

Partners in Progress

2016 Agency 229
Annual Report

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Partners in Progress

A message from the directors

Today's world is changing rapidly.

We are facing pressures from a growing population, emerging health threats from new diseases, and challenges of keeping our drinking water safe.

But Virginia Cooperative Extension and the Virginia Agricultural Experiment Station — the two agencies that make up Agency 229 — have been working hard to help Virginia and its citizens overcome those challenges.

The stories in the pages that follow highlight the work we are undertaking in Virginia and around the world. Whether we are preparing students for new opportunities in the workforce, informing farmers of new food safety regulations, providing water testing and education to private water system owners, or helping producers increase their profits through value-added marketing, our mission is to improve the standard of living and quality of life for Virginians.

We encourage you to visit our websites — www.ext.vt.edu and www.vaes.vt.edu — to learn more about our research and programs that are making an impact in communities across Virginia.

Sincerely,

Edwin J. Jones

Associate Dean and Director, Virginia Cooperative Extension

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Exploring genetics to combat malaria and Zika

to combat malaria and Zika



An Asian tiger mosquito (*Aedes albopictus*)
Photo credit: Susan Ellis, Bugwood.org

The Zika virus has quickly become a major health threat, and researchers at Virginia Tech are looking for ways to curtail its spread.

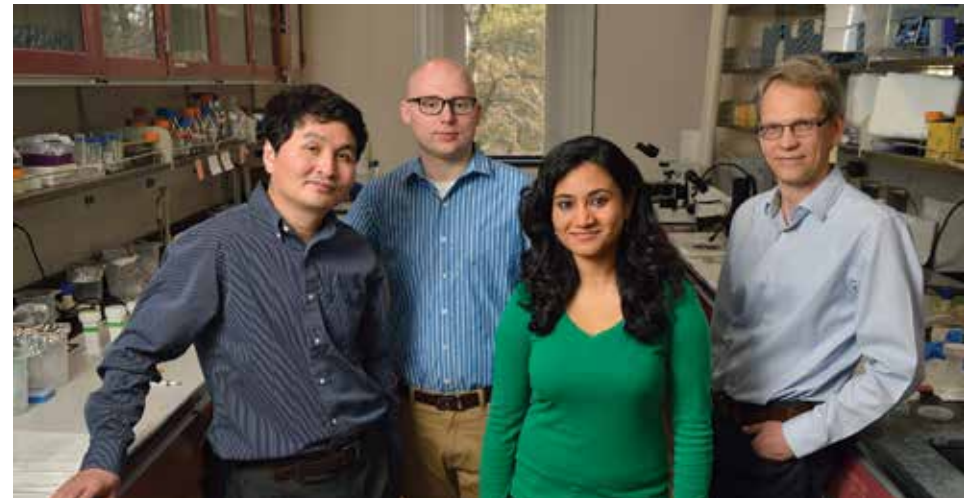
The virus, which is primarily spread to humans by the bite of an infected mosquito, has been passed on to a growing number of Americans since early 2016, and the World Health Organization has declared it a Public Health Emergency of International Concern.

Biochemist Zhijian “Jake” Tu is one of several Virginia Tech researchers zeroing in on the Zika virus. Tu is studying genes that turn biting female mosquitoes into males, and he is exploring genetic strategies to stop the transmission of the Zika virus by reducing the number of female mosquitoes. Male mosquitoes do not bite and are harmless to humans, while female mosquitoes bite

humans to get the blood they need for egg production.

With support from an NIH grant and building on their previous discoveries that were published in the journal *Science*, Tu and some of his colleagues in the Vector-Borne Disease Research Group — Zach Adelman, Jinsong Zhu, and Maria Sharakhova — are investigating the molecular mechanisms and applications of male-determining factor in *Aedes aegypti* mosquitoes, the species that transmits Zika.

Tu, Zhu, and Igor Sharakhov also received NIH funding to study sex determination in a family of malaria-spreading mosquitoes. Working



Fralin Life Science Institute's Vector-Borne Disease Research Group team members, from left: Zhijian “Jake” Tu, professor of biochemistry; Brantley Hall, biochemistry graduate student; Atashi Sharma, entomology graduate student; and Igor Sharakhov, associate professor of entomology

Virginia Tech hops into the farm-to-glass craft beer movement

with a large international consortium, the researchers sequenced the “Y” chromosome — the genetic drive of sex determination and male fertility — in *Anopheles gambiae* mosquitoes. The findings were published in the Proceedings of the National Academy of Sciences.

“Although the master switch genes that govern sex determination are completely different in *Aedes* and *Anopheles* mosquitoes, the approach that targets the female mosquitoes will have broad applications in efforts to control numerous mosquito-borne infectious diseases, including old foes such as malaria and emerging threats such as Zika,” Tu said.

While Zika had only previously been associated with mild symptoms in humans, it can produce more severe symptoms in areas where the virus has recently been introduced because populations have no pre-existing immunity. It has also been linked to a birth defect called “microcephaly,” in which infected pregnant women give birth to brain-damaged babies with abnormally small heads.

About 10 Virginia Tech researchers with expertise in the fields of disease modeling, epidemic mapping, mosquito genetics, and novel insecticides are now focusing on Zika, developing ways to predict the spread of the virus and stop it from doing more damage.

While the College of Agriculture and Life Sciences has long been a steward of viniculture in the commonwealth, the advent of a state-of-the-art brewhouse and malting system at Human and Agricultural Biosciences Building 1 now allows the college to shepherd fermentation research for another lucrative market — craft beer.

The recently installed system lets students learn the latest in malting, brewing, and fermenting techniques and simultaneously fosters the university’s land-grant mission by supporting industry research in fermentation and brewing among faculty members. The announcement by Deschutes Brewery that it will anchor its East Coast location in Roanoke means the facility at Virginia

Tech will also likely be integral to building industry partnerships between the university and commercial brewers.

The 250-liter, professional-grade, German-made Esau & Hueber brewhouse was designed so breweries can develop new varieties of ales and lagers while researching experimental, locally sourced ingredients without having to take their own facilities offline. The system, which can produce 66 gallons of beer in one brewing cycle, is very similar to the ones used in commercial craft brewing operations around the U.S.

The facility is also making it possible for the university to pursue global education opportunities with the Technical University of Munich, where students could put their classroom experience to

use in the heart of Bavaria — a mecca for beer production.

“Our department is big on hands-on learning,” said Brian Wiersema, who oversees the brewhouse for the Department of Food Science and Technology.

The brewhouse is just one way that Virginia Tech is helping the commonwealth’s beer industry, which has an annual economic impact of more than \$8 billion and contributes \$2.9 billion in total annual tax receipts, according to the Beer Institute.

The brewhouse will also help make the brewing industry more environmentally friendly by developing methods to turn spent barley into plastic and fuel — which is what researchers are doing in the lab just across from the brewhouse.

A student spoons spent grain from the brewhouse container into a trash can while classmates look on. The professional-grade brewhouse is similar to what most craft-beer-making facilities use, but it is optimized for teaching.



Energy Masters Program energizes Arlington County

Volunteers in Arlington County and Alexandria are making a difference – one light bulb and toilet tank at a time. With more than 6,000 hours of volunteer service, these masters of energy efficiency are helping low-income families make their homes more comfortable while reducing their water and energy bills.

The Energy Masters Program, funded by the Arlington County Community Development Fund, has made strides in improving energy efficiency for residents living in affordable housing units in Arlington County neighborhoods. The program is a collaboration between the Virginia Cooperative Extension Arlington County Office and two county nonprofit organizations — Arlingtonians for a Clean Environment and Arlington Thrive.

“Training teams of volunteers to go into low-income apartments and do energy- and water-saving improvements helps lower the utility bills of both the residents and the property owners, ultimately improving the environment by eliminating the amount of greenhouse gases that are released into the atmosphere,” said Jennifer Abel, family and consumer sciences Extension agent in Arlington County. “Since starting the program in 2011, we’ve trained 152 volunteers,

and we’ve made improvements in 591 apartments.”

The impetus for the program was a phone call to Abel from a board member of Arlington Thrive — a nonprofit organization that provides emergency assistance to low-income residents who are struggling to pay their rent or utility bills — regarding the costly utility bills of those living in affordable housing units. Arlington Thrive collaborated with Virginia Cooperative Extension and Arlingtonians for a Clean Environment on applying for a grant to fund the energy efficiency improvement program.

Some of the improvements include

- Sealing gaps and holes around windows and door frames.
- Inserting foam gaskets behind light switch plates and outlet covers to prevent air leakage.
- Replacing incandescent light bulbs with compact fluorescent and LED bulbs.
- Installing low-flow faucet aerators and shower heads.
- Mounting a Toilet Tummy in toilet tanks, which reduces the amount of water used.
- Cleaning the coils under refrigerators to help improve cooling efficiency.

