



ADVANCING THE SCIENCE OF SUSTAINABILITY

HUMANS-WILDLIFE-ECOSYSTEMS IN BALANCE

Kathleen Alexander's multidimensional research impacts Botswana and beyond

A billboard announcing "Welcome to the Land of Giants" is the first thing that greets arriving travelers at the Kasane airport in an area of Southern Africa called the "Four Corners Region," where Botswana, Namibia, Zambia, and Zimbabwe meet.

A small town in Northern Botswana, Kasane is the gateway to the world-famous Chobe National Park, considered to have the largest population of elephants in the world and one of the most diverse populations of wildlife in Southern Africa. The region's 70,000 elephants outnumber people nearly four to one.

Next to the Chobe National Park is Dr. Kathleen Alexander's CARACAL (Centre for African Resources: Animals, Communities, and Land Use) Biodiversity Center. Established in 2000, CARACAL operates through a holistic concept ahead of its time, where problems facing communities and ecosystems are engaged interdependently through multidisciplinary approaches that merge societal challenges with innovative solutions. Virginia Tech is currently revising its curriculum and research program to reflect this kind of model.

"We focus on understanding the challenges that face a community within the context of coupled natural-human systems," Alexander iterated. "We work together with communities and governments to develop solutions that recognize the realities they face — what is feasible for them now and in the future?"

A wildlife veterinarian and professor who received Virginia Tech's Alumni Awards for Excellence in International Outreach in 2013 and International Research in 2015, Alexander holds a Ph.D. in disease ecology and has worked across Africa. She is recognized by many international agencies for her global contributions in disease ecology, wildlife conservation, and rural development.

She joined the college's Department of Fish and Wildlife Conservation in 2007 as her first academic appointment and alternates her time between her lab in Blacksburg and her research center in Botswana. In the past 10 years, she has been awarded more than \$5 million in research grants as the principal investigator from an overall total of \$24 million in collaborative grants, much of which comes from the National Science Foundation.



Before they co-founded CARACAL, Alexander and her husband, Mark Vandewalle, Ph.D., a savannah ecologist, both worked for the Botswana's Department of Wildlife and National Parks in the 1990s. Vandewalle, CEO of CARACAL, is a Botswana citizen with more than 40 years of experience in wildlife management and research.

Alexander ran the government's Wildlife Veterinary Unit. At the time, she was the only woman occupying such a government position across Sub-Saharan Africa. She later worked as an ecological advisor to the Office of the President of Botswana and the government's Attorney General Chambers.

At Virginia Tech, Alexander's research has expanded exponentially. Her discoveries and activities have been game changers.

Game changer #1 In 2010, Alexander discovered a novel tuberculosis (TB) pathogen, *Mycobacterium mungi*, related to human TB, that infects banded mongoose in Botswana. Alexander and her team found that this TB pathogen is transmitted through mongoose social communication behavior, a ground-breaking discovery. As with many animals such as dogs and hyenas, mongoose communicate with other members of their species using urine and anal gland secretions.

Scent marks from sick animals were found to be infected with the TB pathogen, allowing the disease to be transmitted between and within mongoose social groups when individuals sniffed or were marked with the infected secretions. "This discovery has critical implications to our current understanding of how TB and other infectious diseases can be transmitted in territorial species," Alexander explained. "We have recently sequenced the genome of this new TB pathogen and are now beginning to investigate why this TB strain behaves so differently." Together with work on other zoonotic pathogens such as leptospirosis, brucellosis, Rift Valley Fever, and anthrax, Alexander and her group have contributed significantly to public health strategy development for the region.

Game changer #2 Changes in environmental drivers can predict diarrheal disease outbreaks in Botswana. Alexander compiled a 30-year data set (the longest of its kind in Africa) and, with colleagues, identified significant relationships between diarrheal disease and meteorological variables, signaling increased population vulnerability to future climate change. "These relationships will allow us to start forecasting outbreaks and develop government readiness," she said. Diarrhea is the second leading cause of death globally in children under five years of age.

Alexander's group found that the presence of surface water significantly changed the timing of diarrheal outbreaks. Declines in water quality in the river coincided

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Kathleen Alexander, wearing the local sarong skirt wrap as is customary for women, regularly visits the local chiefs to seek guidance and direction on community projects. Here, she and CARACAL research assistant Mpho Ramotadima (left) go over a land use management plan with Kogsi Mwezi, a community chief.

with biannual diarrheal outbreaks in children. Important spatial relationships were also identified between water quality declines and wildlife populations with limited river front access. Alexander and her team have also found high levels of antibiotic resistance even in protected areas, an increasingly urgent global problem.

Game changer #3 "Population growth, wealth creation, and increased agricultural activity have fragmented natural habitats for wild animals," Alexander explained. "This increases human-wildlife conflict and presents a serious challenge to Botswana's conservation initiatives as well as rural livelihoods."

In the Chobe Enclave villages, Alexander worked with communities to develop participatory GIS maps of historical wildlife conflict events and used them to construct strategies for mitigation. This approach integrated traditional knowledge with standard scientific research, including remote sensing and modeling, and provided the basis for empowering communities to drive and develop their own solutions to conservation challenges.

Vandewalle and Alexander are leading a study on the use of forest resources by animals in the Chobe Forest Reserve. Long-term vegetation exclosures provide an opportunity to determine if elephants are primary drivers of forest degradation, a concern that occupies the political landscape. "What we are finding is no — the real threat is far more complex, involving long- and short-term climate dynamics and fire," Vandewalle said.

(Continued on back cover)



School children and their siblings in the village of Parakarungu love Alexander's visits. She works closely with her environmental education programs, now operating across the nine villages in the Chobe District.



The college's 25th anniversary celebration is scheduled for Sept. 15-16, 2017. Our planning committee has been working to create a fun-filled weekend where you can reminisce, see former classmates and professors, tour the campus, and reconnect with the college. The college today is a recognized leader in our disciplines. We remain true to our foundation built on the scholarship of forestry, fisheries and wildlife, wood, and geography, but we have strategically evolved to be a contemporary leader across the natural resources and environment landscape. Our academic programs are a blend of our rich and strong foundation in our core disciplines, with a careful, creative, and large dose of that special sauce that creates the future. The world has surely changed over these past 25 years, and the college has not stood by passively waiting for that change to impact us. What a very special feeling it is to be a part of an academic program that is thriving in today's complex world and in the landscape of higher education. I hope you can join us for an exciting weekend of remembrances, also culminating in our vision to move forward. I hope to meet many of our alumni and friends of the college at the September celebration. Mark your calendar today!

