COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
FOREST RESOURCES AND ENVIRONMENTAL CONSERVATION
VIRGINIA TECH

FORESTRY

leader in excellence.....

Summer 2019

In this issue

Marc Stern facilitates local solutions to global climate challenges

Marc Stern

With extreme environmental events, such as drought, coastal and river flooding, and wildfires, increasing in frequency, there is an urgent need to develop strategies that will reduce negative outcomes. A National Science Foundation grant will help Professor **Marc Stern** study and develop workshops that will empower local communities to take action against climate challenges. The project is a collaboration between Virginia Tech and EcoAdapt, a nonprofit dedicated to helping governments, organizations, and individuals develop climate change adaptations to make communities better prepared and protected from environmental challenges.

"This isn't about experts coming in to tell a community they need to do x, y, and z," Stern explained. "Instead, we're trying to give communities planning tools and strategies so they can go ahead and do the work that needs to be done."

The first component of Stern's project, which will run through 2023, is to survey experts who facilitate workshops that focus on using climate-relevant science to address a broad range of challenges. The project will integrate those strategies with a survey of the experiences of workshop participants. This two-step process will provide a holistic view of what is successful in these workshops and identify potential blind spots for reaching audiences and promoting positive change.

From those findings, the second component is to test strategies in a series of climate adaptation workshops around the U.S. These field tests of effective practices will enable the researchers and workshop facilitators to further refine their understanding of how learning takes place in informal learning environments. The workshops will focus on empowering people to take local action to address a worldwide concern.

continued on page 10

From the department head

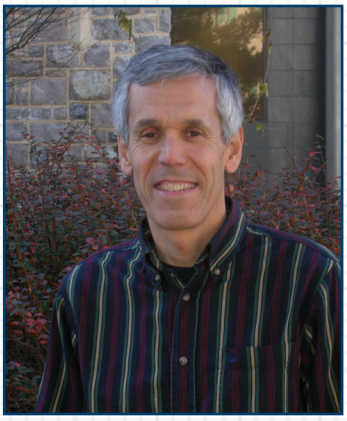
Jay Sullivan

As a student in silviculture class back in the day, I recall being intrigued by the concept of a forest rotation and especially wondered what it might be like to watch a stand from its establishment all the way through to regeneration harvest many years later. Honestly, I wasn't sure whether I'd live to see that happen, especially given the western rotations that I'd learned about, but I remember thinking that it might be the most profound thing I could experience over my career. I don't know how it happened, but I've now been out of school long enough to see rotations come and go, and yes, it is cool to have witnessed stands being planted, growing and maturing, and then being harvested and regenerated successfully in a sustainable cycle of re-establishment and regrowth.

Unanticipated in my school days, though, is another, even more profound rotation that has become so striking to me as the years have added up. It seems that everywhere I travel in my role as head of the Department of Forest Resources and Environmental Conservation (FREC), I run into more and more graduates of our program who have taken on important and influential leadership roles and positions across a wide variety of work settings in both the private and public sectors. We have graduates who manage forests and head agency divisions and departments, who own and operate mills and firms, who serve as CEOs and company presidents, who lead professional organizations and associations, who are researchers making significant contributions, who work as teachers, professors, and even department heads and directors in schools across the country training the next generation of forest and environmental resource professionals — the list goes on and on. Our collective field is teeming with successful and respected Hokies who have risen and continue to rise through the ranks of their organizations due, no doubt, to their hard work, professional integrity, and perseverance. As that student back in silviculture class, it never crossed my mind that I might have a chance to participate in such a profound rotation that continues to refresh our profession and reshape the environment in which we operate. I can't believe that am so privileged as to be in this place and in this position. Keep up the great work, and keep making us proud!

Ralph Amateis retires

Ralph Amateis retired on July 1 following 40 years of dedicated service as senior research associate in FREC. A native of Wisconsin, Ralph received a B.S. degree in forestry from the University of Minnesota, followed by an M.S. degree in forest biometrics from the University of Florida, after which he joined the newly established Loblolly Pine Growth and Yield Research Cooperative (later the Forest Modeling Research Cooperative) on July 1, 1979.



Over a 40-year period, Ralph coordinated the installation of two regionwide installations of permanent sample plots in loblolly pine plantations, as well as the establishment of several experimental trials to evaluate various aspects of loblolly pine silvicuture. He managed the co-op databases and provided technical assistance on growth and yield estimation to the co-op members, numerous graduate students, forestry consultants, and employees of state and federal agencies. In addition to contributing to innumerable publications, reports, and presentations on results from the co-op studies, Ralph was the lead investigator and principal author on a large number of journal articles and papers in proceedings of scientific meetings.

It is with a sense of deep gratitude and sincere thanks that we wish Ralph, a colleague and friend, an enjoyable and fulfilling retirement.

Welcome new faculty!

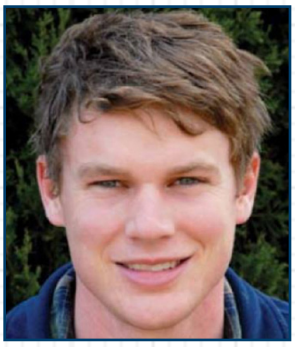
J. P. Gannon joined FREC in August 2019 as a collegiate assistant professor of environmental informatics.

Gannon's research interests focus on examining streamflow generation in rivers and streams at a variety of scales, as well as using remotely sensed data to address environmental issues. He is passionate about teaching and involving undergraduate students in research projects, whether in class or independently. His teaching responsibilities include Intro to Environmental Informatics, Information Technologies for Natural Resource Management, Digital Planet, and the environmental informatics capstone course.

Gannon received his Ph.D. in 2014 from Virginia Tech in forest hydrology; M.S. from Virginia Tech in 2010 in geoscience; and B.S. from The College of New Jersey in 2007 in physics.

Steven Kruger joined FREC in August 2019 as a postdoctoral researcher. He studies the trade in native edible and medicinal forest plants in Appalachia, and producing nontimber forest products in agroforestry systems.

Kruger earned his Ph.D. in forestry from Virginia Tech in 2018, an M.A. in folklore from UNC-Chapel Hill in 2011, and a B.S. in anthropology and sustainable development from Appalachian State University in 2004.



P. Corey Green joined FREC in July 2019 as a research associate. Green's research interests focus on forest resource assessment and characterization using a combination of growth and yield models, forest inventory, and remote sensing. In addition, he is interested in silviculture applications and forest management.

Green is currently a Ph.D. candidate in forestry and received his M.S. in forest resources and his B.S. in statistics from the University of Georgia.

Karen Snape joined FREC in August 2019 as an Extension associate. She will be working with both the SHARP Logger Program (SHARPlogger.vt.edu) and the Virginia Forest Landowner Education program (forestupdate.frec.vt.edu). She will be working with Scott Barrett to coordinate logger trainings across Virginia and with Jennifer Gagnon to help support the activities of the Virginia Forest Landowner Education Program.