“The sense that I get from the volunteers is that they see the real, tangible results of the work they’re doing,” Abel said. “After they see this huge gap in a wall and seal it up, they can immediately feel that they’ve stopped the air leakage that was occurring and therefore

have improved the overall comfort of the residents in their homes. That’s definitely the most exciting thing, and that’s what keeps the volunteers coming back.”

Energy Masters Program volunteer Guillermo Ortiz got involved with the program and immediately recognized its value to the community.

“In addition to the educational aspects, improving energy efficiency in low-income communities was something that really piqued my interest and prompted my involvement,” Ortiz said. “The Energy Masters Program offered me the opportunity to pair my interests in climate change, energy efficiency, and civic engagement, while allowing me to make a difference in historically underserved communities.”

In addition to the retrofits in the apartments, the program now includes one-on-one home visits with residents and more education on steps they can take to improve their energy efficiency. Many of the volunteers also provide education in local elementary, middle, and high schools to teach students about energy efficiency and the importance of energy conservation.

The program expanded to Alexandria in 2016 with support from a grant from the city. Volunteer teams conducted retrofits in 38 Alexandria apartments and are looking forward to doing many more. “Hopefully this program can expand to other parts of the state and ideally to other parts of the country as well,” Abel said.



An Energy Masters Program volunteer caulks a window to prevent drafts and keep moisture from rotting the wood around the window.

Freshwater shrimp become a big deal

As the freshwater shrimp in his ponds continued to grow and multiply, Charles Carter knew he had a good product to sell.

In his second year of production, Carter wanted to create product buzz in order to sell a portion of his production to local consumers. Carter was already selling his product wholesale as a member of the Virginia Aqua-Farmers Network Cooperative, but he also wanted to market retail.

And he knew just where to look for assistance — Virginia Cooperative Extension.

Enter Dan Kauffman, Extension seafood marketing specialist at the Virginia Seafood Agricultural Research and Extension Center in Hampton.

Kauffman had been helping freshwater shrimp producers get their products to market, which also involved another part of his résumé — his fondness for shrimp boils.

“There is already a robust marine shrimp market, but people don’t often know about freshwater prawns,” said Kauffman, whose home department in the Virginia Tech College of Agriculture

and Life Sciences is the Department of Agricultural and Applied Economics.

Working with the Virginia Aqua-Farmers Network, he has paired shrimp producers with gourmet supermarkets, restaurants, and local seafood producers. Kauffman finds that one of the best ways to connect to customers is to get them to the farm where shrimp are being raised and have an old-fashioned shrimp boil. Kauffman, along with Extension community viability specialist Martha Walker, helped Carter put on a shrimp boil, which was instrumental in helping him market his product and introduce him to new clients.

Carter’s shrimp boil was a huge success. Two sittings of more than 250 people gobbled up the delicious shrimp that were grown only a few yards away.

Carter said he owes part of his success to Virginia Cooperative Extension.

“They were really a great partner in this entire process,” he said.

Dan Kauffman (left) is helping shrimp producers expand their markets through shrimp boils.



Sky is the limit for using drones in land management

Virginia Tech has another tool in its arsenal for managing land resources that can be used to do everything from inventorying forests and identifying land-use changes to assessing soil erosion and water runoff on agriculture lands.

What is this powerful tool? A 1.5-pound unmanned aircraft, or drone.

“Our drone, a fixed-wing eBee, carried two different sensors — true color and infrared — that gathered land-use and land-cover data to support inventory mapping,” said John McGee, professor and Virginia Cooperative Extension geospatial specialist in Virginia Tech’s College of Natural Resources and Environment.

The eBee’s sensors capture data that will enable researchers to measure vegetative vigor — places in which chlorophyll activity differs drastically across the terrain. If the ground vegetation is stressed in a confined area, it might indicate that a structure, perhaps a foundation, is buried underground.

This drone is not just a small airplane; it is a complete and sophisticated system, composed of flight-planning software, a camera, sensor technology, and post-processing data software. The eBee flies under the direction of a licensed pilot, operating on parameters provided through the flight-planning software prior to launching. It continually assesses wind speed, wind direction, and other data. The pilot can also monitor environmental conditions and modify the flight plan and the imagery being captured while the plane is in flight.



Adam Downing, Virginia Cooperative Extension forestry agent for the Northern District, is pictured with the eBee at Clermont Farm in Clarke County. Clermont will install a silvopasture demonstration and research project in collaboration with Virginia Tech. The eBee was used to establish detailed baseline land-cover data and historical resources.

Forestry applications for the unmanned aircraft include inventorying forests, identifying changes in urban forests, and monitoring forest health. Agriculture applications include assessing soil erosion, water runoff, and crop health. Facilities planners can analyze pedestrian traffic and lighting needs, plan for emergencies, and use thermal sensors to monitor energy use. The aircraft can also be used to conduct wildlife inventories.

International policy starts in Blacksburg

The new Center for Agricultural Trade at Virginia Tech is paying big dividends for the commonwealth and the nation.

Recently the center found itself in the midst of the highly contested international trade relations negotiations of the Trans-Pacific Partnership. The topic? The heavily protected global dairy market.

The center relentlessly produced up-to-the-minute export models during the negotiations, which were under discussion until the eleventh hour. The models provided clear-cut export scenarios that put the realities of trade tariffs into sharper focus. The International Trade Commission and the Office of the Chief Economist — a political body that reports directly to the president of the United States — used the models.

Part think tank, part classroom, and part idea incubator, the center's mission is to become the leader in creation and dissemination of information on agricultural policy for legislators, educators, and industry leaders.

"With our proximity to Washington, D.C., and our port in Hampton, Virginia, we are perfectly situated to function as a practical

resource for policymakers," said Jason Grant, center director and associate professor of agricultural and applied economics.

Participating in the TPP talks is just one example of the many ways the center plays a key role in shaping national agricultural policy.

During the TPP negotiations that were held in Atlanta last year, Grant and his team provided key modeling information regarding the tightly regulated markets in the global dairy sector that paid off big time.

The concrete gains and losses laid out in black and white allowed the U.S. to solidify a huge win for negotiations around dairy exports and resulted in gaining access to lucrative markets in previously out-of-reach countries like Japan and Canada.

Now U.S. producers enjoy a duty-free quota in Japanese markets and have acquired access to tightly held Canadian markets. Items that run the gamut from cheeses and butter to milk powder and heavy cream are part of the product landscape that Japanese and Canadian consumers will enjoy thanks to Grant and his team.

Jason Grant, director of the Center for Agricultural Trade

Water testing program helps get the lead out

Virginia Tech's recent discovery of abnormally high amounts of lead in the Flint, Michigan, water system has made safe drinking water a hot topic. But while the water in Flint came from a municipal source, private water systems, such as wells, springs, and cisterns, are not immune to this problem.

Testing conducted through Virginia Cooperative Extension's Virginia Household Water Quality Program has found high levels of lead in private systems around the state.

Kelsey Pieper, a researcher on the Flint team who received her doctorate from Virginia Tech, was the primary author on the study that found 1 in 5 private systems had lead concentrations above the Environmental Protection Agency standard for municipal systems. About 45 percent of the samples contained coliform bacteria and 10 percent contained E. coli.

The study determined that, like Flint, much of the lead in private systems is due to corrosive water.

"Homeowners may associate lead in water problems with older homes, but we are finding high lead in water from newer homes as well," said Pieper. "Until 2014, lead-free plumbing could contain up to 8 percent lead. These components are still present in many homes, and exposure to corrosive water may cause the lead to leach."

Nearly one-quarter of Virginia's population — 1.7 million people — rely on private water systems for their source of household water.

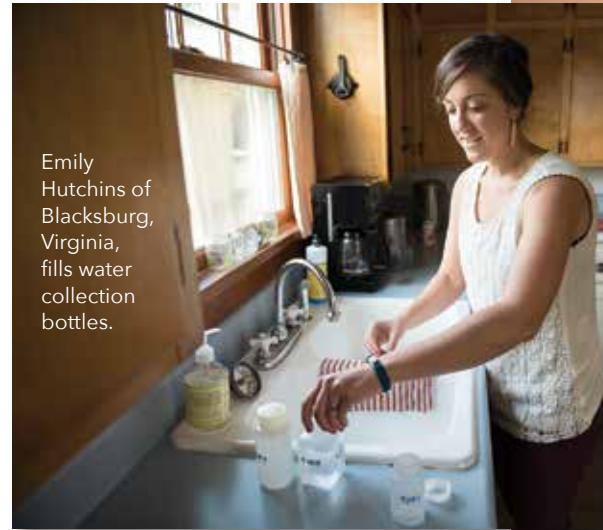
“In addition to learning about their water quality, we work to empower well owners with information about system care and maintenance and to address any problems.”

