SmartPlants and SmartFarms for Global Food, Feed, and Fiber Security

Ozzie Abaye, Crop and Soil Environmental Sciences
Maria Balota, Plant Pathology, Physiology and Weed Science, Tidewater AREC
Aureliano Bombarely Gomez, Horticulture
Susan Clark, Horticulture
Greg Evanylo, Crop and Soil Environmental Sciences
Thomas Fox, Forest Resources and Environmental Conservation
Elizabeth Grabau, Plant Pathology, Physiology and Weed Science
David Haak, Plant Pathology, Physiology and Weed Science
Jason Holliday, Forest Resources and Environmental Conservation
Carrie Kroehler, Center for Communicating Science
Scott Lowman, Institute for Advanced Learning and Research
John McDowell, Plant Pathology, Physiology and Weed Science*
Patty Raun, School of Performing Arts, Center for Communicating Science
M.A. Saghai Maroof, Crop and Soil Environmental Sciences
David Schmale, Plant Pathology, Physiology and Weed Science
Dorothea Tholl, Biological Sciences
Wade Thomason, Crop and Soil Environmental Sciences
Pratap Tokekar, Bradley Department of Electrical and Computer Science
Richard Veilleux, Horticulture*
Boris Vinatzer, Plant Pathology, Physiology and Weed Science
James Westwood, Plant Pathology, Physiology and Weed Science
Randolph Wynne, Forest Resources and Environmental Conservation
Bingyu Zhao, Horticulture

*co-leads
SmartPlants and SmartFarms for Global Food, Feed, and Fiber Security

**Vision Statement**: Meeting the food, feed, and fiber needs of a growing world population represents one of the signature challenges of this century. The UN FAO estimates that food production alone must increase by 70 percent by 2050 to meet the needs of a projected nine billion people. Demand will also increase for livestock feed, biofuel feedstocks, fiber for paper products, and construction materials. Meeting these demands will require implementation of advanced technologies, sustainable management of natural resources, and coordination of political forces. We must think beyond the boundaries of traditional agriculture, to integrate breakthroughs in plant science, engineering, environmental sciences, and other disciplines.

The first component of our vision is **SmartPlants**, in which crops, and their associated microbes, are designed to optimize yields under different stress situations and environmental conditions (Figures 1 & 3 in Appendix 2). We will conduct fundamental research on genotype-environment interactions, integrated with translational research in crop breeding and biodesign. These efforts will exploit cutting edge technologies such as gene editing, genetic selection, genomic breeding, and engineering of the plant microbiome. Our goal is to develop crop varieties that are productive in agro-ecosystems compromized by climate disruption, pest, disease and weed pressures, loss of pollinators, reduced soil fertility, nutrient loss, and salinization.

Equal in importance to resilient crops are innovations in precision agriculture and management of soil and water resources to reduce pollution and enhance ecological health (agriculture accounts for 30% of greenhouse gas emissions and 70% of all freshwater use). Thus, the second component of our vision is the “**SmartFarm**”. This is the farm of the future—efficient, productive, sustainable, and automated (Figure 2). Irrigation systems will harvest and deliver appropriate amounts of water to the right areas of the farm at the right time. Coordinated unmanned robots on the ground (tractors) and in the air (drones) will gather data on plant health and developmental status that informs targeted, automated delivery of pesticides/fertilizers and enables optimal harvest schedules. Turbines will harvest wind energy, and power meteorological sensors to forecast weather and the onset of potentially devastating crop diseases. Farm data will be stored and accessed through the cloud. Big data techniques will transform the raw data into actionable intelligence which will be made available to stakeholders on mobile devices, anywhere, anytime. This paradigm can be extended to SmartForests and into urban areas, where crops will be grown in close proximity to local markets. SmartGreenhouses and SmartRoofs will functionalize the roofs of buildings. Architects and civil engineers will work closely with basic and applied plant and environmental scientists to create opportunities for aesthetic, yet purposeful, farms, structures, and facilities to invent the future of agriculture.

Many of the technologies needed to realize the SmartPlant and SmartFarm components already exist, but have not been sufficiently developed or integrated. We propose to develop a world-class research infrastructure, on and off campus, to incorporate cutting-edge technology in plant phenotyping while monitoring environmental data that influence plant responses to a complex environment. This infrastructure will support bioengineering of SmartPlants and serve as a test bed for SmartFarm technology. The smart farm would provide an excellent learning facility for extension, in partnership with Virginia Cooperative Extension. An important focus will be to leverage Virginia’s diversity in climate and cropping systems in the field. For example, Virginia Tech occupies an important niche in rain-fed systems in humid subtropical and humid continental climates. In light of the expected effects of climate change and non-sustainable groundwater withdrawal levels in many irrigated areas, we will depend on rain-fed systems in humid zones, globally, to a much greater extent over the next 50 years.

The SmartPlant/SmartFarm framework will provide opportunities for students and faculty to work in interdisciplinary teams, united by the common goal of developing ecologically sound agricultural systems that emphasize long-term sustainability. We will integrate these research strengths into a reimagined curriculum that underpins the third component of our vision: VT-shaped undergraduate and graduate students equipped with a deep understanding of plant biology and its role in global production of food, feed, fiber, and fuel, through exposure to multiple disciplines that include societal issues such as the role of women in development; food quality assessment; climate change; and population displacement (Figure 4). Students will develop new knowledge and transformative solutions around real-world agri-food systems that are sustainable and resilient.
SmartPlants and SmartFarms for Global Food, Feed, and Fiber Security

Relevance: Meeting the increasing global demand for agricultural productivity is a complex problem that crosses the nexus of natural and human systems and relates directly to the nine “critical problems” referenced in the Global Systems Science description (http://provost.vt.edu/destination-areas/da-global-systems.html). As a land grant university, VT houses internationally recognized disciplinary expertise in agronomy, soil science, forestry, genomics, molecular biology, biochemistry, plant breeding, entomology, ecology, plant pathology, biological systems engineering, mechanical engineering, remote sensing, computer science, modeling, and bioinformatics. Maintaining and connecting this expertise is critical for realizing our concept. Our research community is interactive, highly cohesive, and attuned to the power of interdisciplinary approaches, as exemplified by our participation in several IGEPs (Figures 1 and 4). Additional cornerstones include the new School of Plant and Environmental Sciences in CALS that combines the three major departments associated with crop production, along with the CNRE strengths in Geospatial and Environmental analysis and agro-forestry. Our faculty are actively developing partnerships that extend VT boundaries: For example, a new partnership in CALS brings VT-Engage and the Virginia Tech Catawba Sustainability Center (CSC) to develop the CSC as an effective resource for the research, development, teaching, and implementation of sustainable practices. Another example is the Research Extension/Education and Experiential Learning (REEL) fellowship program, recently funded by the USDA, that provides an exciting new model to link on-campus and AREC faculty to mentor undergraduates in Translational Plant Science.

Despite the existing networks at Virginia Tech, additional connections are necessary to realize our vision. Thus, a major priority for the upcoming development phase is to conduct a gap analysis that encompasses faculty expertise, research infrastructure, and curriculum, to identify synergistic collaborations, make the necessary connections, and prioritize the most promising foci. This will be undertaken in close partnership with the relevant programs at VT, including but not limited to Colleges, Institutes, Destination Areas, and Strategic Growth Areas (Figure 1). For example, we are already reaching out to VT ARECs to identify interest and capacity for the SmartFarm concept. ICTAS and the IIHCC will be engaged for developing sensors and robotics, and BI and DADS will be engaged to develop the ag-informatics component that will support big data integration, analysis, and decision making. The Virginia Cooperative Extension Service is an obvious partner, particularly for the student training component in applied agricultural concepts and broader impacts outreach to enhance both VCE’s and VT’s community engagement. VT’s presence in the National Capitol Region (NCR) will be leveraged to facilitate interaction with relevant government agencies and industry. We will also reach out to VT MANRRS and MAOP to diversify the Agriculture, Natural Resources, and Life Sciences workforce.

External partnerships will be another key to our success. We will focus our initial efforts on three fronts: First, we will explore partnerships with other land-grant universities which are developing complementary programs. The second front is to engage the agricultural industry to explore mutually beneficial partnerships such as research collaborations and student training. The third front is international: Our faculty have been highly engaged in research, teaching, outreach and extension in Africa, Asia, and South and Central America to enable people throughout the world to become more food secure. We will partner with CALS Office of International Programs to expand our global footprint as a way to attract students and increase research opportunities to meet the world’s demand for safe, nutritious, and sustainably produced food, feed and fiber.

Funding the three components of our vision is an obvious challenge. We will look to US federal agencies such as the USDA, NSF, and DOE, which support research that relates to our concept. A major priority will be to lay the groundwork for large-scale proposals (e.g., Center Grants) as we take advantage of our proximity to the Capitol Region to engage with agency leaders. The agricultural industry has provided substantial support for many of our programs in the past, and we will further engage with industry representatives to identify areas of mutual interest. We will reach out to the VT development office to identify philanthropic opportunities (e.g., supporting student training programs, naming a SmartFarm facility, etc.).

Curriculum Opportunities: One of the most exciting impacts of our concept is the potential for developing new education/training models to align our students with the changing needs of the agriculture industry. Since 2005, the Plant and Soil Science field has grown by nearly 20%, adding new jobs every year since 2001. Market demand for plant scientists and related professionals is projected to have sustained 15% growth to 2020 and beyond. The six largest life science companies project growth in their agricultural scientists’ ranks
with 84% of hires needed in the disciplines of “plant sciences, plant breeding/genetics, and plant protection.”

We envision VT-shaped graduate and undergraduate students in which disciplinary depth will complement breadth in social/policy aspects (gender, race, and economic equity) and experiential learning experiences that link the human sociocultural, environmental and economic dimensions into the SmartFarm concept. We will train students with skills valued in the Ag sector, including systems thinking and big data analytics, well-developed communication and teamwork. Moreover, the students will gain understanding of systems that feed the human population that includes farming, food processing, distribution, consumption, recycling, and their supportive technologies. Graduate student training will leverage connections to relevant IGEPs (Fig. 1): Translational Plant Sciences (TPS); Genetics, Bioinformatics, and Computational Biology (GBCB); Interfaces of Global Change (IGC); Remote Sensing (RS); and the Water INTERface (WI). CALS-based opportunities to specialize as Graduate Teaching Scholars or Graduate Extension Scholars within this focus area will also be available. At the undergraduate level, we will work with faculty responsible for majors in Crop and Soil Environmental Sciences and Horticulture, along with those involved with current minors in the Academy of Food, Health and Sustainability [Civic Agriculture and Food Systems (CAFS, pathways), Global Food Security (GFS, pathways), and Plant Health Sciences (PHS)] to develop a Destination Area major in Crop Design and Food Security under an incipient Plant Science B.S. degree program.

**Description of Resource Needs:** A major component of our vision is to fill gaps in our current expertise. Based on our preliminary analysis we envision five “discipline-bridging” positions to be filled with DA support. We further anticipate 5-10 “discipline-strengthening” hires that will complement the hiring plans of participating colleges and departments. Table 1 outlines a preliminary list, to be refined as our planning proceeds.