We recently dedicated the Legacy Table, which is now on permanent display in the Holtzman Alumni Center. Made from two historic trees on the campus — a white oak from the lawn of the Grove and the Henderson Lawn sycamore — the table is a gift to the university from students in the Wood Enterprise Institute (WEI). WEI is celebrating 10 years of engaged, experiential learning under the leadership of the Professor Earl Kline, Nettleton Faculty Fellow in the Department of Sustainable Biomaterials. Thank you to our many donors and friends who support WEI. I hope you will stop by and see this amazing piece of Virginia Tech history embodied in a beautiful work of craftsmanship.



The Legacy Table was dedicated at a ceremony at the Holtzman Alumni Center in April. (left to right): Dean Paul Winistorfer, Professor Earl Kline, and Matthew M. Winston Jr., senior associate vice president for alumni relations.

Spring semester included eight faculty searches across all departments in the college. Watch for announcements of new faculty joining us this fall in the following areas: geography department chair, geospatial sciences, infectious diseases, fire ecology, forest modeling and analytics, international forest economics and management, biopolymer materials, and packaging systems and design. Faculty and their expertise remain the foundation of what we do in the college. I am pleased we are able to fill vacancies in critical domain areas in the college.

Lastly, Lynn Davis, the only communications director the college has ever had, announced her retirement effective June 30, 2017, after 25 years of service. Lynn has been a strategic partner with me, and the

college's faculty and staff, in developing and executing a robust college communications strategy. She was instrumental in carrying out our brand and perception study during my first year as dean; we have used the results of this study to position our messaging under the brand Advancing the Science of Sustainability. The branding efforts helped propel the college to its No. 1 ranking these past two years. Lynn is the lead writer and strategist behind this publication, our popular quarterly newsmagazine. She and I personally developed a college showcase that is displayed in the hallways of the first floor of Cheatham Hall. Lynn has truly vested herself in our body of work, believes in what we do, and enjoys a large professional network of natural resources professionals and communicators. You may want to reach out to her before June 30 and can connect with her at davisl@vt.edu. Lynn will spend time in retirement visiting with her son and his family in Idaho while keeping a presence in Roanoke. Thank you, Lynn, for all you have given, and we all wish you the very best in your next chapter of life, enjoying your four grandchildren.

I hope to see you all in September at our anniversary celebration. Thank you for your interest, support, and recognition of the college. On behalf of our faculty, staff, and students, we wish you a pleasant spring and a fruitful summer ahead.

Warm regards,

Paul M. Winistorfer
Dean
pstorfer@vt.edu

Tree rings give new details to an old story

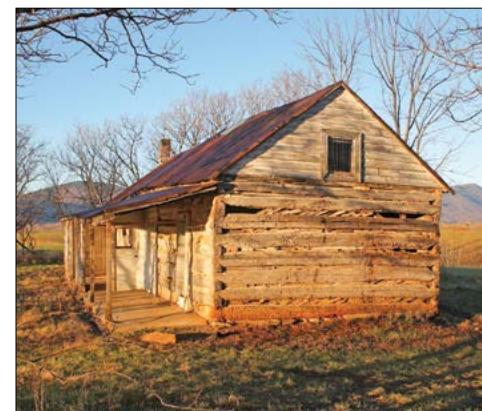
A team of graduate students from Associate Professor Carolyn Copenheaver's Advanced Forest Ecology class uncovered new details of Virginia's rich history through dendrochronology, or tree-ring dating.

Two historic structures — a kitchen and slave dwelling — at Greenfield Plantation in Fincastle were relocated in winter 2016. It was believed that the structures had been constructed in the mid-1830s, but dating of log structures is difficult from an architectural perspective since the same building techniques and materials were used for many decades.

Thanks to a partnership between the college and the Virginia Department of Historic Resources, decaying logs from the structures were analyzed to date when the buildings were constructed. Copenheaver and her students compared the tree-ring patterns in the logs with those from two old-growth white oak forests in Montgomery County and ran the measurements through a software program to determine their exact age.

They were surprised to discover that the structures were built later than originally thought. The kitchen was built in late 1844 or early 1845, while the slave dwelling was not built until 1864. "These might be the latest constructed slave quarters discovered to date," said Mike Pulice of the Virginia Department of Historic Resources. "It really sheds some light on what was going on right before the end of the Civil War." At that time, the plantation's owners likely realized that their operations could not continue if the slave population left. Pulice explained that the new quarters may have been built as an incentive for slaves to stay and work at Greenfield after they were freed.

According to Copenheaver, the tree rings also tell the story of European settlement in the area, including westward expansion before and after the French and Indian War, which ended in 1763. "These samples also provide an opportunity to see what forests in Southwest Virginia were like in the 1700s and 1800s."



Tree-ring dating found that this slave dwelling at Greenfield Plantation near Fincastle, Virginia, was built later than originally believed. Photo by Mike Pulice, Virginia Department of Historic Resources



CNRE celebrates 25 years!

Plans are underway for our signature celebration to mark the College of Natural Resources and Environment's 25th anniversary this year. Join us Sept. 15-16 to visit campus and reconnect with alumni, faculty, staff, and friends. Events include tours and field trips, a student group "Share Fair," family-friendly activities, a memorabilia display and scavenger hunt at Cheatham Hall, and social events on Friday and Saturday evening. Visit cnre.vt.edu/25years for details and registration information.

Correction

The cover article about the Forestry and Wildlife Field Tours in our winter 2017 issue incorrectly identified Harry Haney, who is now retired, as the Honorable and Mrs. Sheldon H. Short Jr. Professor of Forestry. Haney served as the Garland Gray Professor of Forestry. We apologize for the error.