— Erin Ling, coordinator of the Virginia Household Water Quality Program

"The safest thing you can do is have your water tested," said Erin Ling, a senior Extension associate in the Department of Biological Systems Engineering and the Virginia Household Water Quality Program coordinator. Ling recommends that private systems be routinely tested every one to three years.

Jeremy and Emily Hutchins of Blacksburg are among thousands of families across Virginia that have had their water tested through the Virginia Household Water Quality Program. Emily Hutchins had heard about the program from a friend at work. She wanted to have her water tested and was also concerned about the water at her parent's home in Craig County. She convinced her parents to have their water tested at the same time.

"It's good to know what is in your water," said Jeremy Hutchins. "Look at how much stuff can end up in your water. Why wouldn't you want to know?"



Emily Hutchins of Blacksburg, Virginia, fills water collection bottles.

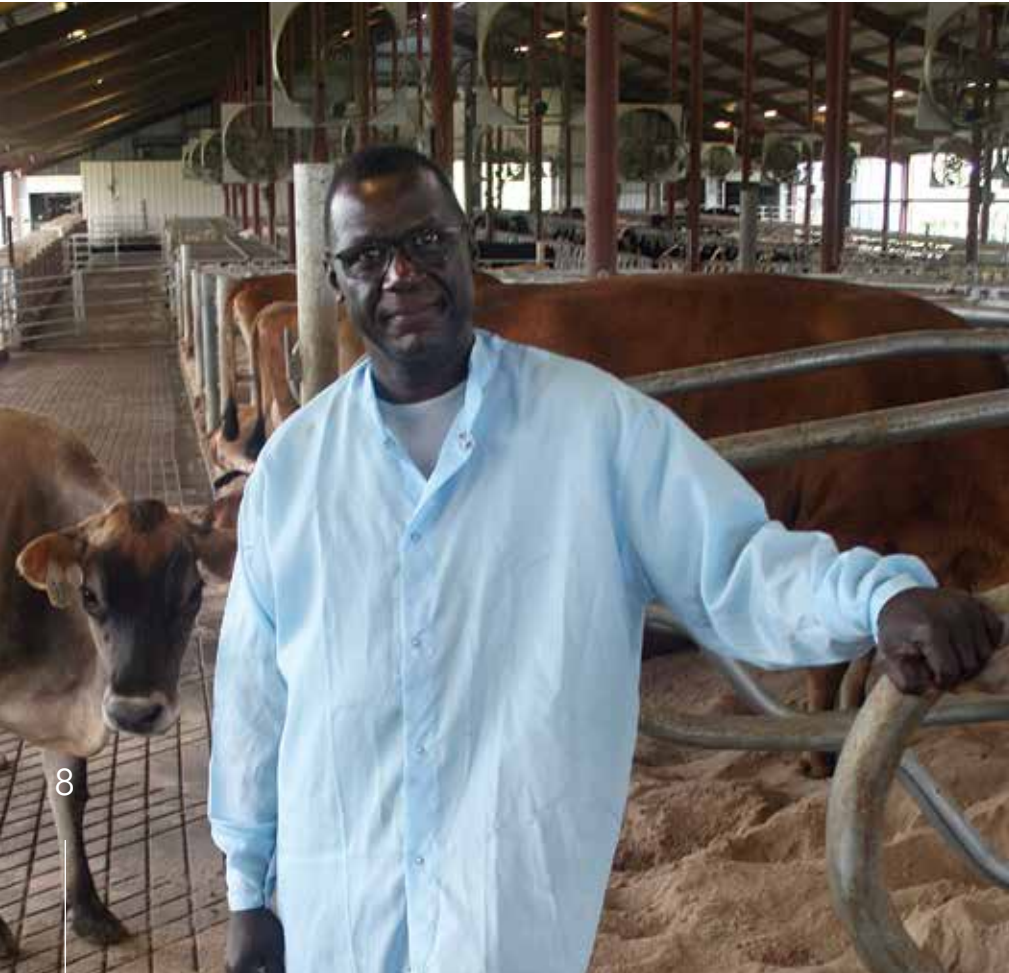
"Our program works through local Extension offices to offer low-cost, confidential water testing for Virginia's well and spring users. Since these are private systems, the owner is completely responsible for maintaining the quality of their drinking water," said Ling. "In addition to learning about their water quality, we work to empower well owners with information about system care and maintenance and to address any problems."

Clinics begin with a kickoff meeting that introduces the program and gives instructions for collecting the samples. After participants collect their water samples, the samples are taken to two labs at Virginia Tech to be analyzed. An interpretation meeting is held to review each participant's results and discuss options for addressing maintenance or water quality problems. More than 50 clinics will be held across the commonwealth in 2016.

"As more testing is done, we will continue to develop a better understanding of the occurrence, sources, and remediation approaches of lead in private systems," said Ling.

For more information, visit www.wellwater.bse.vt.edu.

'Designer manure' could become fashionable on farms



8

"I approach my work by looking at what can be the most beneficial research we can do for farmers."

– Jactone Ogejo, associate professor of biological systems engineering

Eugene Bowman's family has owned a dairy farm in Franklin County, Virginia, for four generations, and Bowman wants to make sure that when he hands it over to his sons, the land is healthy for generations to come.

"It needs to be as good or better than when I got it," he said.

So when his local Virginia Cooperative Extension agent told him about a research project Virginia Tech is undertaking to mitigate fertilizer runoff, Bowman jumped at the chance.

He is now working with Jactone Ogejo, an associate professor of biological systems engineering on a project to create the most fashionable thing to hit farms since Carhartts — designer manure.

Plants need nutrients such as those in manure to help them grow strong and produce food to feed the world. Plants love to suck up the nitrogen in manure when it is used as a fertilizer, but they don't always need the phosphorous that comes with it. If plants don't take up all the phosphorus, what's left can run off into streams and waterways, sending pollutants downstream to places like the Chesapeake Bay.

Using a series of operations, Ogejo is developing a chemical-based process where manure is treated to remove some of the phosphorus — hence the term "designer manure." The recovered phosphorus is set aside so it stays out of the water source and can be sold separately to farmers who are in need of phosphorus for their plants.

"I approach my work by looking at the most beneficial research we can do for farmers," Ogejo said. "This solution will not only protect the environment, but it will also help farmers continue farming while increasing their bottom lines."

Government regulations are increasingly calling on farmers to monitor and curb runoff from their land, and efforts are underway to stem the flow of phosphorus to the Chesapeake Bay, so this research can help them comply with new guidelines. It is being funded in part by the USDA National Institutes of Food and Agriculture.

The process works by first separating the liquid from the solids in manure. The solids can be dried out and reused for other purposes, such as stall bedding. The liquids are then routed to a large vat where chemicals are applied to recover and separate the phosphorus from the other materials; the three different chemicals used are salts based on aluminum, iron, or calcium. Once the chemicals are applied, the phosphorus that is separated can be sold.

Ogejo is testing this system at Bowman's farm but expects it to be available soon to others around the state. He wants farmers to learn about the process through videos and at field days and Extension events in hopes that it will make their work easier while benefiting the environment.

"I really enjoy agricultural production and the challenges of growing good food to put on the table with limited resources," Ogejo said. "I hope this work will help make farmers' work a bit easier."

Taking the bite out of bedbugs

While bedbugs have largely been the bane of landlords and hoteliers, researchers from Virginia Cooperative Extension have discovered that bedbugs are increasingly popping up in spaces such as health care facilities – and that has a lot of people scratching their heads about how to contain the annoying bugs.



Dini Miller, professor of entomology and Extension entomologist, trains health care and social workers on how to get rid of bedbugs and prevent future infestations.

This latest development means the training and research that Dini Miller, professor of entomology and Extension entomologist, conducts at the Dodson Urban Pest Management Laboratory is more necessary than ever for those looking to contain the urban pest problem.

According to Miller, bedbugs have increasingly spread from individual homes to places where people gather to use social services, such as women's shelters; medical care facilities, like dialysis centers; and lower-income, elder care facilities. Elderly populations are at high risk for bedbugs

because their bodies might not react to the bites with the usual red welts, and poorer eyesight means they don't see the bugs well enough to report them.

Miller is training health care and social workers — who often encounter infestations in spaces such as these — on how to get rid of the bugs and address the tangential factors of dealing with the pests, such as difficulty in moving personal belongings in a population with limited mobility.

In 2015 the Dodson Center delivered 63 training presentations at 50 different venues, resulting in 6,945 face-to-face interactions.

Much of what Miller combats during trainings is ignorance.