To capitalize on new molecular breeding tools, we need infrastructure for evaluating crop performance under laboratory and field conditions and monitoring the environmental conditions that influence crop performance. As SPES develops, it will require design and construction of new facilities (i.e., HABBI2) sufficient to house most research laboratories along with state-of-the-art plant growth and phenotyping facilities. In the short term, we will develop prototype phenotyping chambers capable of recording plant growth and response to a wide range of environmental conditions. A second, complementary effort will focus on developing and testing field-based sensors and robotics, using facilities across the State, including Kentland Farms, the VT ARECs, and the Institute for Advanced Learning and Research (IALR) in Danville.
Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME: Azenegashe Ozzie Abaye

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor of Agronomy

EDUCATION/TRAINING

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<td>Wilson College, Pennsylvania</td>
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<td>06/1984</td>
<td>Biological Sciences</td>
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<td>Penn State</td>
<td>MSc.</td>
<td>05/1987</td>
<td>Animal and Dairy Science</td>
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<tr>
<td>Virginia Tech</td>
<td>Ph.D.</td>
<td>05/1992</td>
<td>Agronomy</td>
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A. Personal Statement

I have 25 years of both domestic and international experience closely related to the proposed project. I have extensive background in global food security (teaching, research and outreach) covering not only food production but also social and cultural aspects of food production, distribution and consumption. For the last 18 years, I have been involved in international research, development and education. From 2001-2010, was involved in Rice project in West Africa – through African Food Security Initiative (AFSI)-Quality Food Production, Availability and Marketing Project. Feed resource assessment in Rift Valley, Ethiopia; Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP, Mali. Most recently, (2011-present), have been actively engaged in research/outreach and curriculum work in Senegal through USAID/Education and Research in Agriculture (ERA) in Senegal. The goal of the project is to develop human and institutional capacity in agricultural teaching, research, training, and outreach in order to serve the needs of the Senegalese public and private sectors, including farmers at all levels. Have led Study Abroad Programs (2007-2016) to Ghana, Ecuador, South Africa, British Isles, Senegal and Australia. I have taught undergraduate courses ranging from freshmen to senior/graduate levels.

B. Positions and Honors

Positions and Employment
2010-Present - Professor, Virginia Tech
1998-2010 - Associate Professor, Virginia Tech
1993-1998 - Assistant Professor, Virginia Tech

Professional Services (2006 to present)
2014 and 2015 – Served on NSF/PEER proposal Review Panel
2010-2012 - External Reviewer: US Agency for International Development Collaborative Research Support Program (Livestock CRSP) on Adapting Livestock Systems to Climate Change
2008-Present American Society of Agronomy ASA-CSSA-SSSA Ambassador program
2006 - Invited by American Society of Agronomy (ASA) to join the board members to discuss the first step in restructuring the division (ASA). Breckenridge Resort, CO. 2006
Appendix I. Biosketches

1998-Present - Faculty Advisor to Students of Agronomy, Crop Science, Soil Science, and Environmental Science
2006-Present - National Crops Judging Team Coach's Committee

Honors
2017 - University Alumni Awards for International Excellence in Outreach
2017 – American Forage and Grassland Council Vivian Allen Illumination Award
2016 Outstanding Alumna in International Programs – College of Agriculture and Life Sciences, Virginia Tech
2015 Virginia Tech Pathways Scholar
2013 Gamma Sigma Delta Honor Society of Agriculture – Teaching award
2010 - Mentor Award: Agronomy/Crop Science/Soil Science Society of America Committee on Women in Agronomy, Crops, Soils, and Environmental Sciences (WACSES)
2010 - Honorary American Future Farmers of America (FFA) Degree - National FFA Organization.
2001- University Alumnae Teaching Award.

C. Contributions to Science

The research focus, which strongly supports my extension efforts, has been on alternative crops and incorporation of animals into sustainable systems. As part of that research effort, I have trained over 17 M.S. and Ph.D. students and published relevant papers in several scientific journals:

List of books and Refereed Publications (Since 2010) *denotes graduate student


Appendix I. Biosketches


D. Additional Information

International research and outreach activities: 1999- present
• Improving the livelihood of smallholder farmers in Sub-Sahara Africa through re-vegetation, restoration, and feed supplementation: The potential role of indigenous invasive species – Mali
• African Food Security Initiative (AFSI)- Quality Food Production, Availability and Marketing Project – Mali
• Feed resource assessment and utilization of browse vegetation for small ruminants, Rift Valley - Ethiopia
• Currently (since 2011) involved in research and outreach project (USAID/Education and Research in Agriculture (ERA) in Senegal.

Relevant Courses
• CSES 2244 – Agriculture Global Food Security and Health
• CSES 3444 – World Crops and Cropping Systems
• CSES/APSC 3954 - Study Abroad South Africa and Peru (being developed))
• CSES 3954 - Study Abroad Ecuador: Service learning and food security (First summer session - 2017)
• CSES 3954 - Cultural immersion through food: Study Abroad Ecuador (First summer session - 2016)
• CSES 3954 – Experiential Learning through Service Based Engagements: Impact of Human Activates and Climate Change on Fragile Ecosystems in Ecuador (First summer Session – 2015)
• ALS. 2984. Service Learning in the Developing World: First Year Experience High Impact Practice - Senegal (Winter Session 2013/2014 – Abaye and Wood)
NAME: Balota, Maria

eRA COMMONS USER NAME (credential, e.g., agency login): mbalota

POSITION TITLE: Associate Professor of Crop Physiology

EDUCATION/TRAINING

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<th>COMPLETION DATE</th>
<th>FIELD OF STUDY</th>
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<td>University of Agronomic Science and Veterinary</td>
<td>B.S</td>
<td>05/1982</td>
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<tr>
<td>Medicine, Bucharest, Romania</td>
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<tr>
<td>University of Bucharest, Romania</td>
<td>Ph.D.</td>
<td>05/1997</td>
<td>Crop Physiology</td>
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<tr>
<td>Texas A&amp;M University</td>
<td>Postdoctoral</td>
<td>01/2000</td>
<td>Crop Physiology</td>
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A. Personal Statement

My long-term responsibility is to increase crop profitability and environmental sustainability, a CALS key initiative, through research projects and extension activities. To achieve this goal, each year I develop research programs derived from the regional agricultural needs through direct interaction with growers and other stakeholders. My program is aimed at maximizing production and resources use, and minimizing environmental risks through applied and basic field research. Selection of high yielding cultivars with improved water and nitrogen use efficiency, drought tolerance, and better-suited crops and cropping systems for the Commonwealth are my main targets. Since I work directly with plant breeders at Virginia Tech and other land-grant universities through the country, one of my major objectives is to develop high throughput phenotyping tools for plant variety selection. This will enable genomic discoveries faster implementation in breeding and, ultimately, improved agricultural production. Exploring the new technologies such as unmanned aircraft systems (UAS) I envision as the vehicle towards achieving faster and with better results my main goals.

B. Positions and Honors

Positions and Employment

2001-2005 Assistant Res. Scientist, Texas A&M University
2005-2008 Associate Res. Scientist, Texas A&M University
2008-2014 Assistant Professor, PPWS Department, Virginia Tech
2014- Associate Professor, PPWS Department, Virginia Tech

Other Experience and Professional Memberships

2000- Member, Crop Science Society of America (CSSA)
2000- Member, American Society of Agronomy
2009- Member, American Peanut Research and Education Society (APRES)
2010- Organizer and co-organizer of several symposia at the CSSA annual meetings
2010- APRES Joe Sugg Graduate Student Award Committee, member
2011 Chair, Plant Phys. And Metabolism Division of CSSA
2012 USAID Middle East Regional Cooperation, review panelist
2012 APRES Technical Committee, chair
2014- Associate Editor, Peanut Science
2017- Board Representatives, Plant Phys. and Metabolism Division of CSSA
2017- APRES Bailey Award Committee, member
Appendix I. Biosketches

C. Contribution to Science

Little is known about the effects of short periods of drought on crop production in Virginia and Carolinas where irrigation is available on only 10% of the cropland. My research documented big impact of short droughts on peanut production and identified peanut, wheat and sorghum varieties with better yields under these regional conditions. For example, my program released peanut line ‘GP-VT NC 01’ after contributing to the release of line ‘GP-NC WS 17’; both lines have improved tolerance to water deficit and heat stress. We have shown that UAS and remote sensing technologies could be successfully employed to phenotype stress and yield, and select more productive varieties under the specific environmental conditions of this region.

Appendix I. Biosketches


D. Additional Information: Research Support and/or Scholastic Performance

**Ongoing Research Support**

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<tr>
<th>Grant ID</th>
<th>PI</th>
<th>Start Date</th>
<th>End Date</th>
<th>Title</th>
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<td>NIFA-CARE 2016-08666</td>
<td>Balota (PI)</td>
<td>04/01/17</td>
<td>03/31/20</td>
<td>An Integrated Approach to Improve Drought Tolerance of Peanut</td>
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<td>The goal of this study is to provide short-time solutions for farmers relative to drought. Role: PI</td>
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<td>NIFA-AFRI 2016-10548</td>
<td>Balota (PI)</td>
<td>03/01/17</td>
<td>02/29/20</td>
<td>Development of Advanced Physiological and Molecular Markers for Stress Tolerance in Peanut</td>
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<td>The goal of this study is to develop high throughput phenotyping tools for peanut selection for drought tolerance. Role: PI</td>
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<td>NIFA-BRDI 2016-09953</td>
<td>Balota (VT-PI)</td>
<td>09/01/16</td>
<td>08/31/19</td>
<td>Mid-Atlantic Biomass Sorghum Collaborative</td>
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<td>The goal of this study is to investigate the suitability of bio-energy sorghum production in Virginia and Carolinas. Role: VT-PI (project director is Paul Ulanch, North Carolina Biotech)</td>
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BIOGRAPHICAL SKETCH

NAME: Bombarely Gomez, Aureliano

eRA COMMONS USER NAME (credential, e.g., agency login): aubombarely

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING

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<td>B.S</td>
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<tr>
<td>University of Malaga, Spain</td>
<td>Ph.D.</td>
<td>12/2007</td>
<td>Biochemistry and Molecular Biology</td>
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<tr>
<td>Boyce Thompson Institute, Ithaca, NY, USA</td>
<td>Postdoctoral</td>
<td>12/2012</td>
<td>Genomics and Bioinformatics</td>
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<tr>
<td>Cornell University, Ithaca, NY, USA</td>
<td>Research Associate</td>
<td>07/2014</td>
<td>Plant Systematics</td>
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A. Personal Statement

My work in the Department of Horticulture at Virginia Tech is focused in the generation, processing and translation of this information in a scientific framework (translational genomics) that can be applied in fields such as plant breeding and evolutionary biology. At the same time, I develop new bioinformatics tools that can be used for genomic analysis. My research is focused on the study of the genome evolution under plant domestication, but at the same time to understand how the phenotypic diversity is produced and how this knowledge can be applied to develop new crops able to adapt to the new changing environmental conditions. My fields of expertise complement other member of the team supporting the proposal with my bioinformatics experience, not only at the research level but also in the development of classes to add this component to the student curriculum. I am confident that my contribution to the proposed project

B. Positions and Honors

Positions and Employment
2014 - Assistant Professor, Department of Horticulture, Virginia Tech, Blacksburg, VA

Other Experience and Professional Memberships
2008- Member, American Society of Plant Biology
2017- Editor, Genes, section Plant Genetics and Genomics
2015 NSF Peer Review Committee: Plant Genome Research Program, ad hoc reviewer

C. Contribution to Science

1. My first contribution to the fields of genomics and bioinformatics are related with the use of methodologies such as microarrays, EST Sanger and 454 sequencing to the study of the transcriptomic landscape of polyploidy crops such as strawberry (8x) and tobacco (4x). Polyploidy can be a complex problem from the point of view of transcriptome analysis so I developed a bioinformatics pipeline to identify the origin of the expressed gene for tobacco.