Snape comes to our department after working 15 years for the Virginia Department of Forestry as an area forester in the Fredericksburg area. While working for VDOF, Snape was active in many outreach activities, including working with the Holiday Lake Forestry Camp, serving as a chapter advisor for the Virginia Master Naturalist Program, conducting environmental education programs for youth, and serving as a regional chair for the Virginia Tree Farm System.

Snape received a bachelor's degree from Juniata College and a master of forestry from Duke University.

Angela Possinger joined FREC in August 2019 as a postdoctoral associate, working with Brian Strahm. Her research focuses on understanding processes and drivers of organic carbon persistence in soil. During her Ph.D. program, she used techniques bridging molecular to watershed scales to better describe mechanisms of soil organic matter stabilization via organo-mineral and organo-organic interactions.

At Virginia Tech, she will be expanding the scope of her research to synthesize results from and contribute towards a multi-year, multi-collaborator study of soil carbon stabilization drivers at the continental scale. Her research interests also include forest soil pedogenesis, agricultural management for soil carbon sequestration, and biogeochemistry of coupled nutrient cycles.

Possinger received her Ph.D. in soil and crop sciences from Cornell University in 2019, her M.S. in biological and environmental sciences (with a concentration in sustainable agriculture and food systems) from the University of Rhode Island in 2013, and her B.S. in biology from Roger Williams University in 2010.

Highlights - teaching, research, extension

Grant helps Virginia Tech scientists find new ways to use secondary logging materials

The first image that may come to mind when someone says "logging" is trucks loaded with logs, ready for transport to a sawmill. But what about the rest of the tree: the branches and tops that cannot be cut into boards or made into plywood?

Those secondary materials, called "residues" in the forest industry, represent both a challenge to foresters and a potential boon to the industry. Although they are routinely left behind at harvest sites because of the high cost of processing and transport, new possibilities are being developed to use residues as an alternative source of energy production. They can be converted to electricity or utilized as a heat source in pellet stoves.

Chad Bolding

To better understand the challenges and potential gains of harvesting residues, Associate Professor **Chad Bolding** will participate in a large-scale collaborative project with three other universities to examine forest residue collection across the eastern United States and determine how to make residues an economically viable resource.

Funded with a $1 million grant from the U.S. Department of Agriculture's Agriculture and Food Research Initiative (AFRI), Virginia Tech will work collaboratively with Auburn University, the University of Maine, and West Virginia University to develop and optimize forest residue collection while examining the environmental impacts and economic potentials for the eastern U.S.

"A goal of this project is to determine the procedures used and the profitability of residue collection in the eastern United States," Bolding explained, "and to see if we can optimize the system by reducing costs and making residues a more viable option as a renewable energy source."

To understand the specific challenges, the collaborators have divided the eastern U.S. into four regions: northeast, upper mid-Atlantic, lower mid-Atlantic, and southeast. Virginia Tech will focus on the lower mid-Atlantic states of Kentucky, North Carolina, South Carolina, Tennessee, and Virginia.

"Each of the four regions is unique in terrain, tree species, and climate," Bolding noted. "Even within each region, there are different variables to contend with. Virginia, North Carolina, and South Carolina are important forestry states, with slopes that are more gentle and easier to grow and harvest plantation forests on short rotations. Kentucky and Tennessee have steeper slopes and more hardwood trees, and forestry is less central to their economy. We will diversify our research strategy to better understand those differences and use that information to extrapolate broader conclusions."

One aspect of forest residue collection that Bolding will be focusing on is the environmental impacts of removing residue from forests. "When residues are removed from the forest, there's a potential to expose more bare soil, which can lead to erosion and sedimentation," he said. "Our research will investigate harvest sites across the region to estimate potential soil erosion and determine compliance with water quality best management practices. We will also suggest methods for improvement if necessary."

continued on page 10

Virginia Tech earns Tree Campus USA recognition

For the eleventh consecutive year, Virginia Tech has been recognized for its best practices in campus community forestry through the Arbor Day Foundation's Tree Campus USA program. Launched in 2008, Tree Campus USA is a national program that honors colleges and universities for effective campus forest management and for engaging students, faculty, and staff in conservation goals.

Virginia Tech achieved Tree Campus USA recognition by meeting five national standards, which include maintaining a tree advisory committee, operating a campus tree-care plan, dedicating annual expenditures toward trees, organizing an Arbor Day observance, and executing student service-learning projects. More than 650 trees have been planted across campus since 2008.

Trees are among the most visible representations of Virginia Tech's commitment to environmental stewardship, as demonstrated by two recent projects. Virginia Tech Facilities, the Virginia Tech Division of Operations GIS team, and FREC recently completed a large-scale collaborative inventory and analysis of more than 10,000 trees across 900 acres on the Virginia Tech campus. The tree inventory was performed by FREC graduate student **Peter Stewart** (M.S. 2019) under the supervision of **Eric Wiseman**, associate professor of urban and community forestry.

In addition, the university community can now learn more about the trees that make the Virginia Tech campus so beautiful through an accompanying interactive campus tree inventory map. The map includes identifying information for nearly 10,600 trees across campus, including tree type, species and origin details, height, and more. There are currently 225 different tree species in the campus tree inventory.

The tree inventory and interactive map will be useful in guiding long-term decision-making processes and preservation plans outlined in the Campus Master Plan, capital construction planning, and improving grounds and landscaping coordination. Both tools could also serve as academic resources, as well as new venues for university members and visitors alike to engage with campus.

"Trees are a defining contributor to the natural landscape at Virginia Tech," said Sherwood Wilson, vice president for operations. "The interactive tree inventory map is not only a highly valuable tool for campus planners, it's also an exciting new way for students and community members to further engage with the campus landscape as a living laboratory."

Photo credit: Jun Yu

Jason Holliday receives $2.5 million NSF grant to research poplar genome

Jadon Holliday

The revolution in genome sequencing has radically changed the field of forestry, allowing researchers to understand how the genome influences specific traits of economic and ecological importance. Now, a $2.5 million grant from the National Science Foundation (NSF) will help Associate Professor **Jason Holliday** research the genomic architecture of poplars, fast-growing trees that are a crucial source of forest products.

The field of forest tree genetics has a long — and slow — history. To determine how a trait like height or diameter is manifested through generations of interbred trees, researchers would have to wait until the trees produce seeds, which can take a decade or more. Improvements in genome sequencing have accelerated that research: Instead of waiting years for a generation of trees to mature, researchers can now sequence the genetic code of trees and use the results to better understand the interplay between a tree's genetics, its growth, and the interaction between these factors and the environment.