"We have to address the 'freak out' factor," said Miller. "People who cannot live without assistance are now being even more isolated and deprived of care because health care workers are reticent to enter spaces where there are infestations."

When Miller started the center, she was worried about how to advertise the center's services, but no longer.

"The bedbugs just kept spreading," she said.

Evaluation pays off for producers

Sheep producers are finding new ways to put dollars in their pockets with some help from Virginia Tech's Southwest Virginia Agricultural Research and Extension Center.

The center, located in Glade Spring, is home to the Southwest Virginia Forage-Based Ram Test. The ram test, now in its fifth year, is the only program in the U.S. that evaluates rams through a forage-based performance test designed specifically to quantify growth and parasite resistance. The test provides a mechanism for ram lambs to be evaluated and compared to rams from other flocks in a standardized environment. At the conclusion of the test, the ram lambs that are offered for sale come with a vast body of production data.

"Internal parasites are among the leading health concerns for sheep," said Scott Greiner, Virginia Cooperative Extension

sheep specialist and professor of animal and poultry sciences. "They can pose dramatic economic losses for many producers, especially those in the Mid-Atlantic and Southeast regions of the U.S. where forage-based production is an ideal management system for livestock."

"The value-added research and data collected on these rams is a huge asset to both seedstock and commercial producers around the country who are making selections for their breeding programs," said Lee Wright, Southwest Virginia AREC superintendent and ram test manager.

"Over the years our research has shown that parasite resistance is a highly heritable trait



The Katahdin breed of hair sheep – known for its environmental adaptability, low maintenance, and parasite resistance – has dominated the ram test.

with genetic variation. Identifying rams that have the potential of passing these favorable genetic traits on to the lambs they sire can make a significant impact on the health and well-being of many producer flocks."

Chris and Mandy Fletcher of Abingdon, Virginia, know firsthand the value of having this data available on their rams.

The Fletchers purchased their first ram at the inaugural ram test sale in 2012. They have purchased a ram from the test for the past four years, making their selection based on growth and parasite resistance.

"Each year our genetics and parasite resistance have improved. We haven't had to deworm our ewes in 18 months," said Chris Fletcher.

As a local veterinarian, Chris Fletcher shares his personal experience with his clients. Nearly 90 percent of his medical calls about sheep are related to parasite issues, and he spends a lot of time stressing the value of parasite control. He says using a ram with increased parasite resistance would easily pay for itself with decreased health costs and flock mortality.

Researchers from Virginia Tech also provide information on a variety of management

and nutrition topics to producers during the center's annual field day and sale each September.

"I wasn't familiar with raising sheep when we first got started," said Mandy Fletcher. "The educational program offered as part of the field day and sale has really helped me."

The Fletchers have consigned rams to the test for the past three years. The annual sale serves as a merchandising outlet for their rams, while their ewes are sold off the farm for seedstock. The rams they consign are progeny of rams they have purchased through the sale.

In 2015 producers from eight states consigned 110 rams, with 36 of the highest-performing rams offered through the sale. The sale averaged \$1,222 per head, which surpassed national sale averages from other Katahdin ram sales around the county.

"Our goal for the program has been to demonstrate the tools and application of strategies that can be utilized on-farm for genetic improvement of parasite resistance. The Fletchers are a testimony to the benefits of putting these practices in place, and they are recognizing the benefits on their farm and the farms of their customers," Greiner said.



Mandy and Chris Fletcher, of Abingdon, Virginia, have purchased rams from the ram test sale for the past four years and have improved their flock's genetics by selecting for growth and parasite resistance. As their flock's genetics have improved, the Fletchers have seen a decrease in health care costs and flock mortality.



Agency 229 is...

Innovative research

Virginia Agricultural Experiment Station's network of faculty members in Blacksburg represents three colleges — the College of Agriculture and Life Sciences, the College of Natural Resources and Environment, and the Virginia-Maryland College of Veterinary Medicine. The 11 Agricultural Research and Extension Centers located across the state support basic and applied research on agricultural, environmental, natural resources, and community issues related to the future needs of Virginia, the nation, and the world.



A local presence

Extension offers resources in 107 offices, located in every county and 12 cities across Virginia. It is a cooperative effort among local, state, and federal governments in partnership with tens of thousands of citizens who — through their local Extension Leadership Councils — help design, implement, and evaluate our needs-driven programs.

Expanding education

Virginia Cooperative Extension leads the engagement mission of Virginia Tech and Virginia State University — the commonwealth's land-grant universities.

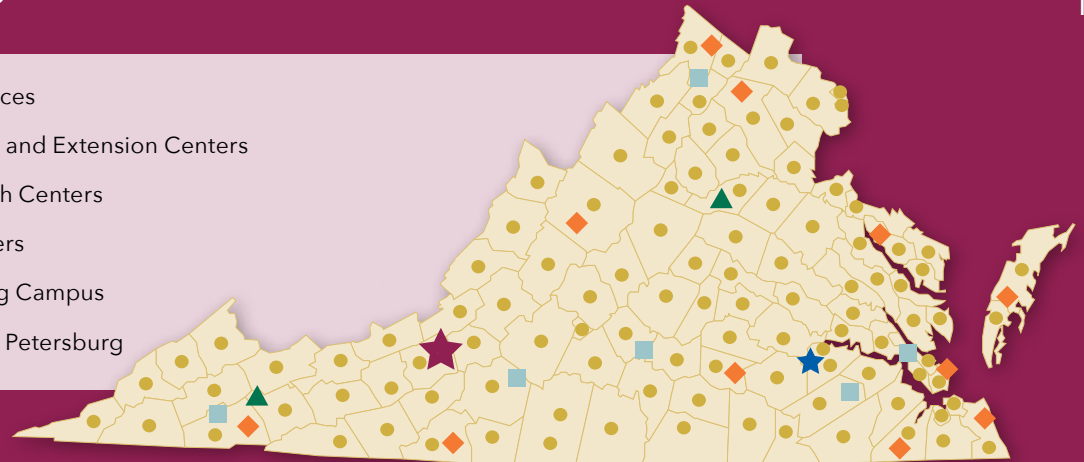
By building local relationships and collaborative partnerships, Extension provides practical education that people can trust to help individuals, businesses, and communities solve problems, develop skills, and build better futures.



Covering the commonwealth

13

- 107 Local Extension Offices
- ◆ 11 Agricultural Research and Extension Centers
- ▲ 2 Departmental Research Centers
- 6 4-H Educational Centers
- ★ Virginia Tech, Blacksburg Campus
- ★ Virginia State University, Petersburg



Scientists determine key factors of honeybee decline



Though a contributing factor, farmer-applied pesticides are not the primary cause of honeybee colony loss in Virginia, according to Virginia Tech scientists Richard Fell and Carlyle Brewster.

The scientists recently took wax, pollen, and bee samples from more than 110 hives across the state and have analyzed about half of them for pesticide residues.

“We did not find excessive amounts of agricultural pesticides in the hives, but we did find a significant amount of beekeeper-applied miticide,” said Fell, professor emeritus of entomology in the College of Agriculture and Life Sciences.

Intended to kill the invasive, parasitic varroa mite, miticides can also be damaging to bees. Fell urged beekeepers to sample their colonies to determine mite infestation levels before treating. If treatment is necessary, beekeepers should use a miticide that does not cause residue problems, such as formic acid.

As more information emerges on the spread of the Zika virus, Fell also encouraged the public to be mindful that mosquito pesticides are toxic to honeybees and should only be applied when absolutely necessary.

Fell and Brewster, who is also a professor of entomology, are now in the third year of a five-year, \$1.4 million project funded by

the Virginia Department of Agriculture and Consumer Services to better understand honeybee decline.

Their next step is to examine select hives more intensely to determine other key factors involved in honeybee loss. The approximate rate of hive loss in Virginia is more than 30 percent per year, and continued losses are expected to drive up the cost for important crops that bees make possible, such as apples, melons, and squash.

While it is good news that agricultural pesticides are not wholly to blame, it also

means that the problem is more complicated than expected, and the researchers have their work cut out for them.

“Landscape change, lack of habitat, and climate change’s impact on floral bloom seasons are all factors that impact honeybees that we need to learn more about and potentially develop strategies around,” Brewster said.

Tim Kring, department head of entomology, said he will hire two new pollinator scientists — one researcher and one Extension specialist — in the coming year.



Extension is ahead of the curve on new food safety rules



Adrianna Vargo, director of grower services at Charlottesville's Local Food Hub, has collaborated with Virginia Cooperative Extension to get critical information to growers regarding the Food and Drug Administration's new Food Safety Modernization Act. Its aim is to make the food supply safer by shifting the focus from responding to food contamination problems to preventing them from occurring. The policy is the most sweeping reform of U.S. food safety laws for both human and animal foods in 70 years.