2. In addition to the contributions described above, I was a main component in the development of the SGN genomic database. One of the main problems in the genomic field is the management and sharing of the data produced by the scientific community. Genomic databases such as TAIR, Gramene, Soybase, SGN and GDR play an essential role making not only publicly available the knowledge produced by the community but also reusable.

3. Finally on of my major contributions to the field of plant genomics has been the development several draft genome extensively used by the plant scientific community. A draft genome can reveal important information about the evolutionary history of a species, genus and family (e.g. whole genome triplication in Solanaceae) but at the same time can be an important tool for plant breeding (e.g. tomato genome) and phytopathology (e.g. N. benthamiana genome).
Appendix I. Biosketches


D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support
George Mason University, Mason 4-VA Research Grant Schwebach (PI) 05/01/17-04/30/18
Computational Analysis of Microbial Evolution: Building Scaffolds to Teach Next-Generation-Sequencing in the Biology Department, Bioinformatics Concentration
The goal of this project is to create a scaffold (6 or more strategic, multi-day lesson modules) for teaching Next-Generation Sequencing (NGS) in Mason’s new Biology Department’s Bioinformatics Concentration. The 19-credit concentration is now approved by the Biology Department, and is now being reviewed by curriculum committees (3 different committees) in Mason’s College of Science (COS), after favorable preliminary review in COS. My role is to collaborate with Prof. Schwebach to develop these modules.
PI: Co-PI/Collaborator

Harvard Arboretum Genomics Initiative and Sequencing Award Bombarely (PI) 05/01/17-09/31/17
Sequencing the Asimina triloba (L.) Dun. (Annonaceae) genome
The goal of this project is the sequencing and analysis of the species Asimina triloba (paw paw) from the Annonaceae family. Sequencing the pawpaw, the only species of the family adapted to temperate climates, will allow the characterization of genes involved in the adaptation to cold environmental conditions and provide additional tools to facilitate molecular breeding in this underutilized fruit crop.
Role: PI

European Commission, H2020-EU.1.3.3, RISE: 690946 Coimbra (PI) 05/01/16-04/30/20
SeedSex
The goal of this project is to reinforce the international scientific network working in the plant sexual development. Because the network is created based in complementary expertise of different members of the partnership, I am contributing with the expertise in bioinformatics and plant evolutionary genomics.
Role: External Partner
NAME: Susan F. Clark
eRA COMMONS USER NAME (credential, e.g., agency login): clark55
POSITION TITLE: Associate Professor of Horticulture and Director, Civic Agriculture and Food Systems

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

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<td>Commission on Dietetics Accreditation</td>
<td>R.D.</td>
<td>6/79</td>
<td>Registered Dietitian</td>
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A. Personal Statement
I have the expertise, leadership, training, and motivation necessary to carry out the proposed research and interdisciplinary curriculum development and assessment. My broad background in human nutrition and biochemistry, sustainable or civic agriculture and food systems along with expertise in pedagogy and curriculum design and assessment, collective impact, collaborative decision-making, community based participatory research (CBPR), ethnographic and survey research align with the proposed project. My recent research scholarship includes qualitative data analysis on the complexities inherent within agri-food systems specific to community food security within rural Appalachia Virginia, North Carolina and West Virginia. My other scholarship also includes assessment of student learning in the sustainable agriculture and food systems curriculum. As PI or co-Investigator on several university and USDA-NIFA-AFRI-funded grants, I have developed interdisciplinary, experiential-based sustainable agriculture and food systems curriculum, and developed methodology for community-based food security assessments. By using a collaborative decision-making governance framework, we engaged and built relationships and trust with diverse community stakeholders, which allowed us to recruit, and track participants over time. In addition, I have successfully administered many interdisciplinary projects (e.g. staffing, research protections, budget), collaborated with other researchers, and produced peer-reviewed publications from each project. Given these previous experiences, I value the importance of developing effective communication among project members and of cultivating collaborative governance and decision-making processes to ensure successful management of any research and curriculum plan, timeline, and budget. The current proposal builds logically on my prior work through the lens of holistic systems thinking related to agriculture and food to effectively navigate complexity and address the world’s most pressing, critical problems that are facing agriculture and food through effective transdisciplinary engagement. Several publications resulting from my most recent funding follow.

Appendix I. Biosketches

B. Positions and Honors

**Positions and Employment**

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<th>Year</th>
<th>Position</th>
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<tr>
<td>2005 –</td>
<td>Associate Professor/Director, Civic Agriculture and Food Systems</td>
<td>Department of Horticulture and Dietetics</td>
<td>Blacksburg, VA</td>
</tr>
<tr>
<td>2005-12</td>
<td>Dietetics Director, Human Nutrition, Foods and Exercise</td>
<td>Virginia Tech</td>
<td>Blacksburg, VA</td>
</tr>
<tr>
<td>1996-2005</td>
<td>Associate Professor, Graduate Dietetic Internship Coordinator</td>
<td>Radford University</td>
<td>Radford, VA</td>
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<tr>
<td>1995-</td>
<td>Instructor, Department of Human Nutrition, Foods and Exercise</td>
<td>Virginia Tech</td>
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<tr>
<td>1991-94</td>
<td>Assistant Professor, Department of Biology/Chemistry</td>
<td>Hollins College</td>
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<td>1991</td>
<td>Instructor, Department of Chemistry</td>
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<td>1981-84</td>
<td>Clinical Research Faculty, Department of Surgery</td>
<td>University of Michigan Medical School</td>
<td>Ann Arbor, Michigan</td>
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<tr>
<td>1979-84</td>
<td>Clinical Instructor, Department of Clinical Nutrition</td>
<td>University of Kentucky</td>
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**Other Experience and Professional Memberships**

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<td>1979 –</td>
<td>Member, Academy Nutrition and Dietetic (AND)</td>
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<tr>
<td>1990 –</td>
<td>Member, Academy Nutrition and Dietetic – Hunger &amp; Environmental Nutrition Practice Group</td>
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<tr>
<td>2005 –</td>
<td>Member, North America Colleges and Teachers of Agriculture and Journal Reviewer</td>
<td></td>
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<td>2010 –12</td>
<td>USDA Higher Education Challenge Grant Peer Review Committee</td>
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<td>2010 –</td>
<td>Member, Agriculture, Food, and Human Values Society</td>
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<tr>
<td>2010 –</td>
<td>Member, Sustainable Agricultural Education Association</td>
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<tr>
<td>2015 –</td>
<td>Executive Board Member, Local Education Agriculture Project</td>
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**Honors**

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<tr>
<td>2009–10</td>
<td>Favorite Faculty Award</td>
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<td>2010</td>
<td>Research Scholar of the Week</td>
<td>Virginia Tech</td>
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<td>2010</td>
<td>Agriculture Women of the Year</td>
<td>Sigma Alpha, Pi Chapter, Virginia Tech</td>
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<td>2011</td>
<td>Scholar of the Week</td>
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<td>2011</td>
<td>University Exemplary Award</td>
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<tr>
<td>2012</td>
<td>Virginia Tech’s University Nominee</td>
<td>U.S. Professor of the Year</td>
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<td>2012</td>
<td>Woman in International Development Award</td>
<td>Heifer International</td>
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<td>2015-16</td>
<td>Beyond Boundaries. Student Working Group</td>
<td>Virginia Tech</td>
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<td>2015 –</td>
<td>Sustainability Institute Fellow</td>
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<td>2015 –17</td>
<td>Pathways Scholar</td>
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<td>2017</td>
<td>Teacher of the Week</td>
<td>Virginia Tech</td>
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**C. Contributions to Science (Recent Relevant Selections)**


C. Contributions to Science (continued)


OTHER REPORTS & MEDIA


3. Heifer International: Sustainable Community Development and Study Abroad http://www.heifer.org/blog/2012/05/experiential-learning-for-va-tech-students-in-honduras.html

D. Additional Information: Research Support and/or Scholastic Performance

USDA, NIFA-AFRI 2011-68004-30079 Clark (PI) 03/01/11-02/28/17
Enhancing Food Security By Cultivating Resilient Food Systems & Communities: Place-Based Foodshed Analysis From Research To Community Practice, (Appalachian Foodshed Project).
Role: PI

USDA, NIFA-AFRI 2009-00879 Clark (PI) 08/01/09 – 07/31/13
Role: PI

Virginia Cooperative Extension Community Viability Grant (pending)
Community Innovation and Capacity Building for Regional Food Systems Change: An Appalachian Foodshed Partnership (AFP) Initiative.
Role: CoPI

Pathways Delivery Grant, Virginia Tech Clark (PI) 03/15/16 – 02/28/18
Civic Agriculture and Food Systems Pathways Minor.
Role: PI

Virginia Cooperative Extension Community Viability Grant 09/01/15 – 10/01/16
Appendix I. Biosketches

Creating a Regional Food Systems Roadmap: Building a multi-state network and leveraging area resources.
Role: CoPI

Virginia Cooperative Extension Community Viability Grant   Clark (PI)   2012-2013
Strengthening Rural Communities through the Appalachian Foodshed Project.
Role: PI

College of Agriculture and Life Sciences Competitive Grant, VA Tech   2012-2013
Developing and Integrating a Service-learning Course with the VCE Master Food Volunteer Program:
Promoting Safe Preservation, Handling, and Serving of Foods to Virginia Citizens.
Role: CoPI

College Agriculture & Life Sciences Grant, Virginia Tech   2012-2014
Building Capacity for an Agrarian Living Learning Community.
Role: CoPI

College Agriculture & Life Sciences Grant, Virginia Tech   Clark (PI)   2010 –2011
Transforming Agricultural and Life Science Education: Exploring the Role of Collaborative-based
Curriculum and Instruction to Enhance Interdisciplinary Teaching and Learning.
Role: PI

Center for Excellence in Undergraduate Teaching Grant, Virginias Tech   Clark (PI)   2008-2009
Faculty and Students Collaborate Using E-Portfolio Design to Enhance the Scholarship of Student
Learning.
Role: PI

College of Agriculture and Life Sciences Grant, Virginia Tech   Clark (PI)   2008- 2009
Educating Tomorrow’s Agents of Change Through an Innovative Curriculum Initiative on Sustainable
Agriculture and Food Systems
Role: PI

Teaching and Assessment Grant, Virginia Tech   Clark (PI)   2007-2008
Multidisciplinary Student Service Learning; Assessment of Student Outcome Learning (SOLs) Through e-
Portfolio Technology
Role: PI
Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME: Evanylo, Gregory Kevin

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor

EDUCATION/TRAINING

<table>
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<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
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<tr>
<td>University of Connecticut</td>
<td>B.A.</td>
<td>05/1975</td>
<td>Biology</td>
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<td>University of Massachusetts</td>
<td>M.S.</td>
<td>05/1978</td>
<td>Plant and Soil Sciences</td>
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<td>University of Georgia</td>
<td>Ph.D.</td>
<td>12/1982</td>
<td>Agronomy</td>
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A. Personal Statement

I have had the training and possess the leadership skills and expertise to successfully conduct the proposed research. My broad background in natural and disturbed soils with specific training and expertise in management of soils to assess and improve their ecosystem services will be necessary to ensure that plant-based food production is sustainable (i.e., high yielding, nutritious crops while maintaining or enhancing the natural resource base and preventing deleterious environmental impacts). My research includes discovering the chemical, physical, and biological effects of soil amendments, including the chemistry, bioavailability, fate and transport of byproduct constituents, such as carbon, nutrients, and heavy metals. As PI or co-Investigator on USDA-SARE-funded grants, I demonstrated the beneficial effects of soil amendments (esp., compost) on soil health and the resulting value to plant production and air and water quality. My work on both natural and disturbed soils will enable me to address a wide range of soil limitations encountered globally in both rural and urban settings. I successfully administered (i.e., staffing, budget, reporting), collaborated with other researchers, and produced peer-reviewed publications from each project. I am, therefore, aware of the importance of frequent communication among project members and of developing and adhering to a realistic research plan, timeline, and budget. The current application includes critical aspects of my previous work.

