

SPRING 2023

# THE MAGAZINE OF SPES

SCHOOL OF PLANT AND ENVIRONMENTAL SCIENCES



TEERING OFF WITH TECHNOLOGY:  
IMPROVING THE COURSE WHILE SAVING RESOURCES



COLLEGE OF AGRICULTURE AND LIFE SCIENCES  
SCHOOL OF PLANT AND ENVIRONMENTAL SCIENCES  
VIRGINIA TECH



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A group of students studied abroad during Winter Term in South Africa, getting hands-on lessons in food security, wildlife, and conservation.



Photos by Mary Desmond for Virginia Tech.





## EXPERIENTIAL LEARNING ENHANCES SPES EDUCATION



Spring is a busy time for students in the School of Plant and Environmental Sciences. Over the next couple of months, they will wrap up projects and take final exams as the spring semester comes to a close.

Until then, students will be busy outside of the classroom, attending club meetings and functions while some of our teams attend national competitions.

Participation in these activities enhances the material taught in the classroom and better prepares them for their future careers. According to BestColleges.com, an online education advisor, extracurricular activities allow students to meet new people, build a community, and network. Hard skills are reinforced, but equally as important, they develop soft skills, like communication, time management, problem solving, and mentoring. These are some of the top skills employers are looking for and will make students stand out when applying for jobs.

Your support on Giving Day is benefiting the students on our four teams and six clubs. During the 24-hour event, where fellow Hokies show their support and give back to the university that means so much to them, you donated nearly \$2,200. Donations came from alumni, faculty, staff, and friends in nine states and Washington, D.C.

This funding will allow our nationally top-ranked teams to travel to competitions. It will give members of our clubs the resources to bring guest speakers to campus, plan trips where they get hands-on experience, and give back to the Blacksburg community through outreach efforts.

On behalf of our students, thank you for your continued support of SPES as we train the next generation of plant and environmental scientists.

Michael Evans  
Director & Professor



Students took a break from classes to attend CALS Fest Spring Fling. They enjoyed an afternoon of food, games, and giveaways while also learning about student organizations in the school and college.



The Magazine of SPES is published four times a year for students, faculty, staff, alumni, friends, and families by the School of Plant and Environmental Sciences at Virginia Tech.

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## SETTING RECORDS: NATIONAL COLLEGIATE LANDSCAPE COMPETITION TEAM MEMBERS WIN SCHOLARSHIPS

A record number of Virginia Tech students won scholarships from the National Association of Landscape Professionals. Six students were awarded scholarships totaling \$8,000.

“I am extremely proud of these students,” said Scott Douglas, team advisor. “They are dedicated and always striving to be the best. They are great representatives of Virginia Tech and the School of Plant and Environmental Sciences.”

The scholarships will be presented at the National Collegiate Landscape Competition in March at Mississippi State University in Starkville.

The NCLC is a conference and career fair for students, giving them the chance to meet industry professionals and interview for internships and careers.

The centerpiece of the conference is a 31-event student competition where they compete in events ranging from driving a skid steer to plant identification and landscape design.



Hannah Burton  
Rossen Landscape – Collegiate  
Leader Scholarship  
\$1,500



Joseph Carlin  
James River Grounds  
Management Scholarship  
\$1,000



Hannah Chambers  
Rossen Landscape – Collegiate  
Leader Scholarship  
\$1,500



Tyler Croson  
Include Software  
Scholarship  
\$1,000



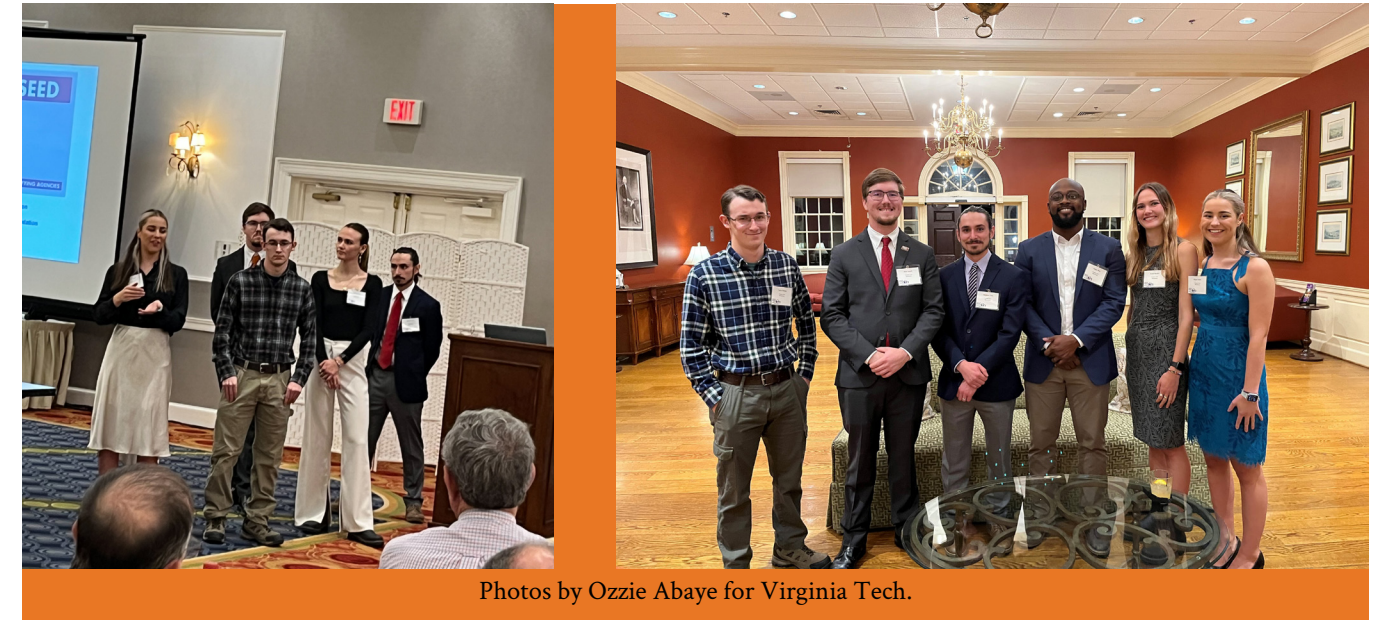
Kevin Painchaud  
Kevin Kehoe and Family  
Foundation Scholarship  
\$2,000



Trey Warren  
Level Green Landscaping  
Scholarship  
\$1,000

## STUDENTS PRESENT STUDY ABROAD EXPERIENCES

A group of students in the Virginia Tech School of Plant and Environmental Sciences presented at the Virginia Crop Improvement Association’s 2023 Virginia Seed Conference in Richmond, Va. The students talked about their study abroad and study in the USA experiences in Australia, South Africa, Arizona, and California. According to the Virginia Tech Global Education Office, around 20 percent of Hokies will study abroad during their academic careers.