Vargo and Extension have acted as boots-on-the-ground liaisons for more than 60 growers throughout Virginia and in North Carolina by providing critical workshops to ensure producers will be able to comply with FSMA legislation.

"One of the aspects of this legislation that has been a huge concern for growers is water testing. FSMA requires so many more water tests throughout the growing season," Vargo said. "Extension has been an invaluable resource for training. They have been very inclusive and responsive to growers' needs."

While implementation of updated food safety rules could be tricky for producers and others in the food supply chain, the new FSMA rules have been on Virginia Cooperative Extension's radar for a long time.

“Extension has been an invaluable resource for training. They have been very inclusive and responsive to growers’ needs.”

— Adrianna Vargo, director of grower services at Local Food Hub

Extension has already been training growers and listening to the challenges they could face when the new rules go into effect after a grace period over the next couple of years.

"As Extension, we see a wide variety of needs, said Amber Vallotton, the state fresh produce food safety coordinator. "We already collaborate on a lot of programs for growers that address the issues that fall under FSMA. All of the trainings have been to push the whole point of understanding risk and preventive measures."

Laura Strawn, an assistant professor of food science and technology and produce safety specialist at the Eastern Shore Agricultural Research and Extension Center, heads up technical resources, education, and outreach for Virginia through the FSMA Southern Training Center, part of a network of USDA-funded regional centers charged

with helping stakeholders comply with FSMA rules. The Southern Training Center, represented by academic and industry experts, uses a "train the trainer" model to train others about the new regulations and requirements. Ultimately, these new trainers teach the growers.

As a lead instructor in both the Produce Safety Alliance and the Food Safety Preventive Controls Alliance curricula, Strawn has partnered with several grower associations and commodity boards, including the Northern Neck Vegetable

Growers Association and the Virginia Apple Board, as well as the Virginia Department of Agriculture and Consumer Services and nongovernmental organizations like the Local Food Hub to provide FSMA trainings.

"We are well-prepared for the FSMA rules affecting the produce industry here in Virginia," Strawn said. "Over the past year alone, we have communicated with several hundred growers throughout Virginia to discuss standards and compliance dates with the FSMA rules."

As part of its grower services program, the Local Food Hub's Adrianna Vargo conducts a mock audit of Singing Earth Farm in Augusta County.



Keeping the commonwealth informed

Gone are the days when residents had to visit their local Virginia Cooperative Extension office to obtain a copy of the latest publication. Today, the entire publication library is available at everyone's fingertips on the VCE website. Although the mode and distribution method of these materials has evolved, VCE publications remain a popular go-to source for research-based information.

"Many things have changed over the years with Extension, but our publications continue to be very popular," said Robert Grisso, associate director of agriculture and natural resources for VCE. "They are just one of the many ways that we provide the public with information to help them solve problems."

Since its humble beginnings in 1914, Extension's goal has remained consistent — to put knowledge into the hands of the

community to better the livelihoods of its residents. Although the pioneer publications were crafted on typewriters, typeset, and printed on a press, their subjects were similar to what one might find today. Topics including improved agriculture practices, nutrition and health tips, food preparation, lawn and garden advice, and 4-H projects are all represented in both early and modern materials.

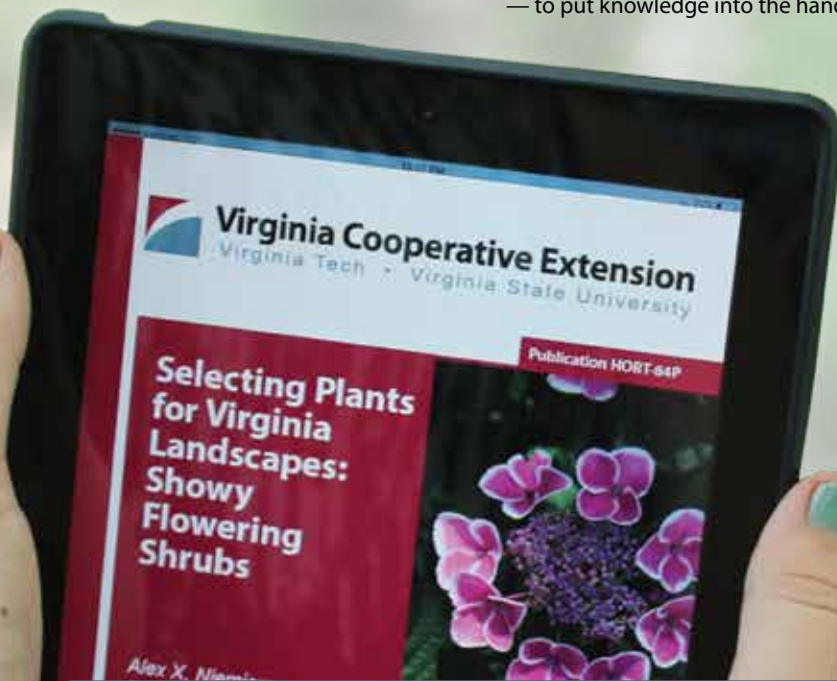
After moving publications online over a decade ago, VCE saw the need to cater to its newfound broader audience. As a result, VCE has started translating some of its more-popular publications into Spanish. The Spanish library has grown to include materials on food preservation, food safety, landscape maintenance, bedbugs, parenting, nutrition, and animal science.

Another modernization of VCE publications was the addition of e-books in 2010. These publications provide the option for e-reader users to download VCE content digitally to their hand-held devices to read at their leisure or on the go.

MaryAnn Kincaid of Virginia Beach has been referencing VCE publications since she set out to cross "Become a Master Gardener" off her bucket list 13 years ago. Kincaid uses these resources to develop her own skills as well as to improve and inspire others to follow suit.

"Over the years, I have witnessed the transition to greater accessibility of VCE publications. When I first set out to be a Master Gardener, everything was in print. We had no direct access to the archives," said Kincaid. "Now, it's much better because people can search for a very specific topic, but their curiosity could be piqued in the process. You can send someone to the website to find one thing, but then they see more options and they might find a new practice or avenue they didn't know they were interested in. There is value in that."

Kincaid acknowledges that there are other resources out there, but she finds VCE publications extremely accessible. "By referring someone to VCE publications, you are directing them to a one-stop shop, thus saving them the hassle and time of searching for reliable sources," Kincaid said. "In fact, the biggest draw for me is the credibility of VCE's publications. Friends and colleagues can share and post articles all day long, but when it comes from Virginia Tech and Virginia Cooperative Extension, I know the information is reliable and backed by research."



Today, VCE's library comprises **more than 3,000 publications** on everything from growing apples to protecting groundwater. Last year the VCE publication website received **more than 4.6 million page views**, and more than **1.8 million VCE publications were downloaded**.

New workforce opportunities for students

Agriculture is an evolving industry that is becoming more scientific and technical. These changes mean exciting new career opportunities, but students must be equipped with the skills and knowledge to meet employers' ever-changing needs.

In an effort to help teachers prepare students for these jobs, Virginia Tech has provided six Virginia high school programs with Virginia Agricultural Education Centers of Innovation grants. This funding is made possible through the Virginia Department of Agriculture and Consumer Services with matching funds from the Virginia Tech Foundation Fund for Community Viability.

"We are excited to work with agriculture teachers who are pushing traditional boundaries to broaden students' education and career opportunities," said Donna Westfall-Rudd, associate professor of agricultural, leadership, and community education and project leader for Virginia Agricultural Education Centers of Innovation.

Teachers were asked to develop proposals that detailed curriculum and activities that supported contemporary agricultural education through the use of new classroom and laboratory technology. The goal of the innovative curriculum was to improve students' career and college readiness.

In Washington County, Holston High School agriculture teacher Sarah Scyphers used her grant to build a barn to house animals near

the school. Scyphers is excited about the learning possibilities associated with keeping the animals on-site. "Instead of playing games and just identifying things, the students can now put their hands on the animals," she said.

Having the animals at the school will allow Scyphers and Phil Blevins, the Virginia Cooperative Extension agriculture and natural resources agent in Washington County, to conduct Beef Quality Assurance training for the students during the school day.

John Carpenter, the middle school agriculture teacher in Carroll County, has worked with Handibot, a smart power tool company, to develop a compact, computerized, numerical-control milling machine that is ideal for school systems as well as affordable. Carpenter's students are using drafting software to develop programming skills while learning an appreciation for one of our country's leading natural resources — timber.

Halifax County agriculture students made art-inspired garden decor and tools. These items will be sold in an online

store created by the students and their high school teacher, Jon Chandler, as an entrepreneurial experience. The students built the online store while learning horticulture and developing business skills.