B. Positions and Honors

**Positions and Employment**
- 1984-1989 Assistant Professor, Eastern Shore Agricultural Experiment Station, Virginia Tech, Painter, VA.
- 1989-1992 Assistant Professor, Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA.
- 1992-2001 Associate Professor, Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA.
- 2001- Professor, Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA.

**Other Experience and Professional Memberships**
- 1978- Member, Soil Science Society of America
- 1979- Member, American Society of Agronomy
- 1987-97 Member, Soil and Water Conservation Society
- 1992- United States Composting Council
- 2000- Water Environment Federation

**Honors**
- 2011 “Development and Use of the Mid Atlantic Nutrient Management Handbook,” was selected as a Project of Excellence by the USDA-NIFA National Water Program.
- 2014 Fellow, American Society of Agronomy
- 2014 Fellow, Soil Science Society of America

C. Contributions to Science

1. My earlier publications on soil health addressed the management of cover crops on soil productivity and environmental quality. These studies show how cover crops can recycle nutrients and provide organic matter under the proper management practices, including timing of cover crop kill and fertilization practices.

2. For most of the past two decades, my focus has been on understanding the chemistry, bioavailability, and fate and transport of constituents (i.e., C, N, P, and heavy metals) in organic byproducts employed to improve the quality of soil and the production of crops.
Appendix I. Biosketches


D. Additional Information: Research Support

Ongoing Research Support
Water Environment Research Foundation and the Metropolitan Washington Council of Governments
July 2013-June 2018
Johnston (PI), Brandt (Co-PI), Evanylo (Co-PI), and Toffey (Co-PI)
Product quality, demonstration, and marketing for high quality biosolids.
The goal of this study is to develop biosolids-based soil amendments for agricultural use and assess their agronomic and environmental attributes.
NAME: Fox, Thomas R.

POSITION TITLE: The Honorable Garland Gray Professor of Forestry

EDUCATION/TRAINING

<table>
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<td>University of Maine</td>
<td>B.S.</td>
<td>05/1980</td>
<td>Forestry</td>
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<tr>
<td>Virginia Tech</td>
<td>M.S.</td>
<td>05/1984</td>
<td>Forestry</td>
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<tr>
<td>University of Florida</td>
<td>Ph.D.</td>
<td>12/1989</td>
<td>Soil Science</td>
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A. Personal Statement

Maintaining healthy and productive forests is essential to the environmental, social, and economic wellbeing of the planet. I have dedicated my career to this goal and have developed a research, teaching and outreach program that is working to develop sustainable management practices for forest ecosystems. I joined the faculty in the College of Natural Resources and Environment at Virginia Tech in 2000 after spending 15 years as an industry research scientist working in forest ecosystems throughout the United States. At Virginia Tech, I have built an internationally recognized research and outreach program dedicated to the sustainable management of forest resources. The specific goal of my research is to increase the productivity, value and sustainability of planted forests and develop the tools needed to implement precision silvicultural practices in the field. My work has been conducted in the southeastern U.S. and throughout Latin America. I am dedicated to the comprehensive land grant mission of Virginia Tech. I teach both undergraduate and graduate classes in silviculture, forest soils and ecophysiology. I have served as the major professor for more than 30 graduate students and have supervised 6 Post Docs. I have published more than 100 papers in refereed journals and 10 book chapters. I have been the PI or Co-PI on grants and contracts exceeding $38 million from federal agencies such as NSF, NASA, USDA NIFA, DOE, USFS as well as significant funding from private industry in both the US and Latin America.

B. Positions and Honors

Positions and Employment

1981-1983 Graduate Research Assistant, Virginia Tech, Blacksburg, VA
1983-1984 Research Associate, North Carolina State University, Raleigh, NC
1985-1989 Graduate Research Assistant, University of Florida, Gainesville, FL
1989-2000 Manager of Research, Rayonier Inc., Yulee, FL
2000-2009 Associate Professor of Forestry, Virginia Tech, Blacksburg, VA
2009-2014 Professor of Forestry, Virginia Tech, Blacksburg, VA
2010-2011 Fulbright Scholar & Visiting Professor, Pontificia Universidad Catolica de Chile
2014-2017 The Honorable Garland Gray Professor of Forestry, Virginia Tech, Blacksburg

Other Experience and Professional Memberships

1976- Member, Society of American Foresters
1997-1998 Chari, Forest Soils working Group, Society of American Foresters
Appendix I. Biosketches

1982- Member, Soil Science Society of America
2013- Board of Directors, Soil Science Society of America
2011-2012 Chair, Reorganization Task Force, Soil Science Society of America
2010 Chair, Forest Soils Division, Soil Science Society of America
2008-2011 Board of Directors, Virginia Forestry Association
2013- Planted Forest Task Force, International Union of Forestry Research
2013- Chair Forest Soils Working Group, International Union of Forestry Research
Associate Editor-Forest Science
Associate Editor-Soil Science Society of America Journal
Associate Editor-Southern Journal of Applied Forestry
Associate Editor-New Forests
Editorial Board-Revista Bosque

Honors
2016 USDA National Partnership Award for Research and Extension
2016 University of Maine, School of Forest Resources Distinguished Alumnus
2014 Virginia Tech Scholar of the Week
2013 Society of American Forester Barrington Moore Award for Biological Research
2012 Fellow Society of American Foresters
2012 Fellow Soil Science Society of America
2010 Fulbright Scholar
2007 Virginia Tech Scholar of the Week
2006 Virginia Tech College of Natural Resources Award for Outreach Excellence
2004 Soil Science Society of America Service Award
2000 NCASI Outstanding Service Award
1998 Society of American Foresters Stephen Spurr Award for Research
1998 Rayonier Achievement Award

C. Contribution to Science
1. My early research was in soil chemistry and focused on ligand exchange reactions between phosphorus, aluminum and organic matter in soils. This addressed the role of low-molecular-weight organic anions such as oxalate as a mechanism where tree roots modify the rhizosphere to increase the availability of phosphorus. I have continued this work off and on throughout my career. This work led to a number of publications


2. My recent work in soils has focused on increasing fertilizer use efficiency in forest ecosystems. The goal is to reduce the loss of nitrogen following forest fertilization. Most of this work has been conducted using $^{15}$N labeled nitrogen fertilizers.


3. The focus of the majority of my current is on silviculture of pine plantations and the impact of management of forest growth and productivity. This includes work on the interactions among genetic improvement, fertilization, and competition control. This work has demonstrated the potential to significantly increase productivity of planted forests which permits landowners to grow more wood on fewer acres which helps to contribute to sustainable forestry. Examples of publications on this topic include the following:


Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME: Elizabeth A. Grabau

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE (if applicable)</th>
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<th>FIELD OF STUDY</th>
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<tr>
<td>Purdue University</td>
<td>B.S.</td>
<td>1974</td>
<td>Biology</td>
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<td>Cold Spring Harbor (summer course)</td>
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<td>1982</td>
<td>Plant Molecular Biology</td>
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A. Personal Statement

My goals and activities in research, teaching and extension over my career have included projects in molecular crop improvement for enhanced nutritional content and availability, disease resistance, food security and sustainability. I have worked collaboratively to improve phosphorus availability in soybeans to reduce phosphorus pollution (low phytate soybeans), enhance vitamin content in peanuts (folate biofortification), study drought tolerance in peanuts (via microRNA regulation) and develop disease resistant peanuts to improve yields and reduce fungicide use (resistance to Sclerotinia blight). I have taught numerous graduate and undergraduate courses in molecular biology and biotechnology, as well as outreach to high school teachers and students, and Extension agents. I have been involved in the regulatory process for bioengineered products through an international exchange (funded by USDA’s Foreign Agricultural Service) designed to facilitate harmonization of international bioregulatory guidelines and have made presentations in numerous venues and workshops on the bioregulatory process. I have also successfully served in an administrative role in the Department of PPWS for nearly 10 years (2006-2015).

B. Positions and Honors

1981-1987  Postdoctoral Research, Howard Hughes Medical Institute, University of Utah, Salt Lake City, UT
1987-1990  Postdoctoral Research, Dept. of Agronomy and Plant Genetics, University of Minnesota, St. Paul, MN
1990-1996  Assistant Professor, Plant Pathology, Physiology and Weed Science (PPWS), Virginia Tech
1996-2007  Associate Professor, PPWS, Virginia Tech
2001-2002  Sabbatical leave at National Institutes of Health
2006-2015  Department Head, PPWS, Virginia Tech
2007-present  Professor, PPWS, Virginia Tech
2010  Sabbatical leave in Department of Agricultural Biosciences and Pest Management, Colorado State University, Ft. Colins, CO
Appendix I. Biosketches

Phi Beta Kappa, Phi Lambda Upsilon (chemistry honorary), N.I.H. Predoctoral Traineeships (1974-1981), 1980 Intra-Science Foundation Graduate Research Award in Biomedical Science, 1994 Henderson Award (PPWS Outstanding Faculty), Sigma Xi

Other Experience

- Member of Public Policy Board, American Phytopathological Society, 2013-2015
- Member of Peanut Variety Quality Evaluation Advisory Committee, 2009-present
- Presentations to national audiences on GM crops and the regulatory process
  - “Nuts and Bolts of US Regulatory Dossiers for Genetically Engineered Crops: Blight Blocker Peanut Case Study”, Special Crop Regulatory Assistance Program, APHIS, Riverdale, MD, Dec. 6-8, 2011
  - “A view from the trenches: Challenges bringing GM crops to the market place.” Invited speaker at Symposium entitled “Genetically modified crop regulations: safety net or insurmountable obstacle?” at the AAAS annual meetings in Washington, D.C., Feb. 18, 2011.
  - “Issues facing release of peanuts containing transgenic traits”. Invited speaker at Symposium on Advances in Genetics and Biotechnology at the Annual meetings of the American Peanut Research and Education Society, Oklahoma City, OK July 2008
- Grant from USDA’s Foreign Agricultural Services to hosted two Chinese exchange scholars for six weeks in summer 2013 to acquaint them with the US policies and procedures for bioregulatory approval of transgenic crops
- International Seminar Presentations
  - “Engineering Disease Resistance in Peanut: Development to Regulation”, presented in October 2013 at: Institute for Plant Protection, Chinese Academy of Agricultural Sciences, Biotechnology Research Institute, Chinese Academy of Agricultural Sciences, Dept. of Biological Sciences, Lanzhou University, Dept. of Biological Sciences, Hong Kong University

Teaching and Advising

- Molecular Biology for the Life Sciences, PPWS 5344
- Biotechnology in a Global Society, ALS 2404
- Biotechnology in Agriculture and Society, PPWS 5044
- Molecular Biology Laboratory, BIOL 4774
- Translational Plant Sciences, GRAD 5134
- Supervised 9 graduate students, mentored 7 post-doctoral scientists, 1 sr. research associate, hosted 3 visiting scientists, served on 32 additional graduate committees, supervised 22 undergraduates for independent research projects
- Instructor for an international summer workshop in Chania, Greece, July 5-16, 1999, sponsored by the American Society of Plant Biologists and the Mediterranean Agronomic Institute of Chania.