Photos by Ozzie Abaye for Virginia Tech.

## SOIL JUDGING TEAM PREPARES TO DEFEND NATIONAL TITLE

The Virginia Tech Soil Judging Team prepares for the National Collegiate Soils Contest.

The team qualified for the national competition after taking second place at the regional contest at Clemson University in South Carolina in October.

Last year, the team won the competition, which took place at The Ohio State University in Marysville, Ohio, beating 20 other teams.

This year’s contest is hosted by Oklahoma State University.



Photos provided by the Virginia Tech Soil Judging Team.



## TRADITIONS CONTINUE AS THE VIRGINIA TECH HORTICULTURE CLUB ENTERS SECOND CENTURY

The Virginia Tech Horticulture Club continues one of its long-standing traditions.

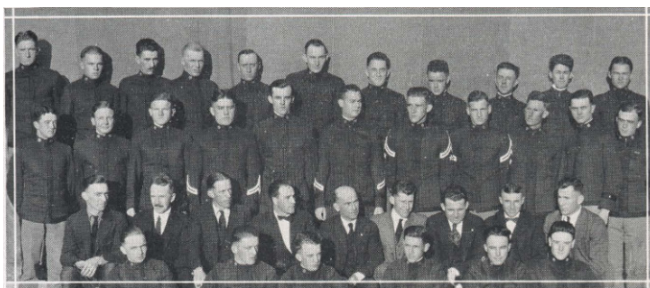
The club has held its annual Valentine's Day Rose Sale for at least a quarter of a century. It gives the students a chance to show their passion for floral design while helping to brighten the spirits of fellow Hokies.

Money raised from the sale helps with club activities, which this year included a group trip to Asheville, North Carolina, spring banquet, scholarships, and a donation to the National Collegiate Landscape Competition team.

"Looking back at the long-standing traditions the club has, I am grateful for the memories I have had during these traditions and hope they continue into the future," said club president Hannah Burton, a junior majoring in environmental horticulture and international trade and development. "We would not be around as long as we have without the strong role our members and values have on our organization."

The rose sale is just one of the many activities the club has held in its more than 100-year history.

The club was started in 1922 as the VPI Horticultural Society, when Virginia Tech was known as Virginia Agricultural and Mechanical College and Polytechnic Institute. According to *The 1922 Bugle*, the first club had 37 members and six honorary members.



VPI Horticultural Society, "The 1922 Bugle", VT Special Collections and University Archives Online

In 1942, two decades after its founding, the Virginia Tech yearbook, *The Bugle*, described the club as "one of the more active curricular organizations on campus." That year, club members held an annual horticultural show in the student activities building, a tradition that lasted for more than a decade.

Some of the club's events and fundraisers have been centered around activities on campus. In 1966, students held a chrysanthemum sale for homecoming. That tradition continued for more than a quarter century.

In 1970, members created corsages for homecoming. That same year they spread Christmas cheer by decorating the library for the holiday.

The club held its first-ever Horticulture Club Exchange in 1982, inviting clubs from Pennsylvania State University and the University of Kentucky to take part.

In 1988, the club held a plant sale. The spring plant sale, now in conjunction with the Hahn Horticulture Garden, is a tradition that still continues. This year's sale was April 20<sup>th</sup> through 22<sup>nd</sup> at the garden.

"I am grateful for the opportunity to lead a student organization with such a long history at Virginia Tech," Burton said. "Leading a club for me is about potentially having an impact on someone's career goals in horticulture. It truly is a privilege to be a part of such a great organization."

Follow the Horticulture Club on Instagram @hortclubatvt.



The Horticulture Club's annual show on campus. Photo from the club's scrapbook.



Students design bouquets in the Floral Design Lab ahead of Valentine's Day pickup. Photos by Patrick McKee for Virginia Tech.

## RENOVATIONS CONTINUE

The School of Plant and Environmental Sciences renovated a lab suite in Saunders Hall.

Old equipment was removed and new furniture and fixtures were installed.

The refurbished spaces will be home to the Sustainable and Organic Vegetable Crops Lab and the Grain Crops Lab.



(At left) New entryway sign. Photo by Sheila Young. (At right) Inside of lab after work was completed. Photo by Patrick McKee for Virginia Tech.

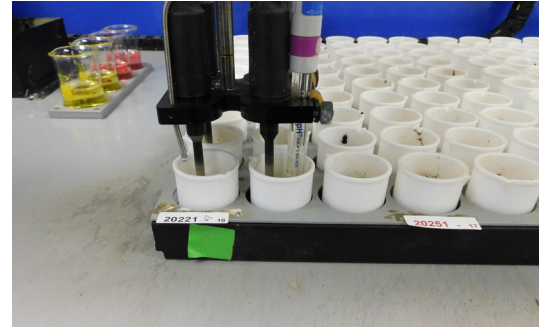


## VIRGINIA TECH'S SOIL TESTING LAB: SERVING THE COMMONWEALTH FOR 85 YEARS

The Virginia Tech Soil Testing Lab, affiliated with the School of Plant and Environmental Sciences and Virginia Cooperative Extension, analyzes soil samples submitted by the public and university researchers.

Tests are performed to evaluate the soil's nutrient potential and to determine the most beneficial application rates of fertilizer and lime for optimum plant growth.

Routine testing includes analysis of nine elements, plus soil pH and estimated CEC. The lab also performs soluble salts and organic matter tests. Samples are analyzed and computer recommendations are generated, typically within three days.



YEAR OPERATIONS  
STARTED

1938

SAMPLES TESTED  
ANNUALLY

50,000+

AVERAGE NUMBER OF SAMPLES  
RECEIVED EACH MARCH

10,000

GALLONS OF LIQUID ARGON  
USED ANNUALLY

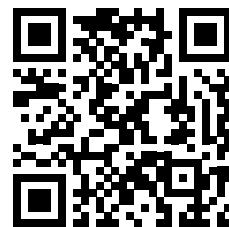
1,000

LAWN SAMPLES TESTING LOW IN  
PHOSPHORUS

1 IN 6

PERCENTAGE OF GARDEN  
SAMPLES WITH TOO MUCH LIME

34



On the web: [soiltest.vt.edu](http://soiltest.vt.edu)

## HAHN HORTICULTURE GARDEN IMPROVEMENT

Students in the Hardscape Materials and Installation class built a new entry garden which connects to the parking lot. This project helps with drainage, foot traffic, and reducing runoff. The new walkway crosses a rain garden and is handicap accessible.





## EXPLORING THE RELATIONSHIP BETWEEN FOOD AND CULTURE



Students prepare a Thai mango sticky rice dessert. Photo by Patrick McKee for Virginia Tech.



Zach DeBush (center) and classmates prepare Thai basil chicken (recipe on next page). Photo by Patrick McKee for Virginia Tech.