"The revolution in genome sequencing has made it possible to drill down into the relationship between genetic variation and variation in traits of economic significance. This allows us to select on the genetics themselves, for traits like height, diameter, or adaptability to the environment in which we wish to grow the trees. This has real potential to accelerate tree breeding programs," said Holliday, an affiliate of the Fralin Life Sciences Institute.

Holliday's research focuses on the natural hybrids of two western North American poplars: black cottonwood and balsam poplar. Poplar hybrids are capable of growing as much as 8 feet in a single year and are an important resource in forest product and bioenergy plantations. Holliday's research will seek to understand how variation in both hybrid genomes and environmental conditions impact desirable traits.

"We're trying to understand how the genomes of the parent trees come together to produce offspring that are more productive but also well adapted to a particular growing site," Holliday explained. "We'll be sequencing the genomes and using a variety of ecological modeling approaches to understand how different parts of the genome contribute to adaptation across different environments."

Holliday's team will be sampling across the natural hybrid zones in western North America, from Oregon to Alaska. They will also be taking samples on an east-to-west grid in an effort to capture the genomic "history" of hybridization that has occurred over thousands of years. To conduct this research, Holliday is partnering with Assistant Professor Stephen Keller of the University of Vermont, Associate Professor Matthew Fitzpatrick of the University of Maryland Center for Environmental Science, and Assistant Professor Jill Hamilton of North Dakota State University.

"One of the things you want to do in this kind of study is to grow trees in lots of different environments, so you can separate how the environment influences the traits versus the traits that are hardwired in the genome," Holliday said. "Poplars are especially suited to this type of work because it's very easy to make rooted cuttings, which allows us to grow genetic duplicates of the exact same tree. In this project, we'll have big gardens of hundreds of trees in Vermont, Virginia, and North Dakota," he continued. "These trees will have the same genetics in all environments, so we can tease apart the extent to which genetics and environmental influence growth and adaptability outcomes."

continued on page 10

Preparing for Generation NEXT: Keeping Virginia's Forests Intact, In Forest, & In Family

Preparing for Generation NEXT: Keeping Virginia's Forests Intact, In Forest, & In Family, a collaborative program among the Virginia Department of Forestry, Virginia Cooperative Extension, and the Virginia Forest Landowner Education Program, received the first place regional award for program organization from the Southern Region Extension Forestry group.

Virginia has approximately 16 million acres of forestland. About 10.1 million acres, or nearly 62%, is in the hands of approximately 405,000 family forest owners. Forest landowners 65 years and older own 41% of these 10 million acres. This means Virginia is on the cusp of the largest intergenerational transfer of family forests ever. Unfortunately, high land values and taxes force many heirs to sell land to meet financial obligations — a major force behind an annual loss of 16,000 forested acres. A common barrier to keeping land intact, in forest, and in the family is knowledge of estate planning tools and having the confidence in knowing where to start.

To address this barrier, Generation NEXT workshops have been delivered in 15 locations throughout the commonwealth. The workshop design draws from national curricula and utilizes local legal and financial experts to develop materials and participate in program planning. Over 300 individuals representing more than 200 family units have participated. In addition, over 100 landowners participated in four half-day mini-workshops held in Southside Virginia in 2018. This effort was designed specifically to reach underserved audiences in the service area of Virginia State University (Virginia Tech's Extension partner).

Following workshop participation, landowners were able to better articulate their land transfer goals and begin planning for the future of their land. Participants indicated the program would increase the likelihood of their property staying intact (86%), in the family (82%), and in woodland (79%). Within six months completing a workshop, 95% of the participants had implemented one or more estate planning actions. Participants estimate an average family savings of $450,000 as a result of attending a workshop. As these landowners continue executing their plans, over 110,000 acres of land is expected to remain in forest and family-owned.

Memorandums of Understanding signed

Virginia Tech has signed Memorandums of Understanding (MoU) with two Brazilian universities: the University of Campinas (UNICAMP) and the Federal University of Lavras (UFLA). The point of contact with UNICAMP is Assistant Professor **Stella Schons**, who is working closely with its Economics Institute on development and conservation research. As part of this cooperation, Schons visited UNICAMP this past summer for a presentation of her research and to discuss collaboration on current and future research. Moreover, Schons and Alexandre Gori of UNICAMP presented a paper this past spring on the effect of deforestation on migration decisions in the Amazon of Brazil.

Under the MoU with UFLA, Professor **Harold Burkhart**, who is the point of contact, and Schons visited the university in early August to discuss future research not only on conservation and development but also, and with special focus on, planted forests in the south and southeast of Brazil, especially with eucalyptus. Some planned activities included papers, guest lectures, and even exchange opportunities for students and faculty.

FREC 3344: Forest Field Studies tour

FREC 3344 students and faculty

Nineteen forestry undergraduates and three graduate students participated in a five-day Forest Field Studies tour throughout Virginia during the week of May 20. The group lodged at the Airfield 4-H Center in Wakefield. The students, led by Associate Professors **Scott Barrett** and **Chad Bolding**, spent each day in the field visiting logging operations, touring mill facilities, examining field sites displaying a range of management strategies, and meeting with forestry professionals in numerous aspects of the profession. They toured a chip mill, a hardwood sawmill, a mulch mill, the Virginia Departmnt of Forestry's Garland Gray Nursery, a plywood mill, two pine sawmills, and a fluff pulp mill. The students also visited both Piedmont and Coastal Plain sites investigating intensive pine silviculture and numerous mechanized logging operations, including high production clean chipping and shovel logging.

The Southeast Chapter of the Society of American Foresters, chaired by Neil Clark, held a meeting with the students, and Pinecrest Timber provided dinner. In addition, a panel including Bob Glennon, Neil Clark, Madison West, Harrell Turner, and William Snyder gave presentations encouraging the students to set priorities, work hard, become involved in their community, and find a life/work balance. Thanks are due to the many hosts, alumni, and company representatives for making the trip a success!

New Christmas tree growers meeting

A workshop was held May 18 on the Glengary Tree Farm in Amissville for new and aspiring growers looking to get started in the Christmas tree farming industry. The program started with a presentation to go over the basics and lay the groundwork for the field portion, which would take up the remainder of the class.

Christmas tree workshop participants

The next two hours were filled with hands-on demonstrations and discussions about different aspects of Christmas tree farming. **Kyle Peer**, superintendent of the Reynolds Homestead Forest Resources Research Center, started it off with a talk on species and seedling selection, and ordering and delivery. Then the participants took turns planting a few seedlings that Tom O'Halloran had left over from the spring planting season. Shawn Appling, the local Virginia Cooperative Extension (VCE) agent from Culpeper County, was up next to give an important lesson in pesticide safety and how to properly read a label. This was followed by Peer's talk on vegetation control methods and herbicide selection, which was a good lead-in for Tim Ohlwiler, VCE agent from Fauquier County, to talk on how to properly calibrate a backpack sprayer. The day ended with a shearing talk and demonstration by O'Halloran, followed by an extensive question-and-answer period covering topics ranging from road layout to porta-potties.