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The pleasure of serving you

Thank you, dear alumni, faculty, staff, students, and friends of the college for the pleasure of bringing visibility to all the extraordinary work you do. As a lifelong learner, I have loved learning about and reporting on your good work ever since the college was created in 1992. It has been an honor to advance the college and make it known throughout the world. I am retiring to enjoy my four precious grandchildren and to pass along to them my love of the natural world.

Blessings to each of you,

Lynn Davis

Alumnus donates renowned photo collection to college

Bob Abraham ('53 B.S. forestry and wildlife), a Christiansburg native and nationally known photographer of birds and marine life, has gifted a collection of 32 of his framed photographs to the college. Abraham's work is regularly featured in the Roanoke Times and in national birding and wildlife publications, and is exhibited throughout the New River Valley. Abraham was the subject of a feature story in the fall 2015 issue of this publication.

"His stunning photography work ranks right up there with National Geographic and Audubon in quality," said Dean Paul Winstorfer. "We are delighted to have received these exquisite wildlife images and have hung them in our Cheatham Hall conference room to kick off the college's 25th anniversary celebration in 2017."



Bob Abraham (center), his wife, Doris, and son, Michael, with one of the 32 photographs Abraham donated to the college.

Spend summer in the Great Smokies!

Join students and non-students alike for a unique summer course, **Natural History of the Great Smoky Mountains** (FIW 2984), open to anyone interested in learning about the area's diverse ecology and natural history. Dr. Don Linzey, who has been conducting research in the Great Smokies for over 50 years, will lead the residential program at the Great Smoky Mountains Institute at Tremont in Tennessee Aug. 4-12.

Visit vtnews.vt.edu/articles/2017/01/cnre-greatsmokiescourse.html for details and registration information. K-12 teachers and Virginia citizens age 60 or older may be eligible for reduced tuition.



Photo by Michael Williams

Virginia ranks fifth for big trees

Virginia ranks fifth among states having the most big tree specimens, with 57 national champion trees, including 12 new champions, according to the 2016 American Forests Champion Trees national register.

Several Virginia trees were delisted this year, however. According to Associate Professor Eric Wiseman, who coordinates the Virginia Big Tree Program based in the Department of Forest Resources and Environmental Conservation, American Forests tightened its measurement requirements for trees with "atypical trunk development" such as split trunks or multiple stem trunks. As a result, Wiseman said that he and other program volunteers plan to remeasure and resubmit some trees to the national register.

Wiseman explained that the mild climate in Virginia provides optimal growing conditions for many species, helping to keep multiple champions on the register year after year. "We have a very diverse physiography in Virginia, so a lot of species can thrive here. Big tree programs like this can really demonstrate to the public what trees can achieve."



The Virginia Big Tree Program relies heavily on volunteers. Veteran big tree hunters Gary Williamson, left, and Byron Carmean have identified many of Virginia's state and national champion trees.

Geography teacher training academy tours mining towns

When geography instructor Stewart Scales agreed to lead an excursion for 20 high school teachers attending the Virginia Geographic Alliance's teacher training academy, he used the opportunity to share not only the importance of geography education but the unique culture of his home.

Scales led the group on a field trip to two mining communities in far Southwest Virginia — Appalachia and Big Stone Gap, Scales' hometown. Throughout the weekend, teachers explored the physical geography of both towns, delved into the social and economic implications of declining mining towns, and heard presentations from guest speakers.

Although the towns are only 2 1/2 miles apart, they are separated by a mountain range. Appalachia, on the west side, is situated in the middle of the coalfields, while Big Stone Gap, on the east side and separate from the mines, housed the company headquarters. "You have physical separation between the blue-collar folks and the administration," Scales explained. "After many of the mines closed, Big Stone Gap was able to diversify its economic base, while Appalachia wasn't."

The teachers also toured the Powell River Project, a partnership between Virginia Tech and several agencies and organizations that serves as a research station to test various agricultural and land-use practices to reclaim abandoned strip mines.

The trip was eye opening for the teachers, many of whom had never visited the region. "A lot of them had heard the worst stories you can imagine about mining sites being empty wastelands," Scales said. "It surprised them to see what you can do if a mine is reclaimed correctly. If you treat it right, you can get biological production out of it again."

The Virginia Geographic Alliance frequently partners with Virginia Tech to arrange field trips for teachers to see and experience concepts relating to geography education firsthand. "Geography is in everything," Scales said. "It's the tool that spans every discipline. The alliance offers qualitative immersion for these teachers and makes it a little easier for them to be able to teach geography."

For Scales, the field trip was more personal than simply sharing geographic knowledge. "My dad was a geologist for the Commonwealth of Virginia, and he did this very field trip for teachers when I was a child. To continue the work my dad started in educating people about Southwest Virginia was really fulfilling," Scales said.

On their tour of the Powell River Project, instructor Stewart Scales points out a retention pond — a control measure designed to allow disturbed sediment from surface mines to settle out of runoff before the water returns to a stream. Photo by Steven Chamberlin





Master's cohort explores water-related issues in India

In January, 28 students and five faculty members traveled to India as part of the Executive Master of Natural Resources program, based in the college's Center for Leadership in Global Sustainability in the National Capital Region. During the 12-day trip, students met and observed local organizations and individuals who are working to improve water management in some of the poorest and driest areas in the world.

The group began their trip in New Delhi, India's capital city, to meet with representatives from WaterAid India, a nonprofit organization working to improve water quality and sanitation in the world's third most populous city.



Students listen as a representative from WaterAid India describes some of the projects the organization has sponsored in the Delhi territory.

They continued to Jodhpur, an arid city bordering Pakistan that is known for its rich history, brilliant blue buildings, and relative lack of economic development. There, the students broke into teams to explore three water-related issues: development projects designed to bring clean water to rural communities, efforts to combat flooding in downtown Jodhpur, and restoration efforts on historic stepwells.

Rocco Saracina, a member of the stepwell team, said, "These wells look like inside-out pyramids that collect rainwater, but many of them have become polluted and fallen into disrepair. Restoring the wells not only provides a source of clean water for these communities, but because people are so reverent to water and many of the wells are associated with particular deities, there's also a social and religious significance."

