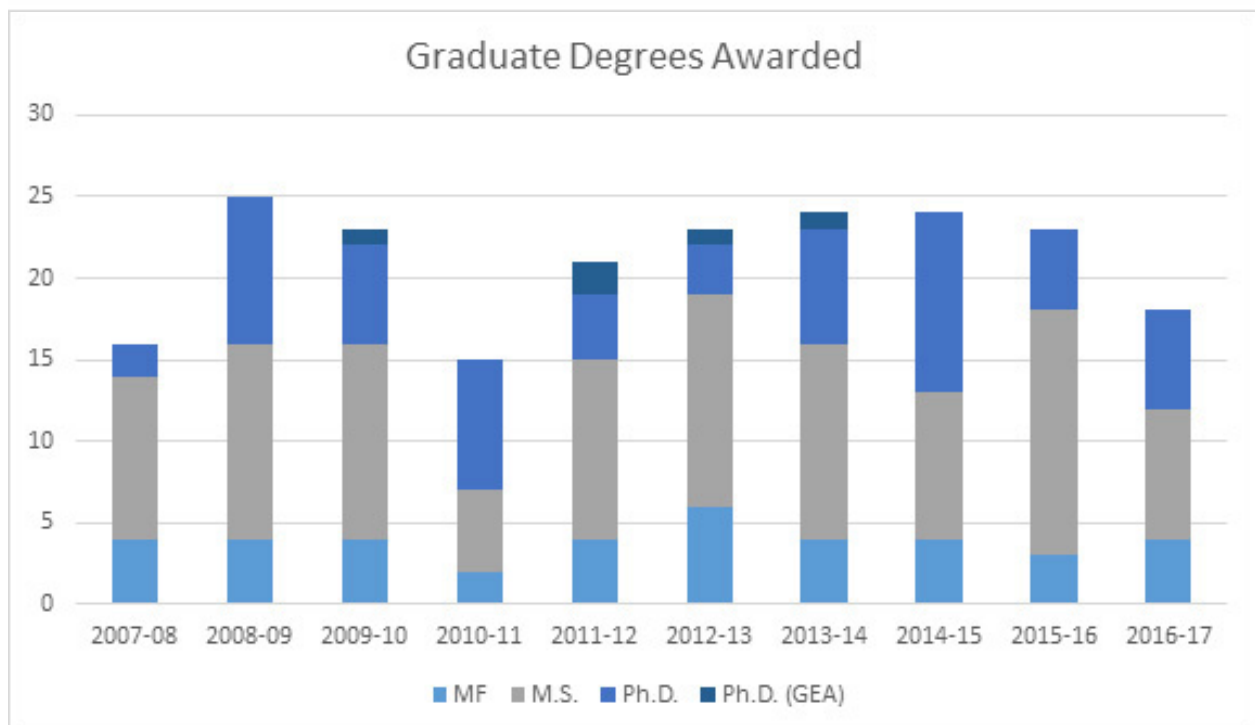Legend: Undeclared, FRM, FOB, ERM, UFOR, WATM, NREE, CRM, NRSE, EI, WRPM

2013
- 4 (FOB)
- 55 (CRM)
- 7 (NREE)
- 11 (WATM)
- 8 (UFOR)
- 34 (ERM)
- 13 (FOB)
- 28 (FRM)
- 36 (Undeclared)

2014
- 3
- 3
- 34 (CRM)
- 5 (NREE)
- 14 (WATM)
- 4 (UFOR)
- 46 (ERM)
- 16 (FOB)
- 22 (FRM)
- 44 (Undeclared)

2015
- 20
- 9
- 2
- 34 (CRM)
- 2
- 7
- 2
- 41 (ERM)
- 18 (FOB)
- 18 (FRM)
- 44 (Undeclared)

2016
- 30
- 16
- 1
- 34 (CRM)
- 1
- 1
- 1
- 36 (ERM)
- 20 (FOB)
- 22 (FRM)
- 26 (Undeclared)