Lessons created for these and the other programs are available to teachers through the Virginia Agricultural Education Centers of Innovation website. Grant recipients have also shared their experiences at the Early Career Teachers conference and the National Association of Agriculture Educators convention.

Community resources and expertise were extremely valuable to teachers developing innovative programs. Each teacher formed an advisory committee made up of community leaders, local industry representatives, parents, and school board members. These committees provided guidance for curriculum development and assistance during implementation of the programs. This support ensured that students received relevant skill development to prepare them for college or future careers.

“We are excited to be able to work with agriculture teachers who are pushing traditional boundaries to broaden students' education and career opportunities.”

— Donna Westfall-Rudd, associate professor of agricultural, leadership, and community education



Holston High School students played an important role in finishing the inside of the barn that was built using the grant funds. Once the structure was up, they constructed walls and sides to keep the animals safe.

Looking for clues about disease affecting cattle and people

A Virginia Tech researcher is hoping to better understand a bacterium responsible for both spontaneous abortions in cattle and an inconsistent and sometimes fatal fever in humans.

Clay Caswell, assistant professor of bacteriology at the Virginia-Maryland College of Veterinary Medicine and an affiliate of the Fralin Life Science Institute, has focused his attention on *Brucella*. While his colleagues at the veterinary college have spent years developing more-effective vaccines, Caswell is taking a different approach to better understand the molecular basis for *Brucella* infection.

"*Brucella* lives inside a host immune cell called a 'macrophage,'" said Caswell, who is studying how two small regulatory RNAs

allow the bacterium to survive there. "The paradox is that it's living inside the very cell that's trying to destroy it."

Caswell has received funding from the Virginia Agricultural Experiment Station to characterize a novel genetic pathway linked to the bacterium's virulence. He has also been awarded recent grants from the American Heart Association and the National Institutes of Health to develop the basic science needed to develop treatments in humans who are exposed through unpasteurized milk and other means.

"Brucellosis is the most common zoonosis in the world," Caswell said. There is no human vaccine for the disease, which infects approximately 500,000 people worldwide every year.

"It is very hard to treat, often requiring two rounds of antibiotics, with a relapse rate of up to 15 percent and the potential for chronic infections. It has a low mortality rate, but when it is fatal, it is often due to a heart infection," Caswell said.

Other researchers at the veterinary college are developing more-effective brucellosis vaccines for cattle. The U.S. Department of Agriculture granted a provisional license for a vaccine developed by Gerhardt Schurig, professor of immunology and former dean, in 1996 and a full license in 2001. Today, the cattle vaccine developed at the veterinary college is used by farmers and veterinarians worldwide.

Civics comes to life at 4-H Day

More than 1,000 4-H members and volunteers visited Richmond in February to meet their state representatives and learn about Virginia's legislative branch of government. Virginia 4-H has celebrated 4-H Day at the State Capitol for 21 years.

Virginia 4-H sponsors the annual trip for 4-H'ers across the commonwealth to express their gratitude to state delegates and senators who support 4-H youth development programs.

"The opportunity to watch our delegates in action is a real learning experience for our students," said Chris Lichty, senior 4-H Extension specialist in Pulaski County. "They were in awe of seeing the discussion on the floor of legislative issues and how intense the debates got between members and delegates from the House and Senate."

"This trip is an opportunity for lawmakers to put faces to the programming that the funding provides for young people all over

the commonwealth," said Cathy Sutphin, associate director of 4-H Youth Development with Virginia Cooperative Extension.

Over 214,000 youth are enrolled in Virginia 4-H's hands-on educational programs. Throughout the commonwealth, more than 12,700 adults and teens volunteer their time and energy to mentor and teach 4-H members about science and technology, career and economic education, citizenship, communication and expressive arts, family sciences, leadership, and other topics. In addition, there are six 4-H educational centers that conduct residential camping programs for more than 10,700 young people annually.

Virginia 4-H engages children and teens ages 5 to 19 in hands-on educational programs and activities designed to help them gain knowledge, life skills, and attitudes that will further their development as self-directed, contributing, and productive members of society.

4-H members and volunteers at the annual 4-H Day at the Virginia State Capitol in Richmond.



Clay Caswell (left), assistant professor of bacteriology, seeks to better understand brucellosis with Ph.D. students James Budnick and Lauren Sheehan.

Growing energy production from the ground up

In the future, the move toward renewable energy produced in the commonwealth could be a boon for farmers, help industries cut costs, and assist in the battle against climate change. Despite the downturn in fossil energy prices, colleges, hospitals, and companies around the state are tapping into the supplies of biofuels, and researchers at Virginia Tech want businesses and farmers to be able to capitalize on this market.

“We have the opportunity to grow a number of plant species — both existing crops and new species — that could be used for everything from chemicals and fuel to paper. Dedicated biomass crops may also enhance our existing natural resources portfolio by conserving soil and reducing runoff,” said John Fike, an associate professor of crop and soil environmental sciences and Virginia Cooperative Extension specialist who has been conducting studies on the feasibility and costs of biofuels.

Although the cheap price of oil and natural gas in recent years has slowed development of bioenergy and bioproduct systems, the industry continues to push ahead.

Ken Moss, CEO of Piedmont BioProducts in Gretna, Virginia, notes that earlier

business models that were based on fuel production alone don't work well in today's economic climate. Piedmont BioProducts has taken a different path and is investigating advanced engineering systems to extract high-value chemicals from plants before turning the post-process residues into fuel oil and soil amendments. Others are going old school, using the biomass as a replacement for traditional sources of boiler fuel.

Fike figures it is just a matter of time before energy prices start to climb again, and when they do, he wants farmers to be armed with research data that can help them decide what crops to grow and to know how those crops can fuel new profits.

He has primarily worked with switchgrass and miscanthus — grass species that are better suited than row crops for use on marginal farmland. These species typically need fewer inputs of fertilizer and other agricultural chemicals than row crops. Along with having lower nutrient needs than traditional crops, switchgrass is a native species that can be hayed or grazed and can provide good wildlife habitat. And, because both species are highly productive and have large root systems, they can capture large amounts of carbon dioxide from the atmosphere and store much of this carbon

in the soil, helping reduce the amounts of greenhouse gases in the atmosphere.

Miscanthus has proved more responsive to nitrogen fertilizer inputs in Fike's studies, although the economic returns have not yet been evaluated. Miscanthus is more

expensive to establish, but it is especially promising for some regions of the state.

With the work of scientists, students, and industry, the power of Virginia's agricultural portfolio could be even stronger in years to come.



John Fike, associate professor of crop and soil environmental sciences and an Extension specialist, studies crops such as miscanthus to determine their feasibility as sources of biofuel.

Communities working together

Communities in the Northern Neck knew they had a problem. Young people were leaving because of a lack of jobs, the current workforce needed additional education, and there were few opportunities for those who wanted to stay in the area.

Four years ago these communities took steps to improve the situation by participating in the Stronger Economies Together program, which has allowed them to build a blueprint for regional economic success.

Today, the Northern Neck is putting its plan into action by engaging partners and leveraging the strengths of this diverse region. Communities have come together to form the Northern Neck Artisan Trail, which highlights the creative talents, foods, and agricultural products of the region, and to participate in the emerging Virginia Oyster Trail. The new trail offers visitors a way to enjoy Virginia's seven different oyster regions, as well as to experience the unique culture of watermen in the Chesapeake Bay.

The region has received grant support from the USDA and the Virginia Department of Housing and Community Development to create the Northern Neck Loan Fund to help emerging entrepreneurs and small businesses

gain access to capital. The USDA recognized the Northern Neck Economic Development Plan for its commitment to strengthening the area's economies and identified it as a model plan for the program.

The SET program promotes collaboration among communities by pooling economic assets among municipalities and expanding the vision of local policymakers in rural areas to think regionally, beyond their own communities. Virginia Cooperative Extension partners with Virginia's USDA Rural Development office, the Virginia Department of Housing and Community Development, the Virginia Tourism Corporation, and Virginia Tech's Department of Agriculture and Applied Economics to deliver technical expertise that leads regions through the planning process.

"The guidance and support that we received from Extension has been invaluable to the region," said Lisa Hull, tourism and economic development coordinator for the Northern

Neck Planning District Commission. "Extension has helped keep the group together through this process."

The Northern Neck and a section of Southside Virginia were the first two regions to complete the program. In 2015, three more regions — the Eastern Shore, the Mount Rogers Planning District, and northern Shenandoah Valley — were selected to participate and are currently forming their plans.

"The SET program provides communities an opportunity to map regions, think about who the stakeholders are, and invite new people to the conversation," said Martha Walker, community viability Extension specialist and SET project coordinator. "Communities are able to come together and make real progress toward enhancing and building on the assets of their communities to spur economic growth."