Another group worked with the Jal Bhagirathi Foundation, which helps communities in the state of Rajasthan take control of their water management practices by providing training and resources. "Often, these efforts are led by women in the lowest caste. They have no power or authority, but they've turned their villages around and brought clean water to the people there," team member Susan Apollonio explained.

While in Jodhpur, the group also took time for cultural experiences, including a visit to the Maharaja's summer palace. "We shared with the Maharaja our reflections about the sustainability issues facing the community and what we learned through our project work in Rajasthan," Apollonio added. "You can spend all day looking at case studies and writing about sustainability and poverty, but when you meet people facing challenges every day, you process it on a different level. The intellectual exercise becomes an emotional one that connects you to people and community."

Since beginning its international programming in 2008, the Master of Natural Resources program has taken nearly 300 students to seven countries to study environmental sustainability issues. "Traveling abroad is integral to global sustainability, particularly in current times," said Michael Mortimer, founding center director. "It changes these students' perspective on the world they live in. It's a fantastically powerful opportunity."

Wooden homes prefabricated in U.S. could help reduce housing deficit in Latin America



Gaurav Kakkar (left), Henry Quesada (second from left), and Robert Smith (third from right) met with colleagues representing government and industry during their visit to Ecuador.

local architects and engineers often do not have the background to create sustainable wooden structures. In addition, one of the biggest challenges is the cultural distrust of wooden structures' ability to stand up against fire, earthquakes, or decay. However, this perception is changing following a 2016 earthquake in Ecuador, after which residents saw that most surviving structures were those made of wood.

In addition to helping remedy the global housing crisis, the development of the fabricated wood housing industry would be a boon for the "wood basket" region of the U.S. Southeast and Appalachians, thus increasing the region's economy. "The opportunity to increase the export of higher value products such as prefabricated homes could mean an increase in economic development for the industry and specifically for rural areas where many jobs depend on the forest industry," explained Professor Robert "Bob" Smith, co-principal investigator on the project.

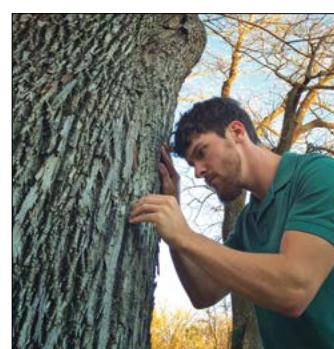
The data collected during these visits will be used to develop a marketing handbook for manufacturers in the U.S. looking to export prefabricated wooden homes. The handbook will include both the marketing aspects and logistical issues related to the packaging, transportation, and installation of the structures.

A research team from the Department of Sustainable Biomaterials is examining the market potential for wooden houses prefabricated in the U.S. as a way to help decrease the housing deficit in Latin America. These structures — which could be manufactured to specific international standards, packed in containers, and exported around the world — would provide affordable housing with ease of construction and low environmental impact.

The team, led by Associate Professor Henry Quesada, traveled to Peru, Ecuador, and Colombia to determine the market for, as well as the barriers to, using wood in residential and commercial structures. Master's student Gaurav Kakkar explained that the

team found several infestations of the invasive emerald ash borer, which has been chewing its way through North American ash trees.

Student's discovery saves campus trees



Michael Webb made a discovery last spring that helped Virginia Tech's building maintenance and grounds unit take action and save as many as 30 threatened trees. Webb found several infestations of the invasive emerald ash borer, which has been chewing its way through North American ash trees.

First discovered in the Great Lakes region in 2002, the pest has killed millions of trees and spread to more than 30 states and provinces.

Webb began working as a plant health care specialist for Bartlett Tree Experts in Roanoke even before completing his forestry degree in May 2016. He found his first emerald ash borer infestation on a job in Roanoke, prompting him to inspect ash trees throughout the area. When he found infestations on trees near Norris Hall and Cheatham Hall on campus, he contacted his advisor, Associate Professor Eric Wiseman, for advice. Wiseman directed him to the university's Insect Identification Lab to confirm the find and passed the information to Virginia Tech's Facilities Department.

Despite Webb's efforts and the university's prompt response, 35 ash trees were already beyond help and had to be removed. Fortunately, the number and diversity of trees on campus means that Virginia Tech's overall landscape is not significantly affected. Approximately 30 remaining ash trees were treated and will be closely monitored to ensure their long-term survival.

Virginia Tech hosts regional tree climbing championship

The college's Department of Forest Resources and Environmental Conservation hosted the Mid-Atlantic Chapter of the International Society of Arboriculture's annual Tree Climbing Championship on the grounds of the veterinary school in April. Arborists from Virginia, Maryland, West Virginia, and the District of Columbia competed for top scores in climbing events that test their speed, agility, and safety.

"The skills competitions emulate work practices," explained Associate Professor Eric Wiseman. "All of these competing arborists are professionals. These events are meant to highlight their good technique and safety practices."

Events included a work climb, which tests the competitor's ability to move about the tree using a

climbing line and saddle/harness; an aerial rescue event, a timed event that tests the competitor's ability to climb to and safely lower a climber who is unable to descend without assistance; and a belayed speed climb, which tests the competitor's ability to climb a predetermined route from the ground to about 60 feet up a tree using a belayed climbing system for safety.

Among the finalists were natural resources conservation alumni Jeff Inman ('11) and Mary-Ellen Burnette ('15), both with Bartlett Tree Experts. The overall male and female winners will represent the Mid-Atlantic Chapter at the International Society of Arboriculture's International Tree Climbing Championship at the National Arboretum in Washington, D.C., in July.



The competition events emulate on-the-job practices.

Wildlife conservation students venture to Ecuador

From dip-netting in water infested with alligator-like caimans, to attracting big cats with perfume, a group of students got the experience of a lifetime in Ecuador last summer. Five wildlife conservation students, along with five students from the College of Science, capped off a semester-long course with the trip to Ecuador, where they experienced the country's politics, history, culture, biology, and conservation issues.

Under the guidance of co-instructors Bill Hopkins and Ignacio Moore, both affiliated with Virginia Tech's Global Change Center, students conducted research projects during the trip, in teams or individually, based on subjects related to their interests.