> **"Kyle Peer's presentation, along with the insights from the owner, Tom, and his granddaughter, Beth, were immensely helpful. The opportunity to spend time with them and ask questions was very important. They were welcoming and very helpful!"**
>
> **— Workshop participant**

The overall feedback from the day was very positive. This workshop is not a sales pitch but rather an honest look at the amount of time, cost, and effort it takes to produce a quality Christmas tree. It is important for the health of the industry to recruit new growers and to encourage them to join a grower's association.

Scientists seek to understand genomic variation in the American chestnut to help restore it to North American forests

At the turn of the 20th century, the American chestnut accounted for a quarter of the hardwood trees in some parts of Appalachia. The large tree was a crucial food source, producing nuts that were a staple in the diets of white-tailed deer, wild turkeys, and bears. In 1904, a fungal blight was first discovered on trees in New York City, accidentally introduced via imported Asian chestnut trees. The invader spread quickly; by 1906 it was estimated that 98% of American chestnuts in New York City were impacted by the blight, which first forms a canker under the bark of a tree and then forms a ring that "girdles" the tree, killing everything above it. Just a half-century after it was discovered, the blight had all but eradicated mature American chestnut trees from the North American landscape, infecting an estimated 4 billion trees and irrevocably altering Appalachian forest ecosystems.

Now, a $500,000 grant from the National Institute of Food and Agriculture will help Associate Professor **Jason Holliday** research methods to utilize the genetic diversity of remaining trees as part of broader efforts to introduce disease-resistant American chestnuts to U.S. forests.

"The roots of the American chestnut still survive," explained Holliday, who is also an affiliate of the Fralin Life Sciences Institute. "While the chestnut is no longer fulfilling its historical role in the ecosystem, the genetic material persists. You can still find them in the forest, but they look more like a shrub now. The fungal blight lives above ground and doesn't affect the roots, so many of the trees persist but rarely reach maturity."

For decades, efforts have been underway to return a blight-resistant American chestnut to eastern forests. Two parallel methods in tree breeding — traditional methods of hybrid breeding and newer transgenic methods that utilize genetic engineering strategies — are inching closer towards successfully developing a blight-resistant cultivar. Once that is accomplished, the next challenge is incorporating the genetic diversity that the pre-blight trees had developed over centuries to ensure that American chestnut can reclaim its place as a nut-producing tree in North American forest ecosystems.

This is where Holliday's research comes in. His team will gather and sequence the genomes of the surviving American chestnuts to understand how pre-blight genomic variation across the historical range of the species helped these trees adapt to and thrive in specific environments. "Working with Dr. Jared Westbrook, director of science at the American Chestnut Foundation (ACF), we're going out and collecting leaf samples from chestnut stump sprouts all across the tree's historical range, from Maine to Alabama," Holliday said. "We'll be sequencing the genomes of approximately 500 trees across that range to understand the extent to which genomic differences are related to environmental variation."

The data from this effort will allow ACF scientists to incorporate adaptive genetic variation that developed through centuries of natural selection operating on chestnut populations across diverse environments. This would ensure that blight-resistant lines of the American chestnut have the capacity to survive and reproduce.

"The goal is to propagate a bunch of the wild chestnuts and bring their genetics into an orchard context," Holliday explained. "They will then be grown to maturity so that we could collect pollen from them and use those trees to diversify the blight-resistant lines that are being developed. The end goal is to have one population of trees that is good for restoration in Virginia, a different population that is good for restoration in New York or Pennsylvania, and so on."

It has been a century since the American chestnut has been an overstory contributor in North American forests, but the recent revolution in genome sequencing has accelerated efforts to return this dormant species to its role in the forest ecosystems of Appalachia.

Photo by Rachel Collins, Roanoke College.

Marc Stern facilitates local solutions to global climate challenges

continued from page 1

"If environmental concerns are framed exclusively as a global challenge, it's easy to brush them off as something too big to take on," Stern said. "When you instead make it local — when you say, 'here's a community, here's what's happening, here's what's predicted, so let's talk about it' — that makes the challenge manageable. The global side, and the politics surrounding it, becomes a secondary issue; rather, you're concerned that every time it rains your town has a flood, and you start thinking about what to do about it."

In order for these workshops to successfully reach and resonate with the intended local audiences, Stern notes that it is crucial that the workshops be developed to engender trust between experts and participants so that successful collaboration can happen. "We've done a lot of research around how trust can be developed in collaborative settings, which we hope to translate to facilitation techniques that can lead to a sense of empowerment and participation. We want participants to leave these workshops with a sense that they can solve these challenges."

For Stern, the project is a chance to make a lasting change in the world. "I look for projects where I can make an on-the-ground, tangible difference, and this is an obvious place to do that," Stern said. "If we can help even one of these communities on a positive path toward dealing with climate challenges by adapting their policies and planning efforts, that impact would be well worth the effort."

Grant helps Virginia Tech scientists find new ways to use secondary logging materials

continued from page 4

The grant funding, which will cover three years of research, is part of AFRI's commitment to improve rural economies by stimulating new ventures in biological resource utilization. Part of the project will be the doctoral work of **Austin Garren**, a FREC graduate student.

For Bolding, the joint efforts of the four universities are an opportunity to capitalize on the research strengths of each school while allowing a broader collaborative effort with partners and companies in the forest industry. "It's a very exciting project to be working on," he said. "It's very challenging, but by working regionally, I think it will be easier to get a clearer picture of what's taking place across the eastern United States and where we can go next. I think this work is going to greatly expand what we know about residue collection, and it could have a positive impact on renewable energy in the eastern U.S."

Jason Holliday receives $2.5 million NSF grant to research poplar genome

continued from page 6

To further diversify the environments captured in the study, Holliday's group has teamed up with ArbNet, an international community of arboretums, to create 20 "mini-gardens" of poplar hybrids across North America. Partner arboretums will grow replicates of the same poplar trees, allowing researchers to test their responses to different environments.

To aid in data collection and encourage STEM education to students, Hamilton will work with a postdoctoral fellow at North Dakota State to develop a middle school curriculum that will include hands-on collection and synthesis of data at these growing sites.

The project aims to provide the most comprehensive picture to date of the genomics of hybrid poplar trees, allowing researchers to examine the ways that genomics influence a tree's capacity to adapt to a range of environmental factors.

Schons teaches special studies course

In the spring of 2019, Forest Resources Management and Business was offered for the first time as a special studies course, led by Assistant Professor **Stella Schons**. The aim of the course was to expose students to basic forest management planning and business concepts to support sound decision-making, from the level of the stand to the forest landholding and the business organization as a whole. Students performed harvest scheduling and financial analysis activities and even wrote a small business plan in which they applied basic business administration concepts to real forestry business problems.