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Photo credit: Omega Protein Inc.



Photo courtesy of Andrew Pitts

Furniture-maker Andrew Pitts is a member of the Northern Neck Artisan Trail.

4-H builds communities around the world

In a Senegalese village, children grow vegetable seedlings and organize traditional wrestling events as fundraisers in a positive youth development initiative modeled after Virginia Cooperative Extension's 4-H program.

At the Ndoumbouji primary school, the main focus is gardening.

"The teachers told us that every break they have, the students run to the garden," said Ozzie Abaye, a Virginia Tech professor in the Department of Crop and Soil Environmental Sciences. "The group wants to try to expand the garden project outside of the campus."

Through activities such as gardening and leadership training, 4-H's international programming has helped to improve thousands of lives around the globe.

Kathleen Jamison, professor emerita and 4-H youth development specialist, and her team completed training workshops in March designed to scale up the programs' outreach efforts throughout Senegal.

"4-H provides opportunities for younger members of the community to express themselves and be heard," Jamison said. "This is important since young people continue to be an effective way to spread knowledge about new technologies and approaches to problem-solving in their own communities."

4-H programming has been changing the lives of young people from the Dominican Republic and Virginia for more than a decade.

"I realized my urge to help others, my passion to work with kids, and discovered a sense of

leadership that went far beyond my previous experience," said Julie Billingsley, a 4-H'er from Highland County who participated in the service-learning project.

Carol Nansel and Christine Hodges, 4-H Extension agents from Shenandoah and Alleghany counties, organize the annual weeklong trips to the island where younger children participate in day camps for two days, while teens interact with each other through service projects that teach principles of environmental sustainability and leadership.

"Each year I watch the 4-H'ers discover a culture and language different from their own," said Nansel. "I see them learn ways to communicate with Spanish speakers when words fail them, and I see their eyes opened to the world that exists outside their comfort zone."

Glenda Snyder, senior Extension agent emerita, introduced CHARACTER COUNTS! — an education program developed by the California-based Josephson Institute of Ethics — to schools in Brazil.

Snyder and a local school principal trained 80 school and community representatives, and CHARACTER COUNTS! was implemented as a pilot program in Brazilian schools to help at-risk young people, some whose parents were incarcerated. Officials reported positive results such as improved student conduct, decreased violence, more respectful behavior, and increased parent volunteerism.

The relationship with educators in Brazil has grown and developed over the past nine years

as Extension faculty members have trained more than 1,000 Brazilian teachers, principals, and community leaders, impacting 70,000 students annually.

"We've got over 100 years of experience in youth outreach," said Snyder. "Our expertise has been utilized across the commonwealth — and across the globe."



Community members of Domingo Maiz, Dominican Republic, asked the Shenandoah County 4-H group to paint a 4-H clover on the village's mural to recognize the group's community service work with local children.



Virginia Cooperative Extension senior 4-H youth development agent Ruth Wallace (left) poses with a group of children and adults in Senegal. In March of this year, Extension and the 4-H Positive Youth Development in Agriculture Program traveled to the West African nation to scale up programming in the region. Reggie Morris, 4-H youth development Extension agent in Alexandria, Virginia, is pictured in the second row, second from right.

Building a better SOYBEAN

Soybeans are one of Virginia's top crops, ranking sixth out of the commonwealth's top 10 agricultural commodities.

The vast majority of the crop is processed as feed for farm animals — including cows, pigs, and chickens — which are also top products for the state.

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Soybeans contain high levels of phytic acid, which stores phosphorous. When animals ingest soybeans, the phytate is broken down in the gut.

While ruminants such as cows can break down soybeans with ease, nonruminants like pigs and chickens have difficulty breaking down the high-phytate content in a traditional soybean. In addition, the waste produced by animals who consume soybeans is also high in phosphorous, which has far-reaching ramifications for bodies

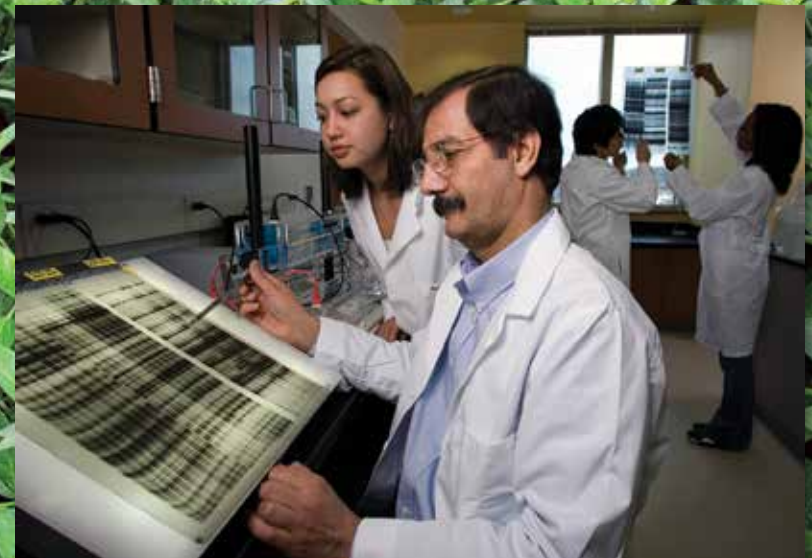
of water like the Chesapeake Bay that are overburdened with phosphorous runoff.

M.A. Saghai-Marooof, professor of crop and soil environmental sciences, is one of several researchers in Virginia Tech's College of Agriculture and Life Sciences helping to produce new soybean varieties with lower levels of phytate, which in turn is more easily digested and produces less phosphorous.

The new plants can be lucrative for the state but are also easy on non-ruminant stomachs due to low phytic acid.

Saghai-Marooof identifies soybeans with desirable genetic traits using cutting-edge technology such as the mass spectrometer — a machine that measures metabolites that go beyond the DNA footprint of a plant — and gives researchers the ability to see metabolic processes at work in the genetic development of an organism.

"Virginia Tech is making a soybean specifically for Virginia livestock that will be environmentally friendly and will be utilized by the animals in the most efficient way," Saghai-Marooof said.



Faculty members such as M.A. Saghai-Marooof, professor of crop and soil environmental sciences (front), are making agriculture more profitable in the commonwealth by building a soybean that can be grown in Virginia and digested easily by nonruminants.

Tracking and stopping human and agricultural viruses

Viruses are molecular thieves that take from their hosts under the cloak of darkness. But now a Virginia Tech scientist has found a way to not only track viral hijackers, but also to potentially stop them from replicating.

The discovery has broad-ranging applications in stopping viral outbreaks such as hepatitis C in humans and a number of viruses in plants and animals because it applies to many viruses in the largest category of viral classes — positive-strand RNA viruses.

“Even though these viruses infect very different hosts, they all replicate similarly across the board, so what we learn from one virus can potentially be translated to control viruses in agricultural production as well as human health,” said Xiaofeng Wang, an assistant professor of plant pathology, physiology, and weed science in the College of Agriculture and Life Sciences.

Xiaofeng Wang, assistant professor of plant pathology, physiology, and weed science

Wang’s findings could target any number of plant viruses by developing sprays to halt the virus, which would save the agricultural sectors millions of dollars.

Wang used the bromo mosaic virus to study how viral infections start. He found that by inhibiting host lipid cell synthesis, the viral replication stopped.

Wang also collaborated with researchers to study how human viruses like hepatitis C and poliovirus regulate host lipid synthesis. He found that viral replication behaved in the same way as plant viruses.

Developing a drug delivery system to combat the hepatitis C virus has vast ramifications for human health. The system would be much more nimble at treating viral outbreaks than slow-moving vaccines and could play a crucial role in halting the debilitating infection that affects 3.5 million people in the U.S., according to the Centers for Disease Control and Prevention.



GOT HIGH-QUALITY MILK?

Nothing is quite as satisfying as a tall, cold glass of milk, but odd flavors can be off-putting to consumers.

Researchers at Virginia Tech have traced what could be one indicator of contamination when milk’s flavor profile turns sour — too much iron in cows’ water sources.

A collaborative research effort involving the departments of dairy science, food science and technology, biochemistry, and civil and environmental engineering discovered that iron in bovine water sources was causing oxidized flavors, degraded milk proteins, and general poor stability of milk products. High iron content also decreased the cow’s ability to efficiently process some types of nutrients, which decreases production levels and makes the animals susceptible to a host of

other health issues including mastitis and other bacterial infections.