B. Contributions to Science

Selected publications representing scientific contributions in projects listed above:

Appendix I. Biosketches


D. Additional Information:

Grant proposal currently pending:
Appendix I. Biosketches

NAME: Haak, David C.

eRA COMMONS USER NAME (credential, e.g., agency login): dhaak

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING

<table>
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<tr>
<td>North Carolina State University Raleigh, NC</td>
<td>MS</td>
<td>12/2002</td>
<td>Crop Science</td>
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<tr>
<td>University of Washington Seattle, WA</td>
<td>PhD</td>
<td>06/2010</td>
<td>Biology</td>
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<tr>
<td>Indiana University Bloomington, IN</td>
<td>Postdoc</td>
<td>06/2014</td>
<td>Genomics</td>
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A. Personal Statement

My long-term research goal is to identify factors that shape plant stress responses to understand, predict, and possibly mitigate, global change impacts on both biodiversity and agriculture. In work funded by the NSF I am characterizing differential gene expression under drought and simulated herbivory across multiple species from the tomato clade. Important contributions include, developing regulatory networks describing the genomic interaction between drought and herbivory induced stresses. This work has identified 27 common genes that are differentially expressed under the combined stress, providing a small handful of candidates to test for agricultural utility. In addition, I have begun to expand his program to include epigenetic and microbiome mediated impacts on plant stress responses. An important discovery from this work has been that herbicide stress causes large scale epigenetic reprogramming, and he has identified that an important class (RC Helitron) of gene capture/moving transposable elements are activated under herbicide stress, potentially contributing to the rapid evolution of herbicide resistance. Finally, it is becoming increasingly clear that the soil and leaf microbiomes play a key role in plant stress responses and I have has been working to identify the functional microbial gene networks involved in wild chili fruit responses to pathogen attack.

B. Positions and Honors

Positions and Employment
2014-Current Assistant Professor of Plant and Microbial Genomics, Virginia Tech, Blacksburg, VA

Other Experience and Professional Memberships
2006- Member, American Association for the Advancement of Science
2008- Member, Society for the Study of Evolution
2009- Member, Ecological Society of America
2014- NSF Peer Review: Dimensions of Biodiversity

Honors
2005-2010 National Science Foundation Graduate Research Fellow
C. Contributions to Science


D. Additional Information: Research Support

USDA Recommended Westwood (PI) 05/01/2017-04/30/2020
Assessing the role of epigenetics in weed response to stress.
The goal of this study is to identify the epigenetic mechanisms weeds exploit to respond to stress.
Role: Co-PI

Jeffress Trust Recommended Haak (PI) 07/01/2017-06/30/2017
Do RNA viruses hijack host alternative splicing machinery for infections? A bioinformaticians’ view
The goal of this project is to elucidate the mechanisms through which plant viruses drive the alternative splicing machinery in host plants.
Role: PI

NSF DEB#1136707 Moyle (PI) 11/28/2012-09/30/2017
Dimensions: Integrating dimensions of Solanum biodiversity: leveraging comparative and experimental transcriptomics to understand functional responses to environmental change.
The goal of this project is to identify the molecular basis for environmental adaptation among the clade of wild tomatoes.
Role: Co-PI
BIOGRAPHICAL SKETCH

NAME: Jason Holliday

POSITION TITLE: Associate Professor

EDUCATION/TRAINING

<table>
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<td>University of Victoria</td>
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<td>University of British Columbia</td>
<td>Ph.D.</td>
<td>05/2009</td>
<td>Forestry</td>
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A. Personal Statement
I am an evolutionary geneticist interested in the causes and consequences of natural variation, primarily in the genera *Populus* (poplar), *Picea* (spruce), and *Pinus* (pine), which comprise among the most economically and ecologically important tree species in North America, and for which extensive genomic tools have been developed. I use a variety of genomic and statistical approaches to dissect the genetic architecture of complex traits, and to understand how the constraints imposed by population history may impinge on future adaptive evolution.

B. Positions and Honors

Positions and Employment
1. **Virginia Polytechnic Institute and State University**
   - Department of Forest Resources and Environmental Conservation
   - Associate Professor, 2015 – Present
   - Assistant Professor, 2009 – 2015

2. **Stanford University School of Medicine**
   - Department of Molecular Pharmacology
   - Research Assistant, 2001 – 2003

Honors
1. National Science Foundation Faculty Early Career Development (CAREER) Program grant, 2011-16.
4. Van Dusen Graduate Fellowship in Forestry, 2005.

C. Contributions to Science

Selected Publications
Appendix I. Biosketches


D. Additional Information

Selected Recent Research Support

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<th>Agency</th>
<th>Role</th>
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<tr>
<td>Identification of genes and alleles for blight resistance in <em>Castanea</em> spp</td>
<td>USDA/NIFA</td>
<td>Co-PI</td>
<td>$150,000</td>
<td>10/15 – 9/17</td>
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<td>Abiotic stress networks converging on <em>FT2</em> to control growth in <em>Populus</em></td>
<td>DOE</td>
<td>Co-PI</td>
<td>$1,430,447</td>
<td>09/14 - 08/17</td>
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<td>CAREER: Integrating whole genome association mapping and landscape genomics to understand climatic adaptation in <em>Populus</em></td>
<td>NSF</td>
<td>PI</td>
<td>$1,542,864</td>
<td>02/11-01/16</td>
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<td>Integrating research, education, and extension for enhancing southern pine climate change mitigation and adaptation</td>
<td>USDA/NIFA</td>
<td>Co-PI</td>
<td>$3,433,404</td>
<td>03/11-02/16</td>
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<td>AdapTree: Assessing the adaptive portfolio of reforestation stocks for future climates</td>
<td>Genome Canada</td>
<td>Co-PI</td>
<td>$4,662,980</td>
<td>07/11-06/14</td>
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Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME: Kroehler, Carolyn Joy

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Associate Director, Center for Communicating Science, Virginia Tech

EDUCATION/TRAINING

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<td>B.S.</td>
<td>05/1981</td>
<td>Biology; English/communications</td>
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<tr>
<td>Virginia Polytechnic Institute and State University</td>
<td>Ph.D.</td>
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<td>Biology</td>
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<td>Stony Brook University, Alan Alda Center for Communicating Science</td>
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<td>06/2015</td>
<td>Summer institute in communicating science</td>
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</table>

A. Personal Statement

My background includes a PhD in biology and many years of writing and editing, primarily to "translate" science for audiences including children, teenagers, college students, adults with no science training, and scientists. I have published scientific research reports, college textbooks, guides for the general public, and more (publications listed below represent some of the variety). Over the past several years I also have been teaching and helping to develop a graduate-level course, Communicating Science. The course uses tools from the arts—theatre improvisation games and writing exercises—to help participants learn to communicate personally, directly, spontaneously, and responsively. I co-facilitated 3 sections of the course and have now also served as solo instructor for 7 sections. In addition, I have led communicating science workshops for undergraduate students, graduate student clubs and groups, faculty, and working professionals. Over the past two years my colleague Patty Raun and I have worked to launch a new university center, the Center for Communicating Science. My goal is to use my experience and training to help people connect across differences and communicate more effectively. For this interdisciplinary project, our workshops will serve to help collaborators work well together and communicate their research effectively to stakeholders, and coursework for both undergraduate and graduate students will help produce young researchers who are effective and engaging communicators both within and across disciplines as well as to the general public.

B. Positions and Honors

Positions
1976-1977  Theatre technical assistant, Millersville State College
1978   Zoology laboratory assistant, Millersville State College
1978   Research assistant, Three Mile Island macro-invertebrate study
1981   Student teaching, high school biology and English
1981   Research assistant, U.S. Fish and Wildlife Service radiotelemetry project
1982   Laboratory technician, Virginia Polytechnic Institute and State University
1982   Biology laboratory teaching assistant, Virginia Polytechnic Institute and State University
1982-1983  Graduate research assistant, Virginia Polytechnic Institute and State University
1983-1985  National Science Foundation pre-doctoral fellow
1985-1986  Cunningham Dissertation Year Fellow
1986-1987  National Science Foundation pre-doctoral fellow
1987-1990  Information officer, Virginia Water Resources Research Center
1990-present  Freelance writer and editor
2013-2015  Guest lecturer, Virginia Tech Graduate School
2015-present  Instructor, Virginia Tech Graduate School
2016-present  Associate Director, Center for Communicating Science, Virginia Tech

Honors
National Science Foundation pre-doctoral fellow, 1983-1987
Cunningham Dissertation Year fellow, 1985-1986
The Universities Council on Water Resources Award for Public Service in Water Resources, 1990

C. Contributions to Science
    Although I presented my graduate research at meetings and published it in scholarly journals, I consider my more important contribution to science to be the work I have done to help non-scientists understand science and research. While employed by the Virginia Water Resources Research Center, I wrote and produced publications for the general public on water-related issues and traveled around the state speaking to citizen and student groups. As a textbook author, I summarize and explain sociological research for college students. In providing editing services for authors, I help them tell their stories more clearly and engagingly, whether their "stories" are aimed at the scientific community or the general public. Over the past few years, I have turned some of my attention to reviewing popular press science books for our regional newspaper and have published nearly 30 reviews. The work I am now doing to help researchers become more effective communicators is motivated by the hope that it will open conversations among scientists and non-scientists, help scientists recognize that others have areas of expertise as valuable as those developed by researchers, build relationships of trust and respect, and, as Alan Alda has said, "make the relationship between science and the public one that's close, warm, and exciting."

D. Additional Information: Research Support and/or Scholastic Performance
    I have applied for and received research fellowships from my graduate university and from the National Science Foundation. I have been employed under and involved in projects funded by the Department of Energy, the U.S. Fish and Wildlife Service, the National Science Foundation, and the Three Mile Island Nuclear Power Plant. Because of the nature of my career, research support has not been much required; perhaps more relevant to this project is my former relationship with National Geographic as a "unit scientist," interpreting water quality data for schoolchildren involved in the NGS Kids Network program; my freelance work and book contracts over the years with McGraw-Hill; and my decades of writing science reasoning test units for ACT, which involves summarizing research studies such that high school students can understand
them--and, I've always hoped, might make them think science is "cool," even in the middle of taking a high stakes exam.