Stella Schons (center) and students

Burning issues

Molly Hunt, an undergraduate forestry major in FREC, tilts a drip torch. Inside the canister, a liquid mixture of gasoline and diesel fuel shifts forward and siphons down, making a full circle around the fuel trap loop before reaching the lit wick. Hunt begins to pour fire.

On the other side of the ridge, senior forestry major **Emily Newcombe** lights a parallel line. The radio on Newcombe's shoulder chirps as voices direct her movements. At the perimeter of the burn, students and members of the Virginia Department of Forestry (VDOF) stand guard, ready to prevent any wayward sparks from crossing the fire line.

The fire starts small. As the flames grow, they burn branches and singe the lower bark of trees. Eventually flames climb 10, then 20 feet high.

This is a work day for students in FREC's Wildland Fire Ecology and Management course. Today's assignment is a prescribed burn.

A history of fire

Fire has always played a role in the forest ecology of southwestern Virginia. "If you look back on the history of our forests, fire has been a natural part of a forest's life," said **Adam Coates**, assistant professor of forest fire ecology and management in FREC. "Wildfires may have ignited when a lightning strike occurred during drier conditions. The fire would move and meander until precipitation extinguished it, a stream or water body created a boundary to contain it, or it ran into fuels that would not ignite. We also know that Native Americans used fire to clear land for agriculture or to maintain wildlife habitat."

"Many older trees have been harvested to expose their annual growth rings," he continued. "Often, you can see in the rings when fire events happened, and you can tell that some of the fire events were occurring when the trees were dormant during cold months, when forest fires from lightning strikes would be unlikely to occur. So we're in an area that was once dominated by repeated and frequent fires, both naturally occurring and manmade."

continued on page 12

Burning issues

continued from page 11

The rise of development, and particularly the movement toward urban living over the past century, has led to efforts designed to prevent naturally occurring fires in order to protect people and property. "As a result, we have forests in Virginia that have large accumulations of fuel in places where a long time ago fire would have burned off that excess," Coates said. "Controlled burns allow us to return the forests to a balance that once occurred naturally, while making sure that wildfire can't reach where people live."

The forests of Appalachia, less studied than drier landscapes where wildfire is a more prevalent occurrence, present compelling new areas of research related to fire use and prevention. "We've gone so long without fire being prevalent on the landscape that it's really hard to put fire back and expect it to do what we think it did a long time ago," Coates said. "To some degree, we have novel forests now. We took fire away and in doing that we've changed the dynamics of our forests. So trying to put it back is a complicated and challenging process. But it's also pretty interesting."

Preparing to light

Prescribed fires are not appropriate for every portion of our current landscape. Some areas have gone extended periods without fire, and other management activities might be needed before prescribed fire can be considered as an option. Careful consideration and planning are necessary for prescribed fire, long before anyone can ignite fuel on the landscape.

On the day of the burn, the first stage of prescribed fire implementation on the ground typically involves shovels and rakes, but — if one is lucky and terrain permits it — preparations might include a bulldozer.

"Once we determine the general area we want to burn, we construct a boundary around it," Coates said. "The key is to remove any potential fuel from the line so the fire can't cross." For the 11-acre burn conducted on Virginia Tech's Fishburn Forest to enhance wildlife habitat, the crew used heavy machinery to dig a portion of the fire break, a perimeter around the burn area where the ground is cleared to bare soil. Students completed the circle using metal rakes and leaf blowers. Personal protective equipment includes fire-resistant clothing, work gloves, fire-resistant boots with 8-inch tops and Vibram soles, and hard hats.

The fire burns with surprising speed, the dormant fuel of the forest quickly exhausted. When it is out, the students march onto the blackened landscape, using steel rakes to check the ash layer for dormant hotspots and taking measurements of the depth of the burn in the layers of soil. The students also study the movement of the smoke and monitor the perimeter to confirm no sparks have crossed the divide into the wider forest. They check tree stumps and pour cold ash and dirt over the heat to fully exhaust the fire.

In one corner, a stand of pitch pines has survived. The trees will grow new shoots from epicormic buds activated by the heat. New branches will grow at angles, developing layers of bark that protect inner layers from future fires. In spring, the trees will drop their cones onto the ash and rich soil, and seeds will emerge from these cones.

That's when you know you got 'em

Conducting a burn with the VDOF gives students one-on-one time with professionals, transfers classroom learning to the field, and creates an experience that helps bring a new generation of foresters to the field. "We ask the students to tell us what they're seeing as the burn is happening," Coates explained. "Afterwards, they'll start to make inferences from the experience. And because each fire is such a unique event, we're asking them to be the scientists of the event, to be the ones asking the questions and working out the answers.

"It's perfect on-the-job training," he continued. "The work of conducting a burn briefing, laying out the objectives, and doing the preparation is what the students are going to wind up leading when they're on a job. You can see their faces light up with excitement about the work we're doing, and that's when you know you've got 'em. That's when you know they're hooked."

continued on page 13

Burning issues

continued from page 12

From the classroom to the forest

Across the U.S., few universities employ professors dedicated to teaching and researching fire ecology. Coates' position reflects Virginia Tech's commitment to studying the role that fire plays as a tool for foresters and as a naturally occurring event that demands preparedness. The availability of a fire expert on campus also broadens research opportunities for other faculty members.

"We have some really terrific, highly specialized faculty here," Coates said, "and having a designated 'fire guy' like me, someone who can put fire on the ground and study the energy being produced by it, really creates unique opportunities for collaboration. We can better understand how fire might affect soil or water, for example. This helps us fit both prescribed fires and unplanned wildfires into the broader context of forest management."

According to Coates, climate change has increased the urgency for studying forest fires. He cites the spate of wildfires in North Carolina, Georgia, and eastern Tennessee in late 2016 as a precursor to what Appalachia could face in coming years. "Only three ingredients are needed to create flames: heat, oxygen, and fuel. If you consider weather patterns and how they affect fire, you have to think about periods of wetting and drying and how they affect vegetation. In the context of fire, living and dead vegetation become fuel. When we receive abundant rainfall, vegetation responds with new growth. If we have extended periods of dry weather after that abundant new growth has occurred, that vegetation becomes dry and easier to ignite," Coates said.

"Under these conditions, all it takes is one major wind or storm event, or someone being careless or malicious with fire, and the results are these seemingly anomalous wildfires. We're seeing rising temperatures and changes in the dynamics of moisture, and we've got to get a grasp on how these events occur so we can make efforts to prevent them, or at least minimize potential damage for people and their property."

Education is also essential. Coates intends to work with communities across the region through the Firewise USA program, aimed at educating residents in suburban and developing areas on how to build houses and maintain properties in ways that reduce fire risk.