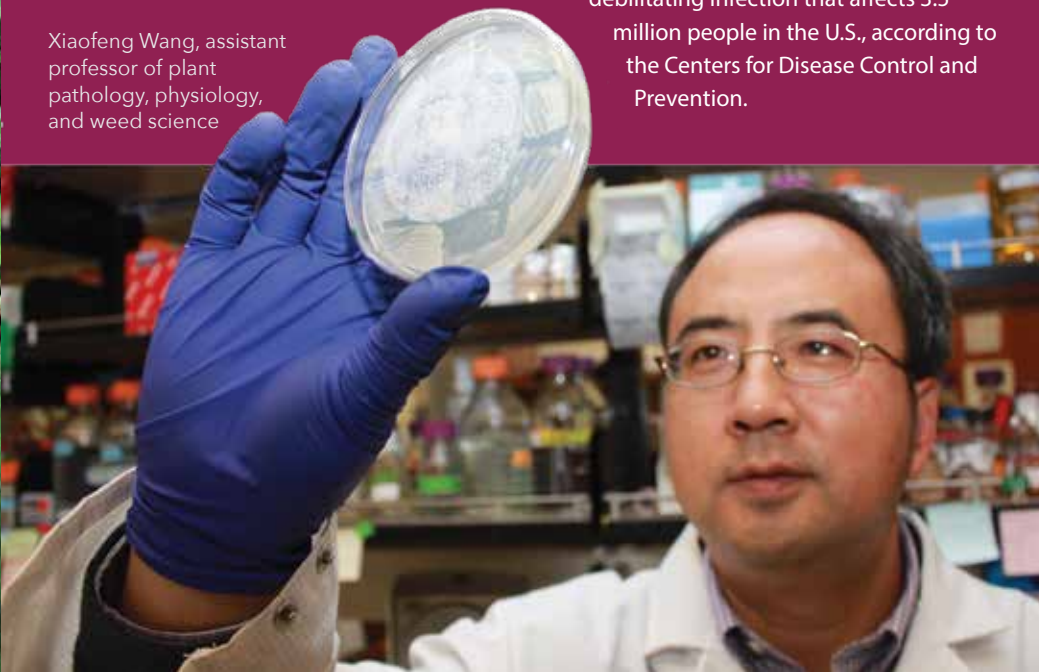
“We found that when iron was present in the water or we added iron, we got a flavor profile that was less than ideal,” said Susan Duncan, professor of food science and technology and one of the lead authors in the iron study.

“While producers may not see the effects of iron in their milk quality immediately, over time this could pose a problem for producers who might notice a decline in quality and sales for no apparent reason.”

More than 80 percent of milk is water, and dairy cows drink about 100 liters of water each day to produce milk.

The amount of iron needed to contaminate milk was as low as 2 milligrams per liter.

“This study uncovered what could be a new baseline recommendation for producers who will likely want to test their water sources and collection and transportation equipment to ensure the iron levels are not too high from any of their sources,” Duncan said.



Interns gain experience while serving the community

Each summer, Virginia Cooperative Extension offers more than 40 college students and recent graduates the opportunity to work on a team that changes people's lives and betters communities.

Through the 10-week program, interns work alongside Extension faculty members gaining experience in youth development, agriculture and natural resources, and family and consumer sciences.

Thomas Vasilopoulos, a 2015 intern, spent his summer with the Extension office in Arlington County. Although he was double majoring in integrated science and technology and Spanish, he found himself doing all sorts of tasks within the office, including helping to design programs and teach children at three different schools.

"They didn't really hesitate to give me a lot of responsibilities," Vasilopoulos said. "Extension hired me to make a positive impact in this office, and that's what I wanted to do."

In the middle of the summer, the Arlington County office's 4-H agent took a new job in Kansas. Due to this transition, Vasilopoulos worked more closely with 4-H programs, acting as a stand-in agent.

"It's really great that Extension made these internships available," said Jennifer Abel, unit coordinator and family and consumer sciences agent in Arlington County. "It's very helpful for us to have some extra hands to help out during the summer."

Vasilopoulos' knowledge of the Spanish language also proved useful throughout his time in Arlington. According to Abel,

“Extension hired me to make a positive impact in this office, and that’s what I wanted to do.”

— Thomas Vasilopoulos,
2015 Extension intern

he assisted in translating documents from English to Spanish that could be used with their Hispanic clients. Vasilopoulos said he discovered his Spanish was a more marketable skill than he had anticipated.

Jordan Hoffman, a crop and soil sciences major at Virginia Tech, served as an intern in the Culpeper County office, where she learned more about the horticulture, agriculture, and 4-H fields. During her internship, Hoffman helped to promote

and make decisions for the completion of the George Washington Carver Agriculture Research Center in Culpeper County and gained networking experience.

"I think the biggest thing that my internship taught me was to be more confident in what I actually know," Hoffman said.

The internship not only provides students an opportunity to learn more about their areas

of interest, but it also allows them to get a taste of Extension and all the different ways it works with the community.

"We hope some of these students will choose to pursue a career in Extension after their experience," said Joe Hunnings, VCE's director of professional development. "Over the past few years, Extension has hired several interns as full-time agents."



Aldyn Abell, a 2015 Extension intern, spent her summer at the Extension office in Orange County. Among her numerous responsibilities, she helped plan and deliver ocean-themed lessons at 4-H Cloverbud Day Camp.

BY THE NUMBERS

Extension and Research Funding

(funding sources for FY2016)

Virginia Cooperative Extension and the Virginia Agricultural Experiment Station received

\$186.6 million

from federal, state, and local governments, as well as from grants, contracts, and other sources.



5.6% Funds from local government



37.2% State general funds



8.3% Federal capacity grants



48.9% Grants and contracts and other funds

Extension and Research Effort

(full-time-equivalent employees)

Total number of faculty and staff members for research and Extension **879 FTEs**

Extension **64%**

Virginia Agricultural Experiment Station **36%**

Location of Research and Extension Faculty

District offices **1.6%**

Virginia Tech campus **45.1%**

Agricultural Research and Extension Centers **10.4%**

4-H educational centers **2.2%**

City and county offices **40.7%**

Return on Investment

For every **\$1** invested by the state, Agency 229 generates an additional **\$1.68**.

Youth Programs

More than **214,567** Virginia youth enrolled in 4-H in 2015.

Value of Volunteers

In 2015, Virginia Cooperative Extension had **28,794** volunteers who assisted Extension staff in delivering educational programs.

They contributed **936,039** hours of service that is valued at **\$24,421,258**.*

* Based on a rate of **\$26.09** per hour, according to the Independent Sector.

Research aids in the fight against invasive species

From soybean fields to hemlocks forests, experts from the College of Agriculture and Life Sciences and Virginia Cooperative Extension are developing ways to deal with and control the hitchhikers, interlopers, and otherwise nasty pests known as invasive species.

"The top 10 pests that we deal with now are non-native, and we spend lots of money to control them," said Eric Day, an entomologist with Virginia Cooperative Extension and manager of the Insect Identification Lab in the Department of Entomology.

Meanwhile Assistant Professor Jacob Barney in the Department of Plant



Pathology, Physiology, and Weed Science, collaboratively studies another invasive species — Johnsongrass — a weed that chokes out crops on farmland because of its fast-growing and extensive root structure.

Barney will study what makes Johnsongrass a globally successful weed and use the research to establish a model for studying other weeds and how to predict invasiveness.

Another most-wanted intruder, the brown marmorated stink bug, is an annoyance to

homeowners, but the real problem is the millions of dollars in damage it causes to crops across the Mid-Atlantic region.

"We have very few agricultural commodities that this bug does not attack," said Associate Professor Tom Kuhar, an Extension entomologist.

Kuhar and his team of graduate students are studying aspects of the stink bug's biology and ecology, its insecticide efficacy, and sustainable practices for managing it in vegetable crops.

Jacob Barney, assistant professor in the Department of Plant Pathology, Physiology, and Weed Science, is just one of a team of faculty members studying invasive species and protecting Virginia producers from their destruction.

Day recently returned from Berks County, Pennsylvania, where a pest that attacks grapes and other stone fruit crops like peaches has been identified: the spotted lanternfly.

"It's a two-prong effort, identifying them and also making people aware of their presence," Day said. "Virginia Cooperative Extension and our partner organizations play a large role in helping to get the word out about these invasive species so producers and the general public can control them."

For more information about our programs, visit our websites or one of our local Extension offices.

Virginia Cooperative Extension
www.ext.vt.edu

Virginia Cooperative Extension local offices
www.ext.vt.edu/offices

Virginia Agricultural Experiment Station
www.vaes.vt.edu

College of Agriculture and Life Sciences
www.cals.vt.edu

College of Natural Resources and Environment
www.cnre.vt.edu

Virginia-Maryland College of Veterinary Medicine
www.vetmed.vt.edu

Additional stories, videos, and links can be found at <http://news.cals.vt.edu/229-report>.