Erin Dailey and her research partner, who both love frogs, examined whether color affects how the amphibians choose their breeding pools. They nailed colored plastic cups to trees to simulate such waters. During her time in the field, Dailey encountered the incredibly rare Pacman frog.

Alexandra Flevarakis studied macroinvertebrate community structures as possible indicators of water quality in an effort to find an inexpensive method for local individuals to assess the quality of their water



The study abroad trip to Ecuador included students from both CNRE and the College of Science.

source. Unfortunately, the remnants of a recent rainy season hindered the research. Despite this, Flevarakis said that studying abroad was a worthwhile decision, as she learned more about Ecuadorian culture, ecology, biodiversity, and even about herself than she would have anywhere else.

Matt Lacey worked alongside another student to research whether big cats are attracted to the Calvin Klein perfume

"Obsession for Men." While they did not find evidence to support the theory, Lacey's team captured images of many wild creatures, including photos of dwarf leopards and video footage of an Andean bear. "Going to Ecuador also helped open my eyes to other cultures and to the realities of the third world," Lacey shared. "It made me even more appreciative of what we have in our backyard."

Christina Nelson conducted observational research on the cooperative breeding behavior of the masked crimson tanager. She also spent time observing the wildlife from an artist's eye, rather than a scientific perspective, illustrating their behavior and movement, and shared that this experience gave her the opportunity to appreciate the world from multiple perspectives.

Emily Reasor's team learned about the use of medicinal plants from members of two Ecuadorian tribes. They learned about two plants in particular — the Matico and the Kilum — that are most effective for treating infected wounds. "Getting to do this in a field setting was one of the best learning opportunities I've ever had," Reasor said.

Packaging students place third in national competition

The college's packaging systems and design program has gained a significant victory — a student team placed third the Paperboard Packaging Alliance's 2016 Student Design Challenge, a competition that drew 72 entries from across North America.

The team's product design for "Pararice" — a play on "paradise" — was created by team leader **Vina Le**. She and fellow team members **Loc Pham**, **Anthony Tran**, and **Miguel Comparativo** did product research, studied concurrent trends in rice packaging, and developed a social media-based marketing plan as part of their capstone project in Professor Robert Bush's Packaging Systems and Design Practicum course.

Bush believes that Le's eye for design helped Pararice stand out from the competition. The judging was based on several criteria, including the product's ability to be reproduced on a commercial scale, stand upright on a store shelf, and hold and preserve a food product.

Virginia Tech has participated in this competition for a number of years, sending a total of four teams in 2016, but has never before placed in the top three. The team members and the Department of



Vina Le's packaging design earned her team third place in a national competition.

Sustainable Biomaterials were awarded cash prizes and invited to Pack Expo, where the students were recognized at an awards luncheon. Participation also makes Virginia Tech eligible for future student scholarships.

"It's great experience for the students," said Bush. "It's a real-life situation, put together by people in the industry. The entries are judged based on how they look, how they are made, if can it be done on a commercial scale. It's good exposure and it prepares the students for projects they'll do when they get jobs."

Le said competing in the design challenge was enjoyable because representation at such competitions helps place the packaging program in the national limelight. "It allowed me to push my knowledge beyond its extent," said Le, who graduated in May 2016 and now works for Packaging Corporation of America, having been promoted from structural design intern to project manager in a matter of months.

Student earns photography honors



Cole Thrift of Williamsburg, Virginia, a sophomore geography major, earned honorable mention in the VOWA/Hunt's Best Outdoor Photo Collegiate Competition, continuing Virginia Tech's success in the annual writing and photo contests sponsored by the Virginia Outdoor Writers Association. Thrift's photo of a garter snake, taken while on a hike to the Cascades with friends, was one of five finalists. His interest in photography was sparked by a trip to Africa with a friend majoring in cinematography to film a documentary. Since then, "I have been experimenting and teaching myself as I grow more and more in love with the art of photography," Thrift said. "I now spend a lot of time enjoying and capturing nature's beauty."

2016-17 Leadership Institute



Now in its seventh year, the institute helps students understand and experience leadership up close. Front row (left to right): Kelsey Krum, Jessica Fitzpatrick, John Connock, Catherine Jucha, Alexandria Cassell, Emily Newton, and Kirsten White. Back row: Director Brian Bond, Associate Director Steve McMullin, Margaret Goetz, Tristan Jilson, Matt Lacey, Lindsay Wentzel, Henry Cohen, and Dean Paul M. Winistorfer.

Students help to solve a real-world crisis

Last fall, students in Associate Professor Daniel Hindman's Green Building Systems course were challenged to design sustainable housing units for use in Middle Eastern countries taking in Syrian refugees. Their mission was to create a prototype for a cost-effective, practical, simple housing unit that could be shipped overseas and quickly assembled. Two student teams focused on the structure itself, a third team designed the interior and furnishings, and a fourth team worked on energy sources for the building unit.

To accommodate the typical needs of Syrian refugee families, the house designed for a four-person family can fit up to 10 people. Other features include a reversible tarp covering that can either insulate or deflect heat depending on the season, solar power with bicycle power as a back-up, flexible fold-up furniture, and an easily packaged but stable foundation of concrete blocks. The total cost of materials and shipping the 12-foot-square unit is \$4,837. The students plan to investigate grant funding to carry their design to the marketplace to help mitigate the refugee housing crisis.



A bicycle can run the unit's generator as a back-up to solar power.



Formaldehyde emissions challenge wood-based composites industry

Wood-based composites are used to make American homes and many of the wood-based items in them. These composites, often made from wood fibers, chips, and flakes, are versatile and useful, and they make timber resources more sustainable. "Composites make it possible to use lower quality wood, reduce waste, and even extend the impact of high-quality timber," said Professor Chip Frazier of the Department of Sustainable Biomaterials and director of the Wood-Based Composites Center. "Fossil fuel-based adhesives make this green technology possible for consumers and society."

Composites require a strong adhesive to hold everything together. The most popular adhesive, because it is effective and cheap, contains formaldehyde, which is derived from natural gas. Formaldehyde is critical to the production of wood composites because it creates molecular networks that bind particles of wood together for the life of the product. "However, in certain cases, water in the atmosphere can reverse this reaction, causing formaldehyde release into the indoor air," Frazier said. "And this is a potential problem for us all. When formaldehyde levels are too high, they can be toxic to humans."