Food has the power to connect people of different cultures and backgrounds. That was the sentiment of 84 percent of Americans who took part in a survey by OnePoll.

This spring, students had the opportunity to explore those connections in a special studies course – *World Crops: Food and Culture*. The course is taught by Ozzie Abaye, a professor in the School of Plant and Environmental Sciences.

Students explored how to feed a growing world population, primary regions of production, factors determining where crops are grown, as well as their economic importance and use in the human diet.

In addition to classroom discussions, students met in the food lab weekly to prepare dishes from around the world, many tied to holidays or celebrations.

In one lab, the class explored Thailand’s Songkran Festival. The water festival marks the beginning of the traditional Thai New Year. The festival is about cleaning, purification, and a fresh start.

The lab also explored the Low Country’s use of rice. Historically, rice is served with meats and shellfish and used to make bread, biscuits, puddings, and cakes.

“I’m glad I got the chance to take this class,” said Zach DeBusk, an agribusiness major. “I have learned skills in the kitchen and learned to prepare different types of food.”



### Ingredients

#### For the egg

- 1 egg
- 2 tablespoons of oil for frying

#### For the basil chicken

- 1 chicken breast
- 5 cloves of garlic
- 4 Thai chilies
- 1 tablespoon oil for frying
- 1 teaspoon of oyster sauce
- ½ teaspoon light soy sauce
- 1 splash of dark soy sauce
- ½ teaspoon sugar
- 1 handful of Thai holy basil leaves

## THAI BASIL CHICKEN

### Directions

#### Fried Egg

1. Fry the egg by heating about 2 tablespoons of vegetable oil in a wok or frying pan on medium-high heat.
2. When the oil is hot and sizzling, drop in the egg.
3. After the egg is cooked, take it out, drain excess oil, and put it on a plate for later.

#### Basil chicken

1. Cut the chicken into small, bite-sized pieces.
2. Rinse and peel the garlic and chilies, then mince to bring out the oils and flavors.
3. Pluck a good-sized handful of Thai basil leaves off the stems.
4. Heat your wok on high heat with 1 tablespoon of oil.
5. When the oil is hot, add the chilies and garlic. Stir fry them for about 20 seconds or until fragrant.
6. Toss in chicken. Stir continuously. At this stage you want to continue to stir and cook your chicken until it’s just about fully cooked. If it starts to get dry, add just a splash of water.
7. Add 1 teaspoon of oyster sauce, ½ teaspoon light soy sauce, ½ teaspoon sugar, and a splash of dark soy sauce. Stir for about another 30 seconds.
8. Grab a handful of holy basil, toss it into the pan and fold into the chicken. Remove from heat. The holy basil only needs to cook for a few seconds. It will continue to wilt and cook from the existing heat of the chicken.
9. Serve over rice.

## SYLLABUZZ

### SPES 2004: CANNABIS - SCIENCE, INDUSTRY, AND CULTURE

Cannabis remains classified as a Schedule I substance federally, but 37 states and the District of Columbia allow the medical use of cannabis products, according to the National Conference of State Legislatures. Twenty-one states and the District of Columbia have enacted measures to regulate cannabis for non-medical use.

Retail sales for cannabis in the United States hit \$27 billion in 2021 and are projected to rise to \$53 billion by 2026.

To prepare students for possible careers in the industry, the School of Plant and Environmental Sciences offers SPES 2004: Cannabis – Science, Industry and Culture.

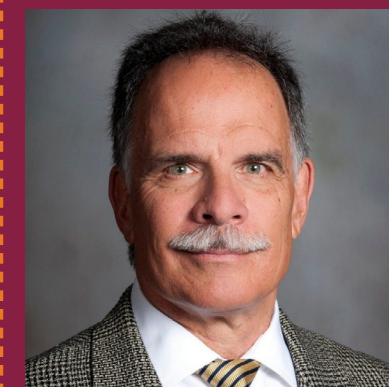
The online course explores the botanical and horticultural aspects of cannabis.

It also delves into legal and commercial issues on the state, national, and international levels.

Students also learn how cannabis medically interacts with the human body and mind while also exploring its deep and historical impact on human culture.

In the two years the course has been offered, it had been a favorite for students. In its first year, 500 enrolled. That number doubled in the second year.

### ABOUT THE PROFESSOR



Alex Niemiera is a professor in the School of Plant and Environmental Sciences. He was presented the 2022-23 Excellence in Teaching Award by the Center for Excellence in Teaching and Learning at Virginia Tech. He previously served as Assistant Dean of Student Programs for the Virginia Tech College of Agriculture and Life Sciences.





The Agricultural Technology Innovation Center at the Corporate Research Center held an open house in November. It was a forum for new Faculty members Brianna Posadas, Hasan Seyyedhasani, and Sanaz Shafian to present information on their research projects and for the center to showcase the equipment and research capacity there.



Associate Professor Bo Zhang and Professor Steven Rideout celebrate Ph.D. candidate Xiaoying Li, who was awarded the Gerald O. Mott Meritorious Graduate Student Award by the Crop Science Society of America. The award recognizes “top-notch” graduate students, pursuing advanced degrees in crop science fields.

Professor Maria Balota received a grant from the USDA’s National Institute of Food and Agriculture.



The project will focus on peanut variety and quality evaluation, harnessing multi-scale data for trait prediction to support cultivar release decisions. Balota’s publication – ‘Walton’, a new Virginia-type peanut suitable for Virginia and northern U.S. growing regions – was one of the top cited articles after its publication in *Journal of Plant Registrations*.



The Princess Anne Garden Club in Virginia Beach presented a check for \$19,000 to Hampton Roads AREC Director Jeff Derr and Laurie Fox, Hampton Roads AREC Demonstration Garden coordinator. The funds will be used to enhance accessibility and educational engagement in the gardens.



Assistant Professor Leighton Reid and Ph.D. candidate Pika MacDougal performed field work in January at Mount Joy Pond Natural Area Preserve near Raphine, Virginia. They used high precision GPS to map individual stems of a federally threatened plant species, small whorled pogonia, for a study of the effects of prescribed fire on its population dynamics.



Associate Professor Jacob Barney received a Destination Area 2.0 grant to investigate invasive species. Whether plants, animals, or pathogens, invasive species wreak havoc on human health, natural resources, and economic systems worldwide, costing \$1.3 trillion globally each year. The team, led by Barney, plans to position Virginia Tech as a global leader in developing innovative science and policy solutions to better predict, detect, assess, and control invasive species. “This is an unparalleled effort that does not exist elsewhere,” said Barney. The transdisciplinary grants are given to teams attempting to solve some of the world’s stickiest and most urgent challenges.

## M.A. SAGHAI MAROOF NAMED FELLOW OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

By: Patrick McKee

The American Association for the Advancement of Science (AAAS) has elected M. A. Saghai Maroof, professor in the School of Plant and Environmental Sciences, a 2022 AAAS Fellow.