2017
- 50
- 25
- 1
- 34 (CRM)
- 1
- 5
- 6
- 40 (ERM)
- 20 (FOB)
- 26 (FRM)
- 62 (Undeclared)

Statistics

(continued)

UNDERGRADUATE DEGREES AWARDED

Year	Degrees
2007-08	29
2008-09	34
2009-10	43
2010-11	40
2011-12	53
2012-13	57
2013-14	58
2014-15	48
2015-16	63
2016-17	45

Graduate Degrees Awarded

MF ■ M.S. ■ Ph.D. ■ Ph.D. (GEA)

Research Sponsors

The American Chestnut Foundation

American Forest Management

American Tree Farm System

Appalachian Sustainable Development

Appalachian Trail Conservancy

Arborgen, LLC

APRIL

Arauco-BioForest

Bayer CropScience LP

BTG Pactual

Bureau of Land Management

Campbell Global, LLC

Campo Forestal SA

CHS, Inc

Cotopaxi

Crop Production Services-Timberland
  Division

Deforsa

Deltic Timberlands

Dominion Foundation

Dougherty & Dougherty Forestry

Evans Properties

eXtension Foundation

Fibria

Florida Grown

Forest Investment Associates

Forestal Bosques del Plata (Argentina)

Forestal Mininco

Forestry & Land Resource Consultants

FuturaGene

Global Forest Partners

Greenwood Resources

Hancock Forest Management

James W. Sewall Co.

Kingwood Forestry Services

Innovatech

Innovative Wireless Technologies, INC

International Forest Company

International Paper

International Plant Nutrition Institute

Jordan Lumber

Klabin

Larson and McGowin, Inc.

Leading Edge Geomatics

Lesco Aviation

Masisa

Matthews Foundation

Milliken Forestry

Mississippi State University

Molpus Timerlands Management

NASA

National Council for Air and Stream
  Improvement

National Fish and Wildlife Foundation

National Park Service

National Science Foundation

National Science Foundation DEB Long
 Term Ecological Research

Research Sponsors

(continued)

National Science Foundation EAR
  Geobiology and Low Temperature
  Geochemistry
National Science Foundation Smart and
 Connected Communities
North Carolina Forest Service
Oak Hill Fund
Omya International
Pheasants Forever
Rainforest Alliance
Rayonier
Renewable Resources LLC
Resource Management Service
Roseburg Forest Products
Smurfit Carton de Colombia/Venezuela
Superior Pine Products Company
Sustainable Forestry Initiative Virginia
 State Implementation Committee
Suzano
Syngenta
Terena, S.A.
Texas A&M University
Timberland Investment Resources
Tree Research and Education Endowment
Fund
US Department of Energy
US Endowment for Forests &
Communities
US Fish & Wildlife Service
US Geological Society

USDA Agricultural Research Service
USDA Forest Service
USDA Natural Resources Conservation
 Service
USDA NIFA
USDA Sustainable Agriculture Research
 and Education Program
USGS
Valor Florestal
Virginia Department of Conservation and
 Recreation
Virginia Department of Environmental
 Quality
Virginia Department of Forestry
Virginia Department of Game and Inland
 Fisheries
Virginia Department of Transportation
Virginia Forestry Association
Virginia Institute of Marine Science-
 Center for Coastal Resources
 Management
Virginia Museum of Natural History
Virginia Native Plant Society
Westervelt Company
Weyerhaeuser Co.
Woods Hole Research Center

NOTES

NOTES

NOTES

Department of Forest Resources and Environmental Conservation
Cheatham Hall, Room 313, Virginia Tech
310 West Campus Drive Blacksburg, VA 24061
540/231-5483 • Fax 540/231-3698 •
http://www.frec.vt.edu

https://www.facebook.com/vtfrec

https://twitter.com/VTFREC