Coates also hopes to develop a designated center for fire research. "I have an infrared camera and numerous devices that measure heat, and we're able to use all of these tools to conduct research in the field," Coates explained, "but we don't have a centralized burning chamber or table experiment space to take smaller amounts of material and run research. It'd be great to be able to manipulate variables in a controlled setting, to create certain types of fires with specific vegetation under specific environments and measure how they burn. We've talked about developing a facility where we could do that type of research with a high level of accuracy. That's the next step."

The wildfire chasers

For **Molly Hunt**, working in forestry has always been an ambition. "I grew up in the woods," said Hunt, a May 2019 graduate. "I have a huge passion for conserving the land and protecting the woods, and I came to Virginia Tech wanting to learn how to do that." The wildland fire course inspired Hunt to join the New River Valley Wildland Fire Crew. Monthly training activities sponsored by the group helped her work toward an Incident Qualification Card, a requirement for fire crews working on federal lands.

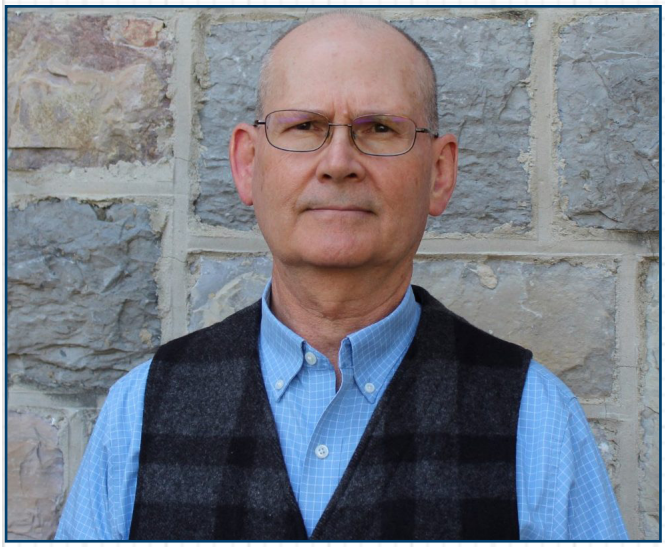
Emily Newcombe spent the summer of 2018 on a wildland fire crew based in Idaho. The team fought fires across the Western U.S. "The biggest fire we saw was around 450,000 acres," Newcombe said. "It was mostly grass and sagebrush that ran really quickly. We'd get to one location and find that the fire had run off, and the heart was 30 miles away from where we expected it to be."

Newcombe, who is working this summer on another wildland fire crew in Darby, Montana, said that working as a woman in the field has been a positive experience. "I don't feel like I've had any negative experiences specifically because I'm a woman," Newcombe said. "There was another female on our crew, and I think that as more women see us out there in the field, they will recognize, 'Oh, this is something we can do.' And the numbers will continue to increase."

Spotlight - faculty, staff, students

W. Michael Aust named Honorable Garland Gray Professor of Forestry

Professor **W. Michael Aust** has been named the Honorable Garland Gray Professor of Forestry by the Virginia Tech Board of Visitors.



W. Michael Aust

The professorship was established in 1985 by the late state Sen. Elmon Gray, who named it in memory of his father, who also served in the Senate of Virginia. The professorship recognizes teaching and research excellence in FREC.

A member of the Virginia Tech faculty since 1989, Aust has focused his teaching, research, and outreach activities on maintaining and improving the long-term sustainability of managed forests with an emphasis on forestry best management practices for protection of water quality and site productivity.

He has received approximately $4.5 million in research funding over the course of his career, primarily for forest operations projects. His research has been instrumental in the development of national forestry best management practices, and his work has informed a brief for the U.S. Supreme Court. Aust's research has supported approximately 50 past and current graduate students and has resulted in more than 200 professional publications.

Aust has been invited to present his work to the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service, as well as numerous national and international conferences. He received the George E. Dissmeyer Forest Water Resource Outstanding Service Award from the Southern Group of State Foresters.

In the classroom, Aust receives high student evaluation scores and is known as a dedicated and demanding professor who challenges all his students and provides hands-on learning experiences. He is an approachable mentor and advisor whom students regularly seek out for counsel and additional learning opportunities. Aust has received 12 teaching awards in his career, including the university's William T. Wine Award for Teaching Excellence in 2018, the College of Natural Resources and Environment Teaching Excellence Award, and the Virginia Tech Alumni Award for Excellence in Teaching.

Aust regularly conducts presentations, workshops, field trips, and Extension programs that address forest operations and provide continuing education for federal and state agencies, professional organizations, certification agencies, and private citizen groups.

He received his bachelor's and master's degrees from Mississippi State University and his doctorate from North Carolina State University.

Thomas Fox and Susan Day conferred emeritus status

Thomas Fox

Thomas Fox, former FREC professor, has been conferred the title of the Honorable Garland Gray Professor Emeritus by the Virginia Tech Board of Visitors.

A member of the Virginia Tech community from 2000 to 2017, Fox made significant contributions to the field of forestry through his work in forest soils and silviculture that focused on intensive plantation management. He authored or co-authored more than 110 peer-reviewed journal articles and book chapters and was principal or co-principal investigator on research grants exceeding $38 million.

Fox brought national and international notoriety to Virginia Tech by serving as co-director of the Forest Productivity Cooperative, a university, agency, and industry partnership with more than 50 members across the United States and Latin America. He also served as the Virginia Tech site director of the National Science Foundation's Center for Advanced Forestry Systems from 2007 to 2017.

Fox received numerous honors and awards throughout his career, including the USDA National Partnership Award for Research and Extension in 2016 and the Society of American Foresters Barrington Moore Award in 2013. He was named a Fellow of the Soil Science Society of America and a Fellow of the Society of American Foresters in 2012. He held the Honorable Garland Gray Professorship of Forestry in FREC from 2014 to 2017.

In the classroom, Fox taught both undergraduate and graduate courses in forest soils, silviculture, sustainable forest management, and forestry field skills. He advised numerous students on master's theses and doctoral dissertations and helped them develop successful careers in both academic and professional settings.

In 2017, Fox was named vice president of forest productivity and sustainability for Rayonier, Inc. Fox received his bachelor's degree from the University of Maine, his master's from Virginia Tech, and his doctorate from the University of Florida.

Susan Day

Susan Day, former associate professor of urban forestry in FREC and the College of Agriculture and Life Sciences, has been conferred the title of Associate Professor Emerita by the Virginia Tech Board of Visitors.

A member of the Virginia Tech community from 2008 to 2018, Day made significant contributions to the field of urban forestry through her work in urban soils and tree response to soil management and site design. She authored or co-authored more than 36 peer-reviewed journal articles and more than 30 book chapters, edited books, or conference proceedings.