Appendix I. Biosketches
Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME
Lowman, James Scott

POSITION TITLE
Senior Scientist

eRA COMMONS USER NAME (credential, e.g., agency login)
LowmanJS

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<td>01/14</td>
<td>Plant Microbe Interactions</td>
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<tr>
<td>The Institute for Advanced Learning and Research</td>
<td>Postdoc</td>
<td>7/15</td>
<td>Robotic Imaging</td>
</tr>
</tbody>
</table>

A. Personal Statement

The long term goal of my research is to increase agricultural sustainability through; 1) the development and application of precision agriculture 2) the use of applied plant biostimulants and: 3) to use this research as a platform to increase participation of under representative minorities in science and engineering. My background in biology is broad and includes experiences in industry and as an entrepreneur. As a master’s student, I studied genetic linkages of isoforms of the enzyme alcoholdehydrogenase with ethanol preference in the white footed deer mouse. As a Ph.D. student, I authored or co-authored 4 scientific journal articles and one book chapter focused on plant interactions with the model beneficial microbe Burkholderia phytofirmans strain PsJN. As a postdoc, I expanded my knowledge base by working to develop and build out the SMART table plant phenotyping platform in partnership with the Department of Mechanical Engineering at Virginia Tech. This system is primarily designed to study the growth characteristics of plants during the first two months of growth. After my post-doc research at the Institute for Advanced Learning and Research was complete, I was promoted to Senior Scientist in July of 2016. Prior to earning my Ph.D., I managed more than 10 grants in the field of sustainable agriculture as a founder of Lynchburg Grows, a non-profit urban farm. Since earning my Ph.D. in 2014, I have served as a PI on four research grants totaling more than $360,000 and have licensed 50 beneficial bacteria to an innovative plant micro biome commercialization company.

B. Positions and Honors

Positions and Employment

7/2009 – 12/2013: Graduate Research Assistant, Virginia Tech, Blacksburg VA. Advised by Jerzy Nowak, Ph.D.
2/2014 – 7/2015: Scientist I / Postdoc, the Center for Sustainable and Renewable Resources, the Institute for Advanced Learning and Research. Advised by Chuansheng Mei, Ph.D.
Appendix I. Biosketches

7/2015 – Present: Senior Scientist, The Center for Sustainable and Renewable Resources, The Institute for Advanced Learning and Research and Adjunct Faculty, Department of Horticulture, Virginia Tech, Blacksburg VA and Department of Biology, Averett University, Danville VA.

Honors

2008 Commonwealth Environmental Leadership Award, the Waldorf Foundation
2012 Outstanding Presentation Award, the Department of Energy Feedstock Genomics for Bioenergy Annual meeting
2017 Outstanding Recent Graduate Alumni, the Department of Horticulture in the Virginia Tech College of Agriculture and Life Sciences

C. Selected Peer-reviewed Publications


*indicates co-first author
D. Research Support

10/14-10/16
**Beneficial Bacterial Endophytes Improve Grapevine Growth and Cold Tolerance to Strengthen the Virginia Wine Industry**
Virginia Department of Agriculture and Consumer Services $39,798
Role: Project Manager

4/15-4/17
**Utilizing Switchgrass and Bacteria to Improve Remediation of a PCB Contaminated Wastewater Treatment Pond**
The Town of Altavista, Virginia $42,000
Role: PI

1/16-1/19
**Southern Virginia Grapevine Improvement Grant**
The Virginia Tobacco Commission $50,000
Role: PI

1/17-1/19
**Utilizing Precision Agriculture to Improve Agricultural Productivity**
The Virginia Tobacco Commission $236,000
Role: PI
BIOPGRAPHICAL SKETCH

M. A. Saghai Maroof
Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA 24061

PROFESSIONAL PREPARATION:

B.S. in Agriculture, University of Tabriz, Iran 1975
Ph.D. in Genetics, Department of Genetics, University of California, Davis, CA 1981
Postdoctoral Research Associate, Department of Plant Pathology, Univ. of Calif., Davis 1981
Postdoctoral Research Associate, Department of Vegetable Crops, Univ. of Calif., Davis 1982
Postdoctoral Research Associate, Department of Genetics, Univ. of California, Davis 1983

APPOINTMENTS:

Professor, Department of Crop & Soil Environmental Sciences, Virginia Tech 1995
Associate Professor, Department of Crop & Soil Environmental Sciences, Virginia Tech 1989
Project Leader, Molecular Genetics, Research Department ICI Seeds Slater, IA 1986

PUBLICATIONS: Over 100 refereed journal articles which have been cited over 15,500 times, with an h-index of 48, and i10-index of 96.

FIVE CLOSELY RELATED RECENT PUBLICATIONS:


FIVE OTHER RECENT PUBLICATIONS:

Appendix I. Biosketches


SYNERGISTIC ACTIVITIES:


Trained/hosted international visiting scientist from China, India and Egypt through funds from the Rockefeller Foundation.

Mentored summer interns and graduate students from the Multicultural Academic Opportunities Program (MAOP at Virginia Tech).

Member, graduate student admission committee (CSES Department, Virginia Tech).

Steering Committee Member, Graduate Curriculum Development in Genetics, Bioinformatics and Computational Biology (Virginia Tech and VBI).

Committee Member, United Soybean Board Fellowship Committee, American Society of Agronomy (2009-2010). Chair, United Soybean Board Fellowship Committee, American Society of Agronomy (2011).


Teaching and Mentoring Experience

Courses Taught: Molecular Genetics for Crop Improvement (CSES 5844), Plant Breeding and Genetics (CSES 4144), Plant Genomics (CSES 5844)

Total number of graduate students advised: 24

Total number of postdoctoral and visiting scholars sponsored: 30
BIOGRAPHICAL SKETCH

John M. McDowell

Expertise as Related to the Proposal:
Functional and comparative genomics of oomycete plant pathogens
Mechanisms through which oomycete pathogens extract nutrients from plant hosts
Functional analysis of oomycete effector proteins
Translating pathogen genomics into new solutions for disease control

Professional Preparation:
University of Tennessee       Cellular and Molecular Biology  B.A.  1987
University of Georgia        Genetics                 Ph.D.  1995
University of North Carolina Molecular Plant Pathology Postdoc. 1995-99

Professional Appointments:
2000-present: Professor (promoted from Assistant Professor in 2006 and Associate Professor in 2013); Dept. of Plant Pathology, Physiology, and Weed Science, Virginia Tech.
2013-present: Scientific Director, Fralin Life Science Institute, Virginia Tech
2010: Interim Department Head, Plant Pathology, Physiology, and Weed Science, Virginia Tech

Five Relevant Publications:

Five Additional Publications:
Appendix I. Biosketches


Synergistic Activities:

Editorships: Editor-In-Chief, Molecular Plant-Microbe Interactions (2016-present); Senior Editor, Molecular Plant-Microbe Interactions (2010-15); Editorial Board, Molecular Biotechnology (2008-15); Review Editor, Frontiers in Plant-Microbe Interactions (2011-present); Advisory Board, The Plant Journal (2004-08); Editorial Board, Molecular Plant Pathology (2000-05); Associate Editor, Molecular Plant-Microbe Interactions (2000-05).


Outreach: Advisory Board, Partnership in Research and Education Using Plants (PREP). This NIH-funded outreach program (Erin Dolan, PI) enables high school students to conduct experiments in their classrooms using mutants of Arabidopsis. I advise on experimental design and execution, produced an interactive video about my research, and travel to high schools to interact with participants and discuss my research. I am also the PI of the subcontract that funds PREP activities at Virginia Tech.

LEADERSHIP APPOINTMENTS:

**Founding Director, Center for Communicating Science**, Virginia Tech, 2017 – present

**Responsibilities:**

- Provide vision and leadership for the creation and evolution of the university center.
- Develop graduate curricula (in collaboration with the Graduate School), undergraduate (in collaboration with the School of Performing Arts, and professional development curricula to create opportunities for scientists, scholars, health professionals, and others to develop their abilities to communicate and connect. The Center’s work emphasizes three areas: social innovation, collaboration and team creativity, and communication across differences. The center provides learning opportunities, such as workshops and courses in storytelling techniques, improvisation, and non-verbal communication, and draws together institutional efforts that are currently isolated and diffuse.
- Create a certificate program for post-MFAs from quality acting programs around the country who wish to learn to apply their theatre and performance training to these transdisciplinary areas. The center serves as a clearinghouse for Communicating Science resources at Virginia Tech.

**Founding Director, School of Performing Arts | Music | Theatre | Cinema**, Virginia Tech, 2007 – 2017

**Responsibilities:**

- Provided vision and leadership, conduct and implement strategic planning.
- Administered and promoted the academic programs and academic support functions of the Music and Theatre departments, Cinema program, and Dance courses. This included ~ 250 undergraduate students in B.A. programs, 21 graduate students in M.F.A. programs, and 200 + undergraduate minors. Additionally, we teach ~ 20,000 hrs. of gen. ed. credits annually.
- Managed all personnel matters within the school, including:
  - Professional and career development strategies for faculty and staff.
  - Development of recommendations for the nomination, retention, promotion, tenure, and compensation of the 65 faculty, 2 department chairs, and 11 staff members in departments and programs.
  - Extend offers for employment (and, when necessary, initiate dismissal) in the school in consultation with the program chairs, personnel committee, dean, and legal counsel.
- Served on the Dean’s Executive Council and the Provost’s Arts Policy Board.
- Served as a liaison between the school and collaborative units on campus including the Moss Center; Student Affairs; the Institute for Creativity, Arts, and Technology, and University Libraries.
- Developed and coordinated physical facilities planning and utilization of the school resources. The school has performance, research, and academic space in eight different campus and off-campus locations.
- Developed external relationships for the purposes of (1) enhancing student opportunities; (2) providing meaningful community outreach opportunities for students and faculty; and (3) enhancing fundraising opportunities (in consort with University Development), (4) developing and maintain alumni relations.
- Supervised performance and event planning, marketing and public relations and recruitment activities of the school. Support coordination of the school’s website and promotional materials. The school produces over 250 events (including a summer arts festival) in 5 different performance venues annually.
- Managed and monitored school budgets, including allocation and oversight of department budgets and program fees. The full budget of the school including salaries in 2015 was ~ $7,500,000.

**Achievements:**

- Catalyzed and implemented the financial and programmatic restructuring of the School of Performing Arts and
Cinema into the School of Performing Arts | Music | Theatre | Cinema. This involved centralizing 75 personnel lines, centralizing budgets, redefining curricular structures, reestablishing reward and assessment systems, establishing lines of communication and connection, and prioritizing collaboration. 2012-2016.