“It is a great honor to be elected as a fellow of AAAS,” said Maroof, whose research programs are directed toward crop improvement, integrating molecular approaches with conventional genetics and breeding. Results from that research have been published in more than 110 refereed journal articles and three book chapters, with nearly 22,000 citations. Maroof’s research has resulted in five patents being issued.

The association bestowed him the honor for “fundamental contributions to plant genetics through the development and application of molecular markers, particularly in population genomics and discovery of disease resistance genes.”

“AAAS is excited to announce the newest class of fellows from across the scientific enterprise in a tradition dating back nearly 150 years and to honor their broad range of achievements,” said Sudip Parikh, AAAS chief executive officer and executive publisher of the Science family of journals.

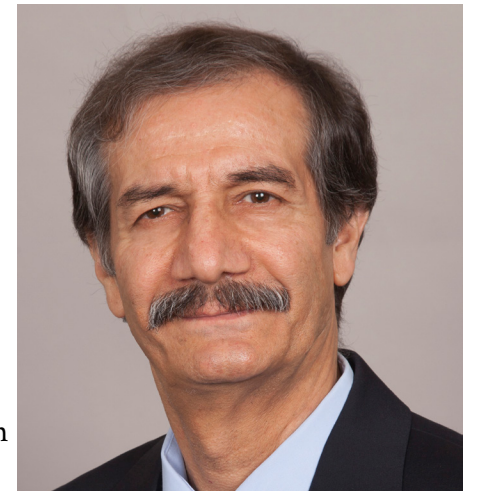
Maroof joined the College of Agriculture and Life Sciences as an associate professor in 1989 and was promoted to professor in 1995.

He was one of the early investigators to employ molecular markers for large scale genetic screening. Maroof first provided evidence for the Mendelian inheritance of DNA molecular markers, then developed a high throughput fingerprinting methodology for efficient screening. One of the resulting papers has been cited 6,500 times.

He has also explored the genomics of disease resistance genes, as reducing crop yield loss due to disease is of paramount importance for ensuring future food security. He worked on controlling gray leaf spot, a major disease problem in corn production areas. This work resulted in several papers, the issuance of a patent and development of gray leaf spot-resistant corn hybrids.

Maroof also conducted a comprehensive study on soybean virus diseases. This work led to the discovery

of new virus resistance genes, chromosomal location determination, and stacking three different resistance genes in a single soybean line. A grant as a Center of Excellence for Soybean Genomics Research resulted in three patents being issued.



Another significant contribution in disease resistance research was the development of an efficient protocol for the identification of resistance genes from any crop. The research has been cited by others nearly 600 times.

His research programs have been supported by funding from state and federal agencies, including the National Science Foundation and USDA, commodity boards, industry, and the Rockefeller Foundation.

During his career, Maroof has trained and advised 27 graduate students, 44 postdoctoral fellows and visiting scholars. Fourteen of those graduate students have received 30 departmental, college, university, and national awards and scholarships.

“I have been very fortunate to work with a group of brilliant graduate students, postdoctoral fellows, visiting scholars and accomplished collaborators on-campus and at the national and international levels. Their significant contributions have elevated the success of my research program,” Maroof said.

Maroof was elected a fellow of the Crop Science Society of America in 2019.

The 2022 Fellows class includes around 500 scientists, engineers, and innovators, spanning 24 disciplines.

The AAAS, founded in 1848, is the world’s largest general scientific society and includes more than 250 affiliated societies and academies of sciences, serving 10 million people.





## TEERING OFF WITH TECHNOLOGY IMPROVING THE COURSE WHILE SAVING RESOURCES

By: Patrick McKee

Photos: David McCall

The swing of the club. The ball soaring through a bright, blue sky. The roar of the crowd as the ball hits the ground. It is the dream shot for any golfer.

But, if the course is in less than stellar shape, then the cheers turn to groans as the golfer has to take their next stroke in poor conditions.

A team of researchers in the School of Plant and Environmental Sciences is working to make sure the turf on the course is in pristine condition for the next round and throughout the season while also saving resources.

The team, led by Assistant Professor David McCall, is working to find alternative ways to manage spring dead spot that are cost effective. To accomplish this, they are turning to precision turfgrass management.

### SPRING DEAD SPOT

Spring dead spot is a disease of bermudagrass and other grasses. It is caused by a fungus that infects in the fall and colonizes throughout winter. Symptoms of the disease are



Patches of spring dead spot at Independence Golf Club.

sunken, circular brown spots that are scattered among green, healthy grass.

“It is one of the most common diseases in Virginia and one of the most problematic for golf course superintendents and athletic field managers,” McCall said.

The disease is recurring and will reappear from year to year. “It might start as the size of a softball,” McCall said. “The next year it might be a volleyball or basketball. Then it might get up to three feet in diameter.”

It will eventually run its course, but that is not an option on the golf course where green, lush grass is required for optimal play.

“It actually impacts playability,” McCall said. “You might think you hit a great shot, but all of a sudden you’re in this hole in the middle of the fairway and it’s not very easy to advance the ball.”

Treating the disease typically takes place in the fall once soil temperatures are optimal, between 65 and 70 degrees.

### TURNING TO TECHNOLOGY

Researchers ramped up their work in 2016 to find alternative ways to manage spring dead spot. In the beginning, it was a labor intensive and manual process to detect the location of the disease. Turning to automation made the process much easier and faster.

The team started small, experimenting on a handful of fairways. In 2022, they scaled up to all 18.



Caleb Henderson works to load maps onto the GPS sprayer used on the course.



Researchers and workers treat spring dead spot at Independence Golf Club.

“For my masters, I worked on a script to automate the process of detecting spring dead spot,” said Ph.D. student Caleb Henderson. “That evolved into, if we have this map, how do we make it so we can actually use it to treat?”

To get the maps, they turned to drones. They were flown on a preplanned mapping flight about 80 feet above the course. An image was taken every second.

“We would stitch the images together and make those hundreds of images into one large photo,” Henderson said. “Once we have that, it just takes a lot of computer vision and some light machine learning to figure out where the spring dead spot is.”

Once the images are acquired and locations for treatment identified, they are then uploaded to onto the



GPS sprayer. As with any technology, there can be hiccups. “I was able to get two maps uploaded, but when I tried to get the third and final map uploaded, it was throwing all kinds of errors,” Henderson said.

Once they discovered a work around, they were able to successfully complete the project.

### MINIMIZING WASTE

“I hate waste when it comes to anything,” McCall said.

Using precision management techniques can reduce the amount of product needed to treat the disease. In many cases, a broad application is administered, but only using it where it is needed saves resources. “We have reduced as much as 85 percent of product applied without sacrificing efficacy,” said Travis Roberson, a Ph.D. student in the School of Plant and Environmental Sciences.