Day brought national and international visibility to Virginia Tech through her leadership in Urban Forestry 2020 and her service on the International Science and Research Committee of the International Society of Arboriculture (ISA). She has been recognized by her profession for her work with awards and honors that include the ISA's L.C. Chadwick Award for Arboricultural Research in 2017 and the Early Career Scientist award in 2010. She received the Mid-Atlantic Chapter of ISA's Award of Merit in 2008 and again in 2018 for exemplary service to the profession.

In the classroom, Day taught both undergraduate and graduate students in urban forest management, urban ecology, environmental site design, and plant establishment. She advised numerous students on master's theses and doctoral dissertations and helped them develop successful careers.

In 2018, Day was named professor in the Department of Forest Resources Management at the University of British Columbia. Day earned her bachelor's degree at Yale University, her master's at Cornell University, and her doctorate at Virginia Tech.

Jeff Marion receives George Wright Society Award for natural resources achievement

Jeff Marion

Jeff Marion has built a career around a lifelong passion for the outdoors, and that effort has culminated in his being selected as the co-recipient of the George Wright Society's Natural Resources Achievement Award for 2019. The award seeks to recognize excellence in research, management, and education related to parks and protected areas.

Marion, a recreational ecologist with the U.S. Geological Survey and an adjunct professor in FREC since 1989, is a founding contributor to the field of recreation ecology, which develops and applies ecological knowledge to examine and limit the environmental impacts caused by recreational use of park and forest lands.

"The land management agencies have a dual mandate that directs them to both protect natural resource conditions and processes and to accommodate appropriate recreational activities in protected areas," Marion explained. "By understanding and modeling the effects of that use, recreation ecologists can work with land managers to direct activities and interventions that will maintain the sustainability of that use."

Marion's passion for the outdoors started at a young age. Growing up exploring the woods and streams of Kentucky, he and his three brothers all achieved Eagle Scout status, and he was a staff member for the Boy Scouts' Philmont Scout Ranch, a high adventure base in New Mexico. These experiences led him to pursue studies in biology and natural resource management.

His "lightbulb moment" came while he was a master's student in the environmental management program at Duke University. "I came across a paper on wilderness management research, and there was a part that examined the literature on resource impacts from wilderness recreation," Marion recalled. "I took it to my advisor, and he suggested I do an independent study on visitor impacts to wilderness. There was some literature on it, but the field wasn't really developed at the time."

Marion transferred to the University of Minnesota to pursue this new topic, where he received his master's and doctorate. This decision allowed him to develop research methodologies that would give the field of recreation ecology a foothold in the wider areas of environmental conservation and natural resources management. He has published numerous papers in leading peer-reviewed journals and helped to develop and expand land conservation principles that have significantly reduced human impacts on remote environments.

Marion has been involved in the nonprofit organization Leave No Trace since its founding, and he authored the organization's 2014 book, "Leave No Trace in the Outdoors." Since 1989 Marion has led the Virginia Tech Field Station of the U.S. Geological Survey's Patuxent Wildlife Research Center. His expertise in recreation ecology has led to his collaboration with leading scientists in China to develop management and preservation policies for forest ecosystems across the world.

In 2014 Marion returned to the Boundary Waters Canoe Area Wilderness in Minnesota to re-measure soil and vegetation impacts on campsites he had previously researched while doing his doctorate in 1982. Marion and colleague **Jeremy Wimpey**, who earned his doctorate at Virginia Tech in 2009, are currently completing a study to characterize and reduce the impacts of hikers on the Appalachian Trail, and have initiated a similar multi-year study of camping impacts on the Pacific Crest Trail.

For Marion, the George Wright Society Natural Resources Achievement Award honors a career that hasn't ever felt like work. "Outdoor activities are my passion, and I followed that passion," he said. "I was fortunate to find a way to combine my outdoor interests with my academic and professional ambitions, and it's never felt like I work for a living. I really enjoy what I do, and I can't believe that I get paid to do what I love."

Michelle Prysby receives 2019 Gerald P. McCarthy Award

The Institute for Environmental Negotiation (IEN) at the University of Virginia announced that **Michelle Prysby** is the recipient of the 2019 Gerald P. McCarthy Award for Leadership in Environmental Conflict Resolution. The McCarthy Award is presented annually to an individual who demonstrates leadership in preserving and protecting the commonwealth's environment through collaboration. Prysby received the award for her work in developing the Virginia Master Naturalist Program from its start in 2005. She is an Extension faculty member in FREC and is based in Charlottesville.

Michelle Prysby (with award)

Class of 2019: Laura Puckett merges a passion for the outdoors with keen insights into environmental data

Whether she is hiking a 1,000-mile stretch of the Appalachian Trail or setting the standard for future environmental informatics majors, **Laura Puckett** is a trailblazer. Selected as the 2019 FREC Outstanding Senior, she has found her niche in the relatively new field of environmental informatics. Excelling in the discipline calls for using quantitative tools to unlock new information about ecosystems and environmental changes as well as a passion for protecting and preserving natural resources.

Laura Puckett

Associate Professor **Quinn Thomas** said that Puckett represents the vision of what an environmental informatics major can be. Puckett was hired to work on Thomas' research team for several semesters, assisting with computational needs for different ongoing projects each semester to improve the ability to forecast the future of forest and freshwater ecosystems. "She's done a range of very computationally intensive problems with a high degree of independence. I can give a general direction and she will figure out how to proceed with the work, which is very impressive," Thomas said.

Puckett's capacities at self-direction were reflected when she was selected for Harvard University's prestigious Harvard Forest Summer Research Program in Ecology, an 11-week program focused on independent projects researching the effects of human and natural influences on a forest ecosystem.

Puckett, who grew up in Radford, is an avid hiker who spends her free time working as a trail maintenance supervisor for 30 miles of the Appalachian Trail maintained by the Outdoor Club at Virginia Tech. "My passion for hiking definitely goes hand in hand with my interest in environmental informatics," she said.

"It's been easy to feel at home at the College of Natural Resources and Environment," Puckett said. "I especially like that the professors care so much. It makes learning more interesting when you know they are so involved with the subjects they're teaching."

In the fall, Puckett will be starting a Ph.D. in ecological and environmental informatics at Northern Arizona University.

Summer fire ecology projects

Assistant Professor **Adam Coates** had six undergraduate research technicians and five graduate students working on various fire ecology projects this summer. Undergraduates **Nick Boley**, **Amy Denny**, **Cora Every**, **Brandon Hughes**, **John Kese**, and **Leah Wood** have spent time collecting forest fuels data on the Fishburn Forest with graduate student **George Hahn**. Boley, Hughes, and Kese have also worked in Great Smoky Mountains National Park to evaluate changes in forest fuels from 2003 to 2019. Denny, Every, and Wood worked part of July with Melissa Thomas-Van Gundy (USDA Forest Service, Fernow Experimental Forest, West Virginia) to evaluate long-term forest changes following prescribed burning.