- Contributed to vision of the Center for the Arts/Arts Initiative at Virginia Tech. The core of this initiative is a new arts precinct with an $116,000,000 performance hall, art gallery, and experimental high tech venue that opened in 2012. 2002 – 2012.
- Administered significant aspects of the renovation and new construction for theatre, music, cinema, and visual art facilities at Virginia Tech: Henderson Hall renovation and new construction of a black box theatre, Theatre 101, which opened in the fall of 2009. $16,500,000 budget. 2002 – 2009.
- Created and supported partnerships with professional theatres, including Ping Chong and Company (NYC), Arena Stage (Washington DC), RidgeTheater (NYC).
- Created Theatre/Cinema Guest Artist Program. Identified funding and supported residencies for guest artists: DBR, Michelle Krusiec, Emsa Lakovich, Andrew Wade, Raphael Lopez-Barrantes, Celeste Miller, Daniel Zippi, Ed Herendeen, Marco Lully, Lucianna Codispoti, Jan Cohen-Cruz, Marty Potter, Matthew Francis, Tina Packer, Tim Mooney, Kristin Linklater, Ping Chong, Fran Bennett, Mark Bly, Michael Rohd, Molly Smith, Stephanie Skura, Tibor Varszegi, Coleen Kelly, Ben Cameron, Caty Borum Chattoo, Matthew Francis, Stewart Margolin.
- Established endowment funds in support of the arts programming and arts students:
  - The Donald A. Drapeau Endowment (established in 2002) has had over two hundred individual alumni contributors and is used to support guest artists and special projects. ($45,000.)
  - The Barbara Carlisle Fund (established in 2007) support new play production activities of the department of theatre arts. ($19,400.)
  - The Blaise Box R & D Fund (established in 2008) supports the research activities of the theatre faculty. ($100,000.)
  - The Bruce Carver Fund (established in 2010) supports multi-cultural arts programming which incorporate emerging technologies. ($125,000.)
  - The Arts Opportunity Fund (established in 2011) funds tuition for students who, for financial reasons, would not be able to continue their arts studies. ($125,000.)

**Director, School of the Arts, Virginia Tech, 2003 – 2007**

*Responsibilities:*
- The School of the Arts was a unit at Virginia Tech that supported the Departments of Art and Art History, Music, and Theatre Arts. Director was responsible for promotion and support of a range of programmatic offerings, while encouraging interdisciplinary pursuits among the visual and performing arts units.

*Achievements:*
- Led the conception, organization, and implementation of the formation of two new schools -- the School of Visual Arts (College of Architecture), and the School of Performing Arts and Cinema (College of Liberal Arts and Human Sciences).
- Initiated planning and supported execution of the first ArtsFusion—a week-long celebration of the arts on campus and in the community. 2003 - 2014.

**Department Head, Department of Theatre Arts, Virginia Tech, 2002 – 2013**

*Responsibilities:*
- Envisioned new directions and fostered continuous improvement in an academic program with a 40-year history of excellence.

*Achievements:*
- Realized a 30% growth in faculty, and a 150% growth in undergraduate student numbers. Responsible for a marked increase in external funding and for a markedly more diverse faculty composition.

**Assistant Department Head, Department of Theatre Arts, Virginia Tech, 1994 – 2001**

*Responsibilities:*
- Scheduled and staffed all department courses.

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**Appendix I. Biosketches**
Appendix I. Biosketches

- Chaired Personnel Committee.
- Provided advising for all graduating students.
- Chaired Scholarships and Awards Committee.
- Developed and processed new courses and curricula.
- Designed special projects.

Achievements:
- Created *Exploring Multiple Intelligences Through Theatre Techniques* (EMITT). From 1997 to 2009, led offer two weeklong summer explorations for grades K – 5. The mission was to provide opportunities for children to expand their ways of learning and understanding.
- Created *Company of Girls of Montgomery County*. From 1994 – 1996, extending from the work with the Company of Women (below), ran weekly workshops for at-risk girls ages 10 - 13 throughout the county related to the work of the Harvard Project on Women and Girls.
- Led/organized *Company of Women* - Virginia 4 week Residency for The Company of Women, a non-profit theatre and educational organization co-directed by Kristin Linklater and Carol Gilligan (Harvard). Throughout the company’s existence it responded to the need for active study of the relationship between women, girls, and our society. The Company used works of Shakespeare to explore and strengthen the voices of women and girls.

SELECTED ADMINISTRATIVE SERVICE:

**University (Virginia Tech - reporting to Provost or President):**
- Chair, Institute and Leadership Review Committee, Institute for Creativity, Arts, and Technology (ICAT), 2016
- Beyond Boundaries, Preparing the Students of the Future Committee, 2015 – 2016
- Search Committee, Executive Vice President and Provost, Virginia Tech, 2015
- Search Committee, Dean of the College of Liberal Arts and Human Sciences, 2014
- Co-Chair, General Education Reform Process, Discourse Task Force, 2014
- University Unions and Student Association Advisory Committee member, 2008 - present
- Search Committee, Center for the Arts Executive Director, 2008 - 2009
- Center for the Arts Board of Directors, (now called Arts Policy Board) 2008 – 2010
- Center for the Arts Building Committee, 2007 – 2013
- Center for Creative Technologies in the Arts Working Group, 2008 – 2013
- Arts Initiative Steering Committee, 2007 – 2013
- Search Committee, Dean of the College of Liberal Arts and Human Sciences, 2007

**College (College of Arts and Science and College of Liberal Arts and Human Sciences - reporting to Dean):**
- Chair, Leadership Review Committee, School of Education, 2016
- Search Committee, Associate Dean for Graduate Education, 2011
- Dean's Budget Advisory Committee, 2007 – 2014
- National Association of Schools of Theatre (NAST) re-accreditation process, Chair, 2006 - 2008

National and International Organizations and Boards and Leadership Responsibilities:
- National Association of Schools of Theatre (NAST) Visiting Evaluators - nominated and selected to serve the organization as a visiting evaluator for accreditation of theatre programs, 2008 - present.
- Voice and Speech Trainers Association (V: Immediate Past President, 2012 – 14
  - Chair of Nominating Committee, 2012-2014
  - President, 2010 -2012
  - President Elect, 2008 -2010
  - Board Member, 2005 - 2014
  - Board Human Resource Liaison, 2005 – 2010
LEADERSHIP DEVELOPMENT:


- **The Wilder Foundation’s J. P. Shannon Leadership Institute** – 5 quarterly meetings. Participated as one of a cohort of twenty-one leaders of the non-profit sector from around the nation. Minneapolis, Minnesota. March 2008 - May 2009. By nomination and application only, acceptance into this institute is highly competitive (there is a 20% acceptance rate in my demographic) and limited to leaders in non-profit organizations that have been in their positions for 5 years or more.

- **National Association of Schools of Theatre** - Workshop for Visiting Evaluators. Participant in multiple training events that included extensive work on certification standards within the discipline of Theatre in Higher Education. Denver, Colorado, 2007. Pittsburg, Pennsylvania, 2008. Inclusion as a Visiting Evaluator requires nomination from within the organization and is highly competitive (fewer than 5% of members are invited to attend the training and serve in this capacity).

- **Virginia Tech’s University Leadership Development Certificate 2007/2008**
  - Dimensions of Management for Successful Leaders
  - Time Management
  - Delegation
  - Collaborative Problem Solving

HONORS AND AWARDS:

- The University of Nebraska’s Alumni Achievement Award, College of Fine and Performing Arts, 2017.
- The Pennsylvania State University’s Alumni Award, College of Arts and Architecture, 2011.
- College of Liberal Arts and Human Sciences Excellence in Administration Award, Virginia Tech, 2010.

ACADEMIC POSITIONS:

**Professor of Theatre**, Virginia Tech, 2008 – Present
- Teach courses in acting, arts leadership, improvisation, leadership presence, personal branding, applied theatre, communicating science, and voice.

**Fellow, Center for Leadership in Global Sustainability, College of Natural Resources**, Virginia Tech. 2013 - Present
- Responsible for creating and delivering the Leadership Communication elements of Executive Masters in Environmental Sustainability in the National Capital Region.

**Associate Professor of Theatre**, Virginia Tech, 1993 – 2007
- Taught courses in acting, heightened and poetic text and scene study, auditions, dialects, diction, mask-work, sensory/emotional work, and theatre outreach.

**Assistant Professor of Theatre**, Virginia Tech, 1986 – 1993
- Taught courses in voice and acting.

EDUCATION:

- **The Pennsylvania State University**, M.F.A. in Theatre
- **The University of Nebraska at Lincoln**, B.F.A. in Theatre

PROFESSIONAL PREPARATION:
Appendix I. Biosketches

- **Communicating Science Institute, Stony Brook University**, (Carl Safina, Howie Schneider, Elizabeth Bass, Alan Alda, Valeri Lantz-Gefroh et al), Alan Alda Center for Communicating Science, 2011.

**SCHOLARLY AND CREATIVE ACCOMPLISHMENTS:**

**Acting (selected roles):**

- **Doubt**. By J.P. Shanley. Role of Sister Aloysius. Dir. Ernest Zulia. Regional tour included performances for the Roanoke Arts Festival and at Hollins University (It was the Hollins University common reading – the freshman class at Hollins University saw and discussed the production). Production was also performed on the campus of Virginia Tech. Regional premiere. July through November 2008.

**Directing:**


**Dialect/Voice Direction in Production:**


**Publications:**


**Selected Papers Presented:**


**SELECTED GRANTS and FUNDING RECEIVED in SUPPORT of APPLIED SCHOLARSHIP and CURRICULAR DEVELOPMENT:**

- Bruce Carver Multicultural Arts Fund Grant ($12,000) for the production of *Joe Turner’s Come and Gone*. Patricia Raun, PI. College of Liberal Arts and Human Sciences, April 2007.
APPENDIX I. BIOSKETCHES

NAME: Schmale III, David Garner Burton

EDUCATION/TRAINING

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<td>Cornell University</td>
<td>Ph.D.</td>
<td>01/2006</td>
<td>Plant Pathology</td>
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A. Personal Statement

One of the goals of my research program is to understand how microorganisms are transported over long distances in the atmosphere. To do this, I have developed technologies with drones (unmanned aerial vehicles or UAVs) to peer into the life of microorganisms flying tens to hundreds of meters above the surface of the earth. These drones are equipped with unique sampling devices to collect and analyze microorganisms during flight. We were the first to document the transport of microorganisms along unique atmospheric features known as Lagrangian coherent structures (LCSs)—dynamic boundaries between air masses that shape atmospheric transport over long distances. We showed that a unique strain of a fungus collected with drones likely moved into the state of Virginia via LCSs. We applied the language of LCSs to the transport of fungi in the genus Fusarium—one of the most important groups of pathogenic fungi in the world. This work was recognized by Popular Science Magazine (I was named one of the Brilliant Ten in 2013), Scientific American (an invited feature article in early 2017), and TedX Virginia Tech.