In addition to materials, precision management also saves on labor costs and is environmentally friendly. “You are saving on your carbon footprint as well, because you are reducing trips back to refill the sprayer because of applying less product,” Roberson said.

### FORMING PARTNERSHIPS

For this and other projects, researchers in the school have partnered with Independence Golf Club in Midlothian, Virginia, for several years.

Over the past several years, more than 100 research trials have taken place at the course with around a dozen warm season grass varieties being established, leading to several publications. Information gathered during these trails has been presented annually at the annual Research Classic Field Day that is hosted at the club.



A sprayer targeting areas to treat.

### NEXT STEPS

Knowing the success of precision management, the team of researchers will continue working on overcoming barriers of adoption.

A barrier for many is upfront capital costs. A preliminary economic analysis shows, by saving resources using precision guided applications, courses could see a return on investment after a couple of years.

“We’ve shown this technology works,” McCall said. “Our stakeholders see that it works and they are beginning to trust it, they just have not pulled the trigger themselves on adopting for their golf courses.”



Maps onboard the GPS sprayer.

## SPES ALUMNUS RECEIVES MUSSER AWARD OF EXCELLENCE

Wendell Hutchens Ph.D. '22 was named the recipient of the 2023 Award of Excellence from the Musser International Turfgrass Foundation.

The award is given to outstanding Ph.D. candidates who, in the final phase of their graduate studies, demonstrated overall excellence throughout their doctoral program in turfgrass research.

“It is an unbelievable honor to receive the Musser Award of Excellence,” said Hutchens. “I could not have accomplished such a feat without my foundational Christian faith, unwavering support from my wife, Anica, my family and friends, and the exceptional leadership of my mentors.”

Hutchens earned his Ph.D. in Turfgrass Pathology at Virginia Tech under Assistant Professor David McCall. His dissertation focused on the biology, epidemiology, and management of spring dead spot of bermudagrass.

Hutchens received his B.S. in Turfgrass Science from North Carolina State University and went on to complete his M.S. in Turfgrass Pathology from NCSU. His research there focused on the influence of post-application irrigation and soil surfactant applications on fungicide movement and efficacy against root diseases.

Hutchens published seven research papers for his M.S. and Ph.D. projects and has seven more awaiting publication on topics related to turfgrass pathology, turfgrass physiology, and native grass implementation in the transition zone of the United States. He has given more than 50 presentations on his research nationally and internationally.

In August 2022, Hutchens became an assistant professor of turfgrass science at the University of Arkansas, where he divides his time between research, extension, and teaching.

“I am beyond grateful for the opportunity to be a faculty member at the University of Arkansas, and I hope to expand the research, extension, and teaching programs during my tenure,” said Hutchens. “My mentors have been incredible to work with and learn from. Their mentorship has taught me to be a better scientist, professional, and, most importantly, person.”

He hopes to focus his career on providing applied, cutting-edge research results in turfgrass pathology, precision turfgrass management, and turfgrass agronomy as well as training the next generation of turfgrass scientists.

Musser International Turfgrass Foundation President Frank Dobie said, “The standards are very rigorous for the doctoral candidates who seek the award, so all of the applicants are of the highest caliber. We strive to select the one candidate that we feel is the best of the best and, this year, that was Dr. Hutchens.”

The criteria for selecting award recipients include graduate work, academic record, dissertation, publications, leadership, and extracurricular activities.







## BRINGING NEW LIFE TO DEGRADED FORESTS IN MADAGASCAR

By: Patrick McKee

Madagascar contains 5 percent of the world’s known plants and animals and 80 percent of those are only found on the island nation that is located off the coast of East Africa. But deforestation is threatening the nation’s biodiversity due to the fact that more than 40 percent of its forests have been cleared over the past 70 years. To address the problem, the government has committed to restoring four million hectares — more than 9.8 million acres — by 2030.

In order to help with these efforts, a team of Virginia Tech researchers in the College of Agriculture and Life Sciences, explored techniques to improve plantings during eastern Madagascar’s dry season.

The project was led by undergraduate student Chris Logan ’22 and Leighton Reid, assistant professor in the School of Plant and Environmental Sciences, in partnership with non-profit Green Again Madagascar.

“This project is a great example of collaboration between ecologists and practitioners to solve a bottleneck problem in tropical forest restoration,” Reid said.

The team of researchers worked at Parc Ivoloina, a forestry station and zoological park near Toamasina, where the dry season runs from August to December and a cyclone season from January to March.

From October 2014 to January 2015, 369 seedlings that represent 17 native tree species were planted. Most of the seedlings were 4-8 inches tall.

They used a circular planting design with a central tree seedling surrounded by a ring of eight seedlings, separated by about six feet.

Controls, which did not receive soil amendments, watering, or shade, were planted in the center. The eight surrounding seedlings received shading with four fronds of a ruderal fern (*Dicranopteris linearis*).

Above: Chris Logan ’22 instructing Green Again workers in restoration monitoring in Malagasy. Photo by Leighton Reid.

The fronds were placed in a cone shape to allow temporary shade without inhibiting growth. The practice is regularly used by Malagasy farmers. The researchers noted a 75 percent reduction in transplant shock, suggesting that intense solar radiation is a primary limitation on initial establishment of dry season plantings.

“It’s good to test these techniques. In the countryside, farmers don’t test very many things, and just do the things they know or what people have done before,” said Marcellin Velo, Chief Operating Officer of Green Again Madagascar.

The team also focused on soil amendments and watering strategies.

Half of the shaded seedlings were soaked in buckets of creek water prior to planting. The other half were planted with only the moisture from their last watering at the nursery.

For soil amendments, half of the shaded seedlings were planted in a hole 33 percent filled with nutrient-rich compost. To help with moisture retention, the other four were filled with one of three locally available absorbent materials: moss, coconut husk or chopped petioles of traveler’s palm (*Ravenala madagascariensis*).

Seedling survival and height were measured after one to eight weeks, one year, and six years after planting.

More than 98 percent of all seedlings survived initial transplant, falling to 83 percent after one year and 41 percent after six years.

The team did not find evidence that soil amendments or watering decreased tree mortality in the first few months, but absorbent materials were associated with a slight decrease in the survival rate after one year.

Researchers observed species provided the greatest variation in seedling survival. After one year, *Uapaca* sp. had a survival rate of 100 percent compared to *Delonix regia* with a survival rate of 44 percent.

Survival rates were more erratic after several years as some successful short-lived varieties died. One example is *Trema orientalis*, which had a zero percent survival rate after six years following a 95 percent rate after one year.

The team recommends using short-lived, high growth species during the dry season. Those producing favorable results in this study include *Uapaca* sp., *Trema orientalis*, *Psiadia* sp., *Macaranga* sp., and *Pittosporum ochrosiifolium*.