Graduate students **Christen Beasley**, **Adam McClure**, and **La' Portia Perkins** spent portions of the summer working with wildland fire scientists at Tall Timbers Research Station and Land Conservancy in Tallahassee, Florida, and Thomasville, Georgia. Graduate student **Chris Dukes** spent most of his summer evaluating the impacts of long-term fuel reduction treatments on forest soils in the southern Appalachian Mountains.

These students have worked very hard to collect data that will better inform our understanding of eastern U.S. forest fuels and potential implications for long-term forest management.

Undergraduate students (left to right) Amy Denny (sitting), Cora Every, Brandon Hughes, Nick Boley, Leah Wood, and John Kese collect fuel samples on the Fishburn Forest in Blacksburg.

A new Leica BLK360 imaging laser scanner was put to use at Greenwood Plantation, Thomasville, Georgia, to better understand understory fuel dynamics prior to prescribed burning. This research is being conducted as part of a grant proposal funded by the Department of Defense.

Graduate students (left to right) La'Portia Perkins, Adam McClure, and Christen Beasley inspect a baby gopher tortoise being cared for at Tall Timbers Research Station and Land Conservancy in Tallahassee, Florida.

Graduate student Adam McClure uses a boom lift to sample longleaf pine cones at Greenwood Plantation, Thomasville, Georgia.

Eric Wiseman receives awards

Associate Professor **Eric Wiseman** received both the 2019 University Certificate of Teaching Excellence and the CNRE Outstanding Faculty Award.

Certificates of teaching excellence are awarded annually by the university to 21 faculty members selected by the individual colleges. The number awarded is proportionately distributed over the university according to the number of instructional faculty positions allotted to each college, with each college awarding at least one certificate.

Eric Wiseman

Promotion and tenure successes!

Scott Barrett was promoted to associate professor with tenure.

Barrett's interest areas include forest operations and biomass utilization, logger education and the impacts of education on logging safety, productivity, and the implementation of sustainable forestry practices.

Barrett is also the coordinator for the Virginia SHARP Logger Program.

Kelly Cobourn was promoted to associate professor with tenure.

Cobourn's interest areas include natural resource economics, applied econometrics, bio-economic modeling, water resource policy, and invasive species management.

Quinn Thomas was promoted to associate professor with tenure.

Thomas' interest areas include broadly focusing on understanding the interactions between forests and global environmental change. To address these questions, he works across a wide range of spatial scales, from individual trees to the globe, using a broad set of tools, including ecosystem and Earth System models, remote sensing, large dataset analysis, and whole-ecosystem experiments.

FREC undergraduate and graduate awards

Undergraduate student **Laura Puckett** received the Outstanding Senior Award. (See story on page 17.)

Graduate student **Jake Diamond** received the A.B. Massey Outstanding Doctoral Student Award.

Undergratuate student **Amanda Roberts** received the David William Smith Leadership Award.

Graduate student **Chris Dukes** received the Outstanding Teaching Assistant Award.

Graduate student **Tyler Weiglein** received the H. E. Burkhart Outstanding Master's Student Award.

Alumni corner

Recent Alumni Award recipient **Danielle Gift** ('09 M.S., forestry and forest products) has spent 10 years with the New York City Department of Parks and Recreation in a variety of roles. She is currently the senior project manager for tree preservation, responsible for initiating and overseeing several programs, including pest and disease management, storm response planning, and tree restitution and replacement.

Danielle Gift

Mentoring and networking are important components of Gift's career. By staying engaged with the Virginia Tech community, she learns about current research and can apply it to her day-to-day work. She maintains a great relationship with her faculty advisor, Associate Professor **Eric Wiseman**, and shares guidance and advice with students about being an urban forester. There are currently two Hokies employed in Gift's office, and she looks to hire more.

Gift also dedicates time to urban and community forestry professional councils and organizations. She serves on the board of directors for the New York State Urban Forestry Council, works with the Society of Municipal Arborists' Membership Committee, participates with the Urban Ecology Collaborative, and contributes to the Region 2 (NYC) ReLeaf workshop committee.

"I am honored and completely humbled to receive this award," Gift said. "I'm so excited to share this honor with my mom, the original influencer in my life, and with my dad, who would've been so proud of me."

Commemorative trees

Each spring a tree has been planted on the Virginia Tech campus to commemorate the graduation of undergraduate students from the College of Natural Resources and Environment's four academic departments: Fish and Wildlife Conservation, Forest Resources and Environmental Conservation, Geography, and Sustainable Biomaterials.

Students gather with friends, family, and faculty at the conclusion of the college's commencement ceremony to plant the commemorative tree. During the ceremony, a symbolic item from each department is placed into the tree planting hole, and students pitch in to plant the tree. FREC faculty lead the sourcing of the commemorative tree each year. A species having cultural or ecological significance to rural and urban forests of the United States is selected.

Professor **John Seiler** has been involved with tree selection and sourcing almost every year since the commemorative tree plantings began. Associate Professor **Eric Wiseman** has helped Seiler in recent years. In fall of 2018, Wiseman led a group of undergraduate students to create a website for the trees. He will eventually put metal tags on the trees to identify them and the year they were planted.

We encourage alumni to send us photos or stories about their experiences with planting the trees at www.plantsmap.com/organizations/25261/collections/33343.

2019 M.F., M.S., and Ph.D. graduates!

- Cianciolo, Tommy
- Diamond, Jacob
- Erwin, Gracie
- Fitchett, Leah
- Garren, Austin
- Hammer, Rachel
- Hawks, Brent
- Hurst, Kristin
- Lee, Hannah
- Mahendra, Ayeshan
- Pratson, Daniel
- Russell, Ed
- Scott, Sam
- Stewart, Peter
- Thompson, Brooke
- Thompson, Emma
- Weiglein, Tyler
- Wilkens, Delie
- Yang, Sheng-I

Welcome new graduate students!

M.F. Students

- Howell, Robert
- Sprouls, Jason

M.S. Students

- Byers, Alexander
- Fileding, Jonah
- Horton, Celeste

Ph.D. Students

- Arredondo, Johanna
- Brousseau, Jennifer
- Dettmann, Garret
- Garren, Austin
- Hawks, Brent
- Hurley, Elizabeth
- O'Brien, Caleb
- Talley, Emily

Forestry newsletter is published twice a year, summer and winter, by the Virginia Tech Department of Forest Resources and Environmental Conservation

Newsletter Designer and Coordinator: Tracey Sherman

Newsletter Editor: Kathryn Hollandsworth

Newsletter Photos and Core Stories: FREC Faculty and CNRE/VT/Public News Releases

Please send information for future issues to Tracey@vt.edu

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