For decades the federal government has set limits for allowable formaldehyde emissions from nonstructural composite products like particleboard. However, the Formaldehyde Standards for Composite Wood Products Act, signed into law in July 2010, required even stricter emissions restrictions down to levels that are very near the natural emission of wood itself.

Lignin, the natural polymer in wood that allows trees to stand tall, creates formaldehyde. Frazier calls this "biogenic" formaldehyde, while that created from natural gas and used in adhesives is termed "synthetic" formaldehyde. "Regulators and even some scientists did not realize that wood releases biogenic formaldehyde, particularly when wood is heated, which is how composites are made," he said.

The new emission limits are so low that industry must now account for biogenic formaldehyde, and the industry members of the Wood-Based Composites Center asked Frazier's research group to improve the understanding of how wood produces formaldehyde.

Frazier's research group included several students. Guigui Wan led the effort, assisted by Mohammad Tasooji; both were doctoral students macromolecular science and engineering, an interdisciplinary degree program spanning multiple departments and colleges. Also conducting research in summer 2015 were Heather Wise, who received her bachelor's degree in sustainable biomaterials in December 2015, and George Lewis, a 2016 graduate in materials science engineering in the College of Engineering.



George Lewis and Heather Wise served on the research team as undergraduates.



Guigui Wan (right) extracts a tree core for testing from a tree on the Blacksburg campus while **Mohammad Tasooji** (left) and **Chip Frazier** look on.

"We study the chemistry of how wood forms formaldehyde and what problems this poses in meeting the federal standards," Frazier explained. "Heather and George helped demonstrate that living trees contain biogenic formaldehyde and at vastly different levels among three different tree species."

Lewis sampled cores from yellow-poplar trees on campus, and Wise, now a master's student at the University of Washington, sampled Virginia pines in the woods just outside Blacksburg. Wan and Tasooji worked on these tree species plus radiata pine trees from a Chilean plantation.

Tasooji developed a microscale method to extract and quantify biogenic formaldehyde from a large number of living trees without killing or damaging them. Using this method, the team was able to measure formaldehyde levels in tree increment borings before and after drying and heating. As expected, heating significantly increases the production of formaldehyde — tenfold to thirtyfold.

As far as consumers are concerned, there is no difference between synthetic and biogenic formaldehyde; all that matters is if the level is too high. But, Frazier explained, "Biogenic and synthetic formaldehyde are different at the atomic level. It's feasible for us to distinguish the two because of differences in nuclear isotope ratios."

Currently, Frazier and colleague Brian Strahm, associate professor in the college's Department of Forest Resources and Environmental Conservation, are continuing this research at the request of the center's industry members. Strahm, an expert in using stable isotopes to reveal ecological processes, said, "Chip has grabbed my attention because he wants to show if any of the formaldehyde emitted from wood composites has a natural origin."

Frazier hopes that his work with Strahm can help determine new ways to reduce formaldehyde emissions in American homes. According to Frazier, "Using a different adhesive would be very costly to the average American."

Kathleen Alexander in Botswana

(Continued from back cover)



CARACAL's Mpho Ramotadima (left), **Mark Vandewalle**, and **Alexander** take measurements in one of their forestry research plots to evaluate elephants' impacts on forest resources.

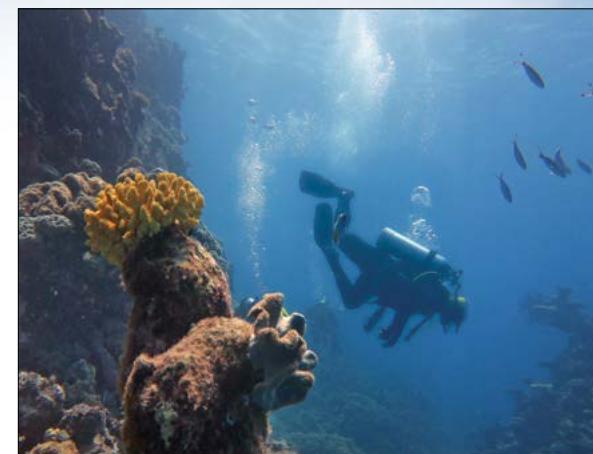
of All Out Africa, a citizen science project based in Tofu, Mozambique, focused on marine research and conservation, including species such as whale sharks and manta rays.

Alexander, who was a marine mammal behaviorist at Sea World in the 1980s, is helping to lead the research program directed at understanding the coupled dynamics of marine system health and rural livelihoods in Mozambique. "This program provides a unique opportunity for Virginia Tech students and others to immerse themselves in marine research, exploring the connections between the natural

marine environment and human communities," she said. Under Alexander's direction, a Virginia Tech winter break course in tropical marine ecology is in development for 2018 that will take undergraduate students to Mozambique. They will scuba dive along the country's tropical reefs to collect and later analyze data on system health, giving them a unique experience in global education.

Game changer #7 Based on her experience in forensics and law enforcement, which began when she worked for the Botswana government, Alexander is now assisting the government's Ministry of Environment, Natural Resources Conservation, and Tourism with the development of molecular wildlife forensic capabilities. Because the illegal trade in wildlife is escalating, remote areas are at greater risk. This partnership is directed at improving the government's ability to identify wildlife products when they are confiscated.

"Bushmeat is often deboned and the skin is removed, making it impossible to prove the confiscated material is wildlife in origin and to make an arrest," Alexander explained. "We help the government use molecular forensics tools in remote regions to fight the illegal trade in wildlife species." This significant game changer "will strengthen Botswana's effort to protect wildlife and stop profitable organized crime syndicates from gaining a foothold in the country."



Alexander scuba dives to gather information on coral reefs and whale sharks — the world's largest fish and an indicator species of system health — as part of a collaborative long-term study off the coast of Mozambique to monitor the health of the coral reef system and evaluate how the livelihoods of communities in the region are linked to the marine resources. Visit cnre.vt.edu/africa to view short videos of the marine field site.