“The findings from this experiment exemplify how forest restoration, using approaches from local farmers, is a practical and useful way to orient restoration plantings in Madagascar,” Logan said. “It’s very possible that other restoration applications can be found using their knowledge.”



Reid delivers an outreach presentation at Pere Thierry CRS outpost in Antsiramandroso. Photo provided by Eva Colberg.



Four-year old *Parkia madagascariensis* trees that survived a wildfire near Amoratandrazana. (From left to right): Chris Logan, Eva Colberg, Marcellin Velo. Photo by Leighton Reid.



## VIRGINIA TECH RESEARCHERS TO INVESTIGATE TRANSCRIPTIONAL REGULATION OF CANNABINOID SYNTHESIS IN INDUSTRIAL HEMP

By: Patrick McKee

Industrial cultivation of hemp is seeing a massive expansion in the United States due to new federal laws and consumer demand.

Due to these changes in regulation, passed as part of the Agriculture Improvement Act of 2018, researchers are legally able to perform tests on hemp and growers can produce plants. In 2021, the USDA says hemp, which has a THC concentration of less than 0.3 percent on a dry weight basis, was grown on 54,000 acres, with a value of more than \$824 million.



Photo by Dan Mirolli for Virginia Tech.

In partnership with York University in Ontario, Canada, and the Institute for Advanced Learning and Research in Danville, Virginia, researchers in the College of Agriculture and Life Sciences have received a \$600,000 grant to study the regulation of the genes that are responsible for cannabinoid biosynthesis.

“We are interested in the regulation of the gene expression of the enzymes that are responsible for cannabinoid biosynthesis,” said Bastiaan Bargmann, an assistant professor in the School of Plant and Environmental Sciences. “We currently just don’t have a lot of knowledge about how the biosynthetic pathway is regulated.”

An improved understanding of those processes could allow for better selection or modification of plants with particular cannabinoid content, potentially increasing profits and reducing risk for growers, as crops with more than the allowed level of THC must be destroyed. Discoveries could also help the pharmaceutical industry as cannabinoids are becoming increasingly significant for the treatment of pain, anxiety, epilepsy, and cancer.

“We have a list of nine transcription factors that we want to investigate further and see if they regulate the expression of these genes that are involved in cannabinoid biosynthesis,” Bargmann said.

To understand the regulation of the cannabinoid synthesis pathway in hemp (*Cannabis sativa L.*), researchers will map the relationship between factors that turn on or off the genes for enzymes, measure the effect of manipulating these factors, and engineer hemp cells and plants with the modified profiles.

“If we can find ways to manipulate the biosynthesis so that, instead of these main ones (THC and CBD), we start to get other ones like CBG (*Cannabigerol*), CBN (*Cannabinol*), and others, then we can perhaps grow crops that have a greater economic value than the ones we currently have,” Bargmann said.

## VIRGINIA TECH RESEARCHERS EARN NATIONAL RECOGNITION FOR ADVANCES IN DRONE PRACTICES

By: Mary Hardbarger

Several faculty members in Virginia Tech’s College of Agriculture and Life Sciences are among a national group of university researchers awarded the 2022 Excellence in Multistate Research Award for an ongoing project that has helped accelerate the use of drones in agricultural systems.

The award-winning project, “Research and Extension for Unmanned Aircraft Systems in U.S. Agriculture and Natural Resources,” evaluates and identifies the most reliable, cost-effective, and user-friendly drone platforms and sensors for monitoring and managing stressors in agriculture and natural resources. To maximize the accuracy of the data collected, project members developed hardware, software, and detailed protocols for calibrating and using drones.

Maria Balota, a professor in the School and Plant and Environmental Sciences and Tidewater Agricultural Research and Extension Center; Daniel Fuka, a postdoctoral associate in the Department of Biological Systems Engineering; Cully Hession, a professor and graduate program director in the Department of Biological Systems Engineering; and Joseph Oakes, the superintendent of the Eastern Virginia Agricultural Research and Extension Center, represented the university on the team of scientists.

They have been part of this project, which was recently renewed, since 2016.

“The contributions of this group to the multistate effort were on large-scale water quality monitoring and high-throughput phenotyping of various crops and varieties by drone imaging,” said Balota, project chair. “Our multistate, multidisciplinary research and outreach have helped overcome barriers and accelerate broader use of drones. By efficiently collecting large amounts of data, drones can help guide better decision making, greater advances in plant and animal breeding, and more profitable and sustainable management.”

Virginia Tech is the leading institution for the first year of the renewed project, which runs from September 2022 to October 2023.

When the project was conceived in 2016, Balota said, university researchers had multiple challenges to acquire and utilize an unmanned aircraft system. Before major changes in Federal Aviation Administration guidelines, research programs needed licensed pilots, medically certified visual observers, and government authorization permitting flight in only specified areas. Regulations also were strict regarding use of unmanned aircraft systems for non-research applications including education, Virginia Cooperative Extension, and private use. Against this backdrop, the project was created to leverage strengths that could advance this field.



Virginia Tech faculty are collaborating with institutions across the United States to advance the use of drones in agriculture. Photo by Sam Dean for Virginia Tech.

Since then, project members have shared their knowledge in many ways, including through fact sheets, Extension workshops, programs and materials, peer-reviewed publications, and at regional, national, and international conferences.

As awardees, team members received funding to cover costs for two participants to attend the awards ceremony and to support activities that enhance and contribute to the research or outreach objectives of the project.



## VIRGINIA TECH RESEARCHERS STUDY FLAVOR, SHELF LIFE OF VIRGINIA CHERRY TOMATOES

By: Max Esterhuizen

Researchers seek to enhance the competitiveness of Virginia cherry tomatoes by comparing the flavor, nutrition, and shelf-life qualities of produce from conventional fields and indoor hydroponic systems.

The tomato, one of Virginia's top products, is a multi-million dollar business in the commonwealth and is incredibly nutrient-dense, boasting vitamins, minerals, amino acids, fatty acids, and other benefits valuable to human health.

Among the tomato varieties, cherry tomatoes are gaining popularity for consumers of all ages because they offer outstanding health benefits and are perfect for snacking and salads. Cherry tomatoes require little space for abundant production, which makes cultivation feasible for conventional fields, home gardens, and high-tech controlled-environment agriculture facilities.

In partnership with Virginia State University and the Institute for Advanced Learning and Research, researchers in the Department of Food Science and Technology and the School of Plant and Environmental Sciences will study the flavor and shelf life of field- and indoor-produced cherry tomatoes to maximize their growth in controlled environments.

"Flavor, along with shelf life, are critical in meeting consumers' expectations of cherry tomato quality," said Yun Yin, project lead and assistant professor of food science in the College of Agriculture and Life Sciences. "Indoor agriculture brings a lot of different aspects to the traditional food production systems. It is more resource efficient, has reduced concerns with pesticides, and enable community access of fresh produce."