B. Positions and Honors

Positions and Employment

2001-2005, Graduate Research Assistant, Cornell University, Dept of Plant Pathology, Ithaca, NY
2006-2011, Assistant Professor, Dept of Plant Path, Phys, & Weed Sci, Virginia Tech, Blacksburg, VA
2011-2016, Associate Professor, Dept of Plant Path, Phys, & Weed Sci, Virginia Tech, Blacksburg, VA
2016-Present, Professor, Dept of Plant Path, Phys, & Weed Sci, Virginia Tech, Blacksburg, VA

Other Experience and Professional Memberships

2006-2008 Elected Chair, Committee on Academic Programs & Policies, Virginia Tech
2007-2010 Elected Secretary-Treasurer/ Vice-President/ President, APS Potomac Div.
2010-2013 Associate Editor, Plant Disease
2012-2015 Chair, Pathogen Genetics and Biology RAC, USDA-USWBSI
2012-2014 Elected Divisional Councilor, American Phytopathological Society
2013-2015 Chair, Academy of Teaching Excellence, Virginia Tech
2014-Present Director, Biological Transport (BIOTRANS Graduate Program, Virginia Tech

Honors

2010 Favorite Faculty Award, Office of Residence Life at Virginia Tech
2010 Member, Virginia Tech Academy of Teaching Excellence
2010 Sporn Award, Virginia Tech Undergraduate Teaching Excellence
2013 Recipient of the Popular Science 2013 Brilliant Ten Award
2013 TEDx Virginia Tech Speaker, “Drone-ing for life in the atmosphere”

C. Contributions to Science
1. We developed the first autonomous (self-controlling) drone to sample plant pathogens in the atmosphere hundreds of meters above crop fields. This work has changed the technological landscape for crop biosecurity; new technologies with drones are now available to detect and track the movement of pathogens in the atmosphere, and transport models validated with field experiments can now be used to predict the risk of disease spread between neighboring fields.


2. We were the first to document the transport of microorganisms along unique atmospheric features known as Lagrangian coherent structures (LCSs)—dynamic boundaries between air masses that shape atmospheric transport over long distances. We showed that a unique strain of a fungus collected with drones likely moved into the state of Virginia via LCSs. We applied the language of LCSs to the transport of fungi in the genus *Fusarium*, and LCSs are now considered to be an important mechanism by which microorganisms can invade new territories.


3. Another goal of my research program is to develop strategies to detect, monitor, and control mycotoxins. We have also quantified mycotoxins in a nutrient-rich co-product of fuel ethanol production (dried distiller’s grains with solubles, or DDGS) that is a significant food source for domestic animals.


D. Additional Information: Research Support

**Ongoing Research Support**

Tokekar, P., and Schmale, D.G. $900,835. NSF. NRI: Coordinated Detection and Tracking of Hazardous Agents with Aerial and Aquatic Robots to Inform Emergency Responders. 10/2016-9/2019. Co-Principal investigator, ~50% of funding. The goal of this project is to coordinate unmanned robots in the air and water to assist in the identification of hazardous agents in water.


Schmale, D.G. $80,027. USDA-USWBSI. Diagnostic testing services for deoxynivalenol in the eastern U.S. 05/2015 to 04/2016. Principal investigator. The goal of this project is to provide mycotoxin testing services.

Christner, B., Vinatzer, B., Schmale, D.G., Weber, C., Morris, C., and Sands, D. $1,997,876. NSF. Research on Airborne Ice-Nucleating Species (RAINS). 1/1/13 to 12/31/16. Co-Principal investigator. The goal of this project is to examine the diversity of ice-nucleating microbes in precipitation.
BIOGRAPHICAL SKETCH

NAME
Dorothea Tholl

POSITION TITLE
Associate Professor of Biological Sciences

eRA COMMONS USER NAME (credential, e.g., agency login)

EDUCATION/TRAINING

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<th>FIELD OF STUDY</th>
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<td>Diploma</td>
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<tr>
<td>University of Michigan</td>
<td>Postdoctoral</td>
<td>2005</td>
<td>Plant Chemical Interactions</td>
</tr>
</tbody>
</table>

NOTE: The Biographical Sketch may not exceed four pages. Follow the formats and instructions below.

A. Personal Statement

Research in the Tholl laboratory focuses on the Biology, Genomics, and Biochemistry of Chemical Communication. Specifically, we are interested in two areas - chemical interactions and perception of plant roots and the biochemistry and engineering of insect-produced pheromones. I have long standing research expertise in the area of specialized metabolism. My research as postdoctoral associate and junior group leader at the Max Planck Institute for Chemical Ecology was centered on the biochemistry and molecular regulation of plant volatile compounds, specifically volatile terpenes, in the model system Arabidopsis. I expanded this work at Virginia Tech to other plant systems with a focus on the role of volatile compounds in belowground beneficial or pathogenic interactions and the effect of global change on root crop aroma. A new area of interest investigates the biosynthetic evolution of volatile terpene pheromones in insects with application in metabolic engineering of insect pheromone biosynthetic pathways in trap crops. In the past 12 years, our studies have been supported by the NSF, USDA, BARD, the Kate and Jeffress Memorial Trust, and internal funds from Virginia Tech. I continue to be involved in international collaborations such as investigating the role of terpene volatiles in carrot aroma upon temperature stress (D. Mwafaq Ibdah, ARO, Israel). I have been successfully mentoring several postdoctoral associates, Ph.D. students, and many undergraduate students in my position at Virginia Tech. Our projects have resulted in multiple peer-reviewed publications, several of which have appeared in high impact journals. In summary, I have developed a productive research program in an area of high relevance for plant and insect chemical communication.

B. Positions and Honors

Positions and Employment

2005-2011  Assistant Professor, Department of Biological Sciences, Virginia Tech, Blacksburg, VA
2011-present  Associate Professor, Department of Biological Sciences, Virginia Tech, Blacksburg, VA
Appendix I. Biosketches

Other Experience and Professional Memberships

Editorial Board, The Plant Journal, Journal of Chemical Ecology
Advisory Board, New Phytologist
Scientific Advisory Board, Leibniz Institute for Plant Biochemistry, Germany
NSF, DOE, BARD grant panelist
Phytochemical Society of North America, member
American Society of Plant Biology, member
Sigma Xi, The Scientific Research Society, member
International Society of Chemical Ecology, member

Honors
2006  Full Membership of Sigma Xi (The Scientific Research Society; Virginia Tech University Chapter)
2007  Arthur C. Neish Young Investigator Award, Phytochemical Society of North America.
2016  Elected Co-chair, Gordon Research Conference on Plant Volatiles
2016  Outstanding Service Award, Department of Biological Sciences, Virginia Tech
2017  Wernsman Speaker Award, Department of Crop and Soil Sciences, NC State

C. Contributions to Science
1. Root chemical interactions and root crop aroma


2. Additional recent publications of importance to the field of plant-organism interactions


D. Research Support

Ongoing Research Support

USDA-NIFA 2016-67013-24759    Tholl (PI)    02/16-01/31/20
Defining molecular mechanisms of terpene aggregation pheromone biosynthesis in stink bugs for engineering pheromone producing trap crops.
Role: PI

BARD IS-4745-14 R    Ibdah (PI)    08/01/14-04/30/18
How temperature stress changes carrot flavor: Elucidating the genetic determinants of undesired taste in carrots.
Role: Co-PI

NSF-IOS 1355106    Rutter (PI)    12/14-05/31/17
Collaborative: unPAK: undergraduates Phenotyping Arabidopsis Knockouts: A distributed genomic approach to examine evolutionarily important traits.
Role: Participant

Joint Genome Institute Synthetic Biology Resource Grant 2568    Zerbe (PI)    01/01/2016- 12/31/2017
DNA Synthesis to Fuel the Elucidation and Engineering of Terpenoid Secondary Metabolic Systems for Bioenergy Crops and Forest Trees.
Role: Co-PI

Fralin Life Sciences Institute/Life Sciences I, Virginia Tech    Tholl (PI)    Nov 2016 – May 2017
Determining volatile based niches in root-microbe associations.
Role: PI
Appendix I. Biosketches

Completed Research Support (last three years)

USDA-NIFA  Tholl (PI)  12/1/15-04/30/16
Role: PI

NSF-IOS  Tholl (PI)  01/01/16-12/31/16
Role: PI

Fralin Life Sciences Institute, Virginia Tech  Tholl (PI)  spring 2015
RNA-Seq Illumina analysis on pentatomids.
Role: PI

NSF-MCB  Tholl (PI)  03/01/10-02/28/15
Organization of terpene specialized metabolism in plant roots.
Role: PI

NSF - DBI - Research Coordination Networks; RCN-UBE  Dolan (PI)  09/11-08/15
Course-based Undergraduate Research Experiences Network (CUREnet).
Role: Participant
A. Personal Statement
Dr. Thomason’s primary responsibilities are outreach/extension education and research for the Virginia corn and small grains industries. The core focus of his extension education program is integration of corn, wheat, barley, and other crops into profitable cropping systems for the eastern U.S. Practical, economical, and environmentally sound production techniques are major areas of emphasis.

B. Positions and Honors

Positions and Employment
1999-2001 Senior Agriculturist, Dept. of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK
2001-2003 Soil Fertility and Crops Specialist, Samuel R. Noble Foundation, Ardmore, OK
2004-2010 Assistant Professor/Extension Grains Specialist, Virginia Tech, Blacksburg, VA
2010-2015 Associate Professor/Extension Grains Specialist, Virginia Tech, Blacksburg, VA
2015- Professor/Extension Grains Specialist, Virginia Tech, Blacksburg, VA

Other Experience and Professional Memberships
1998- Member, American Society of Agronomy
1998- Member, Soil Science Society of America
2005- Member, Crop Science Society of America
2004- Virginia Grain Producers Association
2004- National Corn Growers Association
2004- National Association of Wheat Growers
2012- Mid-Atlantic Certified Crop Advisor Board of Directors

Honors (selected)
2017 University Alumni Award for Excellence in Extension, Virginia Tech, Blacksburg, VA
2016 Outstanding Contributions to the 7th National Small Farm Conference, USDA
2014 Land Grant University Award, Virginia Agribusiness Council, Richmond, VA
2014 No-Till Innovator Award, Organization–Virginia No-tillage Alliance. Syngenta Crop Protection and No-Till Farmer Magazine
2013 Excellence Award in Applied Research, Virginia Tech College of Agriculture and Life Sciences, Blacksburg, VA
2011 Friend of Agriculture award, Virginia Grain Producers Association, Richmond, VA
2010 Excellence in Technology Transfer award, USDA-ARS Federal Laboratory Consortium, Mid-Atlantic Region, USDA-ARS
C. Contribution to Science

My primary responsibilities are extension education and research in support of the Virginia corn and small grains industries. My career goal is to solve current and future problems facing producers and agribusiness in Virginia and globally and to increase adaptation and adoption of new knowledge and practices. To achieve that goal I focus on two main program areas.

1. Expanding adoption of no-tillage crop production systems and those that incorporate cover crops (conservation agriculture systems). These systems can improve soil quality, crop performance and resiliency in the face of abiotic stresses, including those expected to become more acute due to climate change. Examples of recent publications in this area include the following (*indicates graduate student):

And recognition of the Virginia No-Tillage Alliance, to whom I serve as an adviser, as recipient of the 2014 No-Till Innovator Award, presented by No-Till Farmer magazine and Syngenta Crop Protection in the Organization division.

2. Implementation of precision agriculture systems and technologies to improve the efficiency and productivity of crop production. Since 1998 I have worked in the area of remote sensing of spectral reflectance of plants and soils to determine and treat small scale variability in nutrient and water availability. Examples of recent publications in this area include the following (*indicates graduate student):

Complete List of Published Work:
https://scholar.google.com/citations?user=7kfO6UAAAAJ&hl=en
D. Additional Information: Research Support and/or Scholastic Performance

**Ongoing Research Support**

Corn hybrid testing and management studies  
VA