In sum, Alexander's work recognizes and addresses the three major issues that confront Africa: poverty, conflicts with wildlife, and health. Through all the complexity and inter-connectedness, she hopes to empower the local communities and provide tools that will allow them to develop sustainable rural livelihoods and healthy natural systems.

Alexander joins school children from the village of Mabele. To her right (right to left in the photo) are Kgosi Ramsden, CARACAL education coordinator; Mma Nkwalale, principal education officer for Chobe; and the Mabele Primary School principal. Visit cnre.vt.edu/africa to view short videos of students from several primary schools honoring her education efforts with their sweet voices.



DONOR PROFILE

H. William "Bill" Gabriel

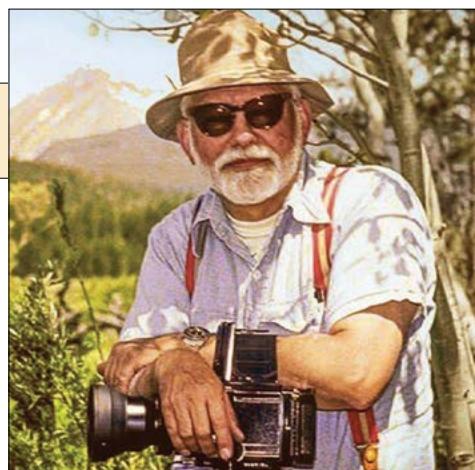
Thinking outside the box

"I dreamed of an outdoor life somewhere in the mountains, and at some distance from civilization, so I aspired to a degree in forestry and wildlife conservation," said H. William "Bill" Gabriel ('56 B.S. forestry and wildlife). "But we were poor folks, and tuition, room, and board at VPI [now Virginia Tech] was out of reach. Then I won a Virginia Academy of Sciences scholarship with a small study of local birds, so I applied to VPI and was offered a state scholarship. That changed my life."

Gabriel remembers hard work as an undergraduate and Spartan cadet accommodations in what is now Eggleston Hall. "I could look out my window and watch the stonecutters carve figures for the Pylons," he recalled. He was shaping his own future just as purposefully. With his career goal firmly in mind, he found jobs on campus during the academic year and, in the summers, hitchhiked to California where he fought forest fires and gained other hands-on experience.

"My education at VPI was the key to realizing a dream of an interesting and colorful outdoor life well off the beaten track," he said. "In my 32 years with the U.S. Forest Service, I worked from the windblown, treeless tundra of Alaska's Arctic coast to the steaming equatorial forests of Ecuador, and loved every minute."

Following retirement from government service, Gabriel became a writer and photographer, with work published in textbooks, encyclopedias, Audubon, Discover, Natural History, Time, and U.S. News. But after a dozen years of travel spanning six continents, ill health forced a second retirement. Gabriel now serves his local Montana Audubon Society chapter as chair of an endowment



supporting research at the University of Montana, where he had earned a doctorate in wildlife. His charitable giving includes both of his alma maters.

"For quite a while, my donations to VPI were small sums in response to annual giving solicitations," he said. But he wanted to more fully express his appreciation for his education and for the scholarships and student work opportunities that made his undergraduate education possible. "In 1999, I decided to endow an undergraduate scholarship for a forestry student that would make me feel like I was repaying for [all] I had received."

"I'm not a rich person and wasn't able to fund an endowment all at once," Gabriel added. However, as with other seemingly unattainable goals, he reached outside the box to create a solution that worked for him. "I arranged to fund the scholarship over a number of years with gifts of stock, IRA proceeds [charitable IRA rollovers], and cash, depending on what worked best for me each year." Gabriel included scholarship support in his estate plans as well, making Virginia Tech and the University of Montana equal beneficiaries of his life insurance and retirement account.

"My idea has been to help individual students realize their dream of a life among the trees and the birds, just as I was enabled by help from others," he said. "I guess that behind all this is a love for the outdoors, coupled with a desire to raise a new generation of foresters who will care for the health of our environment. I just want to help students, one by one, so they can go on to greater things."

Gifts of Stock

Your gift of stock or other securities can fund all or part of any gift you would otherwise fund with cash — and donating securities can provide tax benefits that effectively reduce the cost of making your gift. For more info, contact Emily Hutchins at ehutch@vt.edu or 540-231-8859.

Graduates earn top-notch meteorology jobs

Several recent graduates have leveraged their education and experience into high-profile meteorology positions.



Amanda Leitz ('14) B.S. meteorology) landed a position with the COMET program at the University Corporation for Atmospheric Research in Boulder, Colorado, where she works to develop training modules for meteorological needs such as data assimilation for weather satellites, aviation meteorology, and tropical cyclone forecasting. "In

order to figure out who you want to be and what you want to do, you need to explore your options," Leitz said. "As an undergraduate, I had two internships at an aerospace engineering company plus one at WDBJ7 in Roanoke, and I volunteered at the National Weather Service office in Blacksburg. It was thanks to all those opportunities that I was able to understand better what I wanted to do with my degree."

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Trevor White, a business information technology graduate who earned a master's in geography in 2016, is just down the road from Leitz at the Center for Severe Weather Research (CSWR) in Boulder. White, a Hokie Storm Chase veteran, earned a coveted

position working with CSWR President Josh Wurman, who was often featured on the Discovery Channel's "Storm Chasers" series. As an associate scientist, White is involved in data analysis, writing computer code, and visualization of weather data. "CSWR is where I planned to work after 10 years or so," he said. "Ideally, I'll start and end my career there. This is the lifetime job I wanted. I can't think of a better place I would want to work."

Joining White as an associate scientist at CSWR is fellow Virginia Tech and Hokie Storm Chase alum **Courtney Laughlin ('12 B.S. physics)**. Inspired by her studies and work under Dave Carroll, senior instructor in the geography department, Laughlin went on to earn a master's in meteorology at Penn State.

According to Carroll, stories like these are what make the geography department so unique. "It's a very student-centered department," Carroll said. "We get a lot of people transferring in who have a technical focus to their studies but want more of a service component. Meteorology provides that because you can really see the benefit to society."

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Hitt honored with Presidential Early Career Award



In January, President Obama recognized **Nathaniel "Than" Hitt ('07 Ph.D. fisheries and wildlife sciences)** as one of 102 scientists and researchers to earn the Presidential Early Career Award, the highest award that the government gives to independent researchers in their early careers.