The rapidly growing controlled-environment agriculture industry in Virginia enables sustainable crop cultivation with reduced resources and indoor growing spaces, increases access to produce by reducing physical crop acreage due to the vertical growing method, and provides a consistent year-round supply free of environmental factors.

"Our preliminary research shows that cherry tomatoes produced indoors have a relatively longer shelf life but not as much flavor as field-grown varieties," Yun said. "Flavor plays an enormous role in consumer acceptance, and we are studying ways to boost the flavor of this economically important crop in Virginia."

Researchers will analyze the tasting components such as sugars and acids as well as health-benefiting bioactive compounds using liquid chromatography. Gas chromatography-mass spectrometry coupled with olfactory detection port is a powerful method to measure predominant compounds contributing to cherry tomato aroma profiles.

The Virginia Department of Agriculture and Consumer Services and the U.S. Department of Agriculture are funding the research through the specialty crop block grant program that awarded a number of grants to the college.



Fresh picked cherry tomatoes. Photo courtesy of Emily de Vinck.

## JOURNEY OF A LIFETIME IN SOUTH AFRICA

### A FOCUS ON FOOD SECURITY, WILDLIFE, AND CONSERVATION

By: Patrick McKee

South Africa is one of the most ecologically and culturally diverse countries in Africa. It has well-developed commercial farming as well as substance-based production in rural areas.

To explore the nation's practice for food security, production, distribution, and utilization, as well as the potential contributions to agriculture by wildlife, a group of 19 students traveled to South Africa during Winter Term 2023.



### EXPLORING THE WORLD

"I thought it would be really interesting to go to another country," said Grace Bartlett, a junior crop and soil science major. "It is the first time I have been out of the country before. I thought South Africa was probably not going to be somewhere I could visit without doing it through school."



Kruger National Park. Photo by Karen Drake-Whitney.

South Africa makes up just one percent of Earth's land area, but is home to 10 percent of the planet's known bird, fish, and plant species and six percent of mammal and reptile species.

Senior Bernard Frantz, a crop and soil science major, has taken part in faculty-led trips before, but never traveled internationally. "I wanted to try to go as far as possible," Frantz said. "When I saw Africa was on the table, I knew I had to go."

Sophomore forestry major Jacob Chang was interested in the animal life, saying, "I've always wanted to visit Africa.

Seeing the big fauna was what got me to apply. I have always wanted to go on a safari. It's a continent I had never been to and something I really wanted to see."

Emily Meluch is a senior majoring in animal science and environmental economics. For her, she wanted to learn about the country's conservation efforts. "I knew they were going to be studying wildlife conservation," Meluch said. "I wanted to go see all the animals there."

### ON THE FARM

Students visited several farms while on their journey across South Africa. They visited a game farm to learn about ecotourism, employment, and food security.

"Being an agronomy major, I'm very interested in food conservation," said Bartlett. "I think seeing everything in real life, the farms, the different forages, the wildlife too, really helps us understand more about what we learn in the classroom. We got hands on experience. I can recognize the crops better, based on what I saw."

The trip also included a tour of Langgewens Experimental Farm. Established in 1926, the research farm



covers about 1,300 acres and is home to two long term conservation agriculture projects: crop rotation trials and soil tillage trials.

The crop rotation trials focus on improving soil health with the goal of increasing grain production. The soil tillage trials look at the “long term effect of soil disturbance and crop rotation with maximum retention of crop residues on soil quality and grain yield.”

“Their cover crops there are better than we have in some areas in the U.S.,” said Frantz. “It was really impressive because they have cover crops that have been there for over four years. That material just adds and adds and adds. Because of their seasons over there, there’s not really mold they have to worry about. They can just keep those on and that keeps your soil from eroding in the wind, it keeps your ground warmer in the winter and cooler in the summer. It provides a lot of benefits. Seeing something that’s way better managed over there was really impressive.”



is home to more than 1,500 species of plants, many of those are endemic. Because of its biodiversity, it has been nominated for World Heritage Site status.

From November through March, the Cape Doctor, a southeasterly wind, brings warm, moist air from the sea. When orographically lifted up the mountain, it cools and condenses, causing fog, referred to as locally as the tablecloth, to form.

“When we went there, it was completely shrouded in a cloud, Frantz said. “Wondering around in a fog, because of a cloud, was super impressive to me. It was very calming.”

## TAKEAWAYS

For the students this trip helped them better understand what they have learned throughout their educational careers.

“Seeing is believing,” Frantz said. “Sure, you can do Zoom calls or guest speakers, but actually going there and seeing it makes those experiences that much more meaningful.”

“It was very grounding,” Chang said. “We talk in words and theories. You can’t really explain an experience or a culture.”

The trip was also a good opportunity for the group to learn more about themselves.

“It’s really good to get out of your comfort zone,” said Bartlett. “A lot of people don’t realize how much it helps you to grow when you put yourself in a new area with new people.”

## KRUGER NATIONAL PARK

First protected: 1898  
National park: 1926

7,576 square miles

Home to:

- 126 species of reptiles
- 50 species of fish
- 33 species of amphibians
- 3,000 Nile crocodiles
- 219 species of butterfly

On the web: <https://www.krugerpark.co.za/>

## ON SAFARI

A favorite part of the trip for many of the students was a visit to Kruger National Park.

“We set out just before sunrise at 4:30 a.m.,” said Chang. “Just before the sun started peeking over the horizon, we drove up on a male lion on one side of the road and another sitting on the other, kind of like gargoyles. That was like the most magical moment for sure.”

The park is 7,576 square miles, which is approximately the size of the states of Connecticut and Delaware combined. It extends 220 miles north to south and 40 miles east to west. Kruger is home to 147 species of large mammals – more than any other African game reserve.

Students learned about wildlife conservation and biodiversity and their impacts on animals before taking a tour. On their journey, they observed the hundreds of species of animals that call the park home, which helped students connect what they learned with real-life experiences.

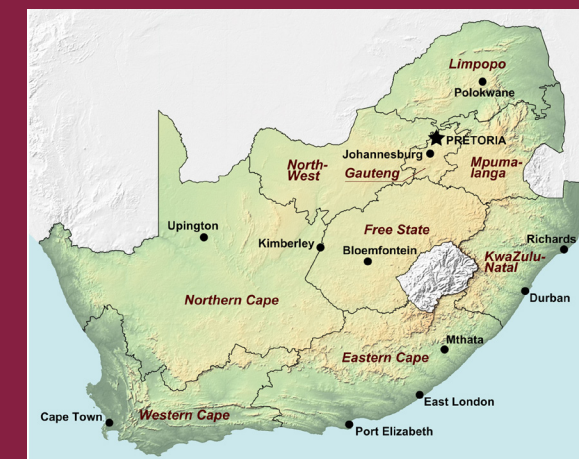
“It helped connect my classroom learning,” said Meluch. “I really wanted to learn about poaching in general. I had not learned a lot about that in the classroom setting, so I got to learn so much about that when I was there because that is where it occurs.”

## NEW NATURAL WONDER OF THE WORLD

Table Mountain in Cape Town was conferred the title as a Natural Wonder of the World by the New7Wonders Foundation in 2011. It is a flat-topped mountain overlooking the city. The mountain has a peak elevation of 3,558 feet with the flat level summit spanning 1.9 miles. The national park draws 4.2 million visitors each year.

According to South African National Parks, the mountain is internationally recognized for its floral diversity. It

## ABOUT SOUTH AFRICA



Population (source: IMF)  
62 million

Capitals

- Pretoria (executive)
- Cape Town (legislative)
- Bloemfontein (judicial)

11 official languages

Currency

South African Rand

GDP (IMF)

US\$419.02 billion

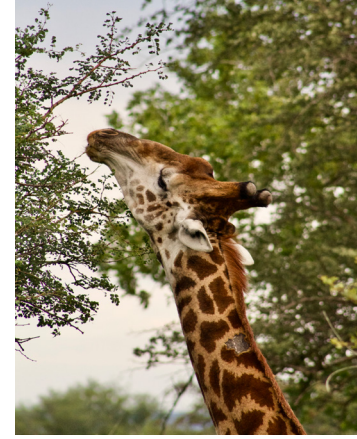
Top Agricultural Exports Worldwide (source: USDA)

- Citrus
- Wine
- Corn
- Grapes
- Seafood

Top Agricultural Exports to the U.S. (source: USDA)

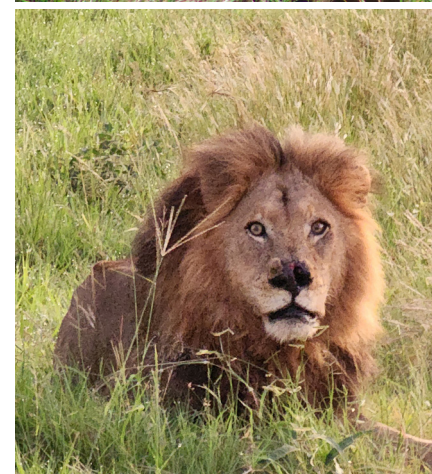
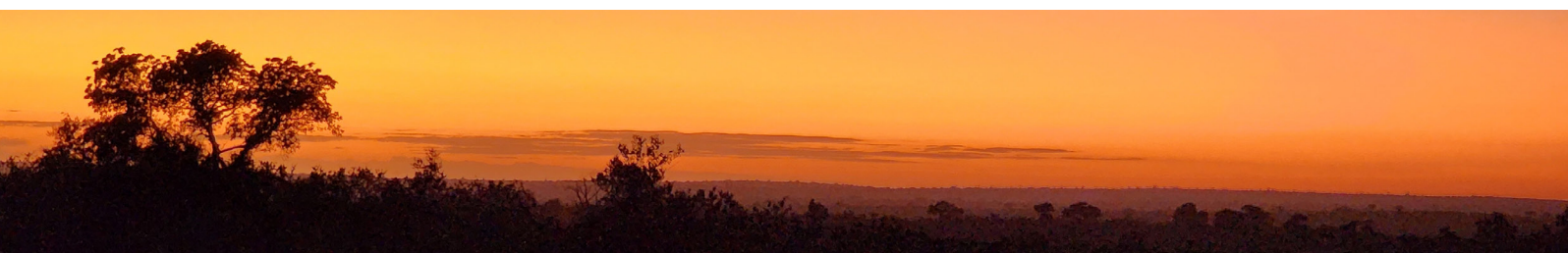
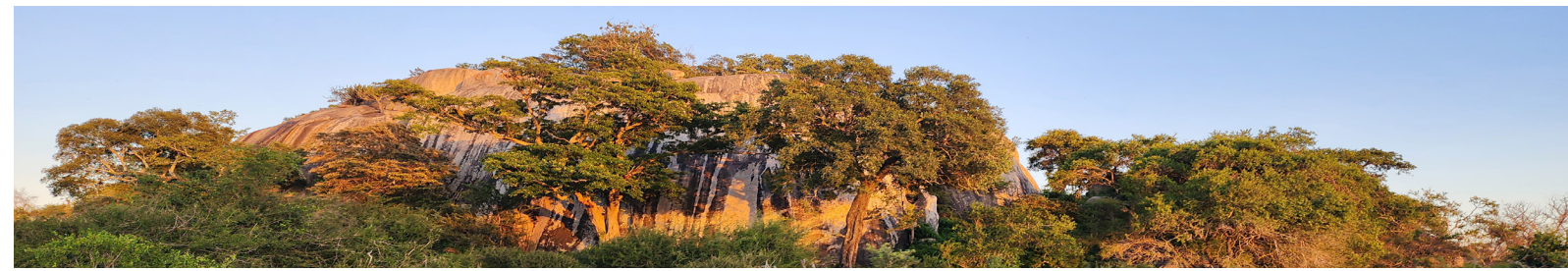
- Macadamia
- Citrus
- Wine
- Sugar
- Seafood





## ON SAFARI IN KRUGER NATIONAL PARK

Photos by Erin Flynn, a senior human nutrition, foods, and exercise major and Karen Drake-Whitney, undergraduate student coordinator





# FALL 2022 GRADUATES

## Ph.D.

- Keren Brooks
- Jaclyn Fiola
- Ariel Heminger
- Naveen Kumar
- Bright Ofori
- Zachary Shea
- Gerald Shija

## Master's

- Connor Doyle
- Vipin Kumar
- Jacob Maris
- Matthew Spoth
- Jessica Wilbur

## Bachelor's

### Crop and Soil Sciences

- Spencer Kent
- Dixon Mills
- Paul Moore
- Jordan Smith
- Kayla Weckworth

### Environmental Science

- Kelly Kosiarski
- Tianwei Qi
- Clare Tallamy
- Babita Thapa
- Caroline Vasquez

### Environmental Horticulture

- Abigail Bonk
- Kyle D'Alfonsi
- JohnPaul Escobar
- Eric McKenzie
- Samantha Ragon
- Cory Reyes
- Liza Washington

### Landscape Contracting

- Giuseppe Canino

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# UPCOMING EVENTS

## SPRING COMMENCEMENT

Thursday, May 11th, 7 p.m.  
College of Agriculture and Life Sciences  
Lane Stadium

Friday, May 12th, 8:30 a.m.  
University Commencement  
Lane Stadium

## GARDEN GALA 2023

Saturday, June 10th  
5:30 p.m. - 9 p.m.  
Hahn Horticulture Garden  
<https://hahngarden.vt.edu/>



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Photo by Mary Desmond for Virginia Tech.