Hitt is a research fish biologist for the U.S. Geological Survey at the Leetown Science Center in West Virginia. His current research focuses on climate change ecology from both physical and biotic perspectives. He is developing landscape models to predict where streams will be resilient to air temperature change, and investigating local adaptation to heat stress in native brook trout.

"I hope my research helps inform biological conservation and restoration planning in the Appalachian region," he said. "It's an honor to be selected by the Obama administration for this award, particularly among such brilliant colleagues within the federal science corps."

Professor Paul Angermeier, Hitt's advisor, said, "Than is passionate about fish ecology and developing the scientific knowledge needed to advance fish conservation. Even as a grad student, he excelled at formulating timely research questions and hypotheses, then designing studies to address them. He also had a clear vision of his long-term career path and how to assemble the skills and experiences needed to meet his career goals. This attitude persists in his work today."

Alumni news online

We love hearing about the great things going on with our alumni, but we don't have enough space in the newsmagazine to print them all. Catch up with former classmates and fellow Hokies online; scan the QR code or visit cnre.vt.edu/tags/alumni.html.

Recent posts

- Matt Hepler ('05 B.A.)
- Johann "John" Kinsey ('77 B.A.)
- Steve McConnell ('88 M.S.)
- Brigitte Orrick ('05 M.S.)
- Austin Short ('89 B.S., '91 M.S.)
- Ben Shryock ('14 B.S.)
- Dennis Treacy ('78 B.S.)
- James Wesson ('76 M.S.)
- Kevin Willett ('13 B.A.)



In memoriam:

- Thomas Bain ('73 B.S.)
- Joseph M. Crockett Jr. ('48 B.S.)
- George D. Crosby ('47 B.S.)
- Don Thomas Morton ('57 B.S.)
- Howard "Gene" Page ('70 B.S.)
- Donald R. Progulske ('52 M.S.)
- Mark R. Smith ('79 B.S.)
- Marshall Dale Stables ('68 B.S.)
- Michael V. Sturgill ('71 B.S.)

Wildlife and infectious disease expert a vital leader with Botswana's communities, tribal chiefs, and government officials

(Continued from front cover)

CNRE NEWS



Game changer #4 Alexander worked for 10 years with local chiefs and their communities to assess threats to food security and livelihoods, and identify sustainable solutions. Ecotourism, while billed as an important opportunity for local communities, may also negatively impact households when tourism developments become barriers to essential natural resources.

Alexander initiated a community-led mapping exercise in which critical natural resources were identified in the landscape and mapped by communities together with their management strategies. She presented these maps to the chiefs in order to empower traditional leadership to drive the land-planning process in their areas and ensure sustainable livelihoods were obtained. Nothing like this had ever been done before.



Michelle Wright (left) and Madalyn Fox are two of the four minority undergraduate students working in Alexander's lab under her African American co-mentoring program funded by the National Science Foundation. In addition to lab work, they are engaged with minority tribal groups in Alexander's field site.

Game changer #5 Fundamentally, it's all about education. At Virginia Tech, Alexander, who is affiliated with the Fralin Life Science Institute, has taken outreach to a new level. Initiating the African Co-Mentoring Framework funded by the National Science Foundation, Alexander focuses on developing opportunities for young African Americans to be leaders and to mentor others in a global setting.

Under this program, Virginia Tech African American graduate students and undergraduates work with minority high school students and Botswana minority tribal youth at Alexander's field site. "When you have knowledge and skills that are valued by someone else, you become a leader and have an opportunity to see



Kathleen Alexander, who provides wildlife emergency assistance to the Botswana government, rescued this white-faced scops owl that is now part of her environmental education program for youth. She has tended to snakes, wild dogs, buffalo, cheetahs, hyenas, lions, eagles and other birds, waterbucks, water hogs, crocodiles, baboons, zebras, mongoose, aardvarks, and pangolins.

your own worth and capability," Alexander commented. "We need to transform the educational process and allow confidence to be built alongside knowledge if we are going to realize true diversity in the sciences."

Alexander has also initiated the VT/CARACAL Community Environmental Educators Program, operated in collaboration with the Botswana government. Unemployed youth across nine villages are hired by Alexander as environmental education interns to work in their community's primary school. They are trained on the delivery of curricula developed in conjunction with her public health and environmental research. The program will reach more than 1,000 children weekly when fully operational.



This bush baby, one of the smallest primates, is CARACAL's favorite educational ambassador.

Innovation in education and conservation is further seen in the Wildlife Ambassadors Program launched by Alexander this year in the Chobe region. Through an essay competition, each school in her study site has selected students who will act as the year's advocate for wildlife and the environment in their school. "We can create a new culture of conservation by allowing young children to have power and a leadership role in environmental advocacy. They will be the decision makers of the future," she said.

CARACAL has been visited by U.S. and French ambassadors to Botswana, among other dignitaries, and hosts more than 3,000 school children annually to teach them about the environment. Rescued, injured, or orphaned wildlife are given a home at the center and contribute to the educational mission. Most Botswana people are fearful of wildlife, but VT/CARACAL educators, together with the center's wildlife collection, provide an opportunity for local children to develop a culture of understanding.



Alexander and Cysko, a skilled wildlife tracker who worked with Alexander for nearly a decade and a half, radio-track collared mongoose as part of her disease ecology research program.

These efforts are complemented by other programs, including the development of a craft center for impoverished women and training programs for government officials managing natural resources. Alexander uses the center as a location where vulnerable sectors of society, such as sex workers, can meet anonymously and self organize. "These young women often face great discrimination and, in some cases, even physical abuse," she stressed.

Game changer #6 Because of her background in promoting environmental sustainability, Alexander and her group are collaborating with Kim Roques, director

(Continued on page 6)

To view a photo gallery and learn more about Kathleen Alexander's work in Botswana, visit www.caracal.info.



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CNRE celebrates 25 years!

This year marks the 25th anniversary of the establishment of the College of Natural Resources and Environment. Visit cnre.vt.edu/25years for details on our signature celebration event Sept. 15-16 and other activities throughout the year to commemorate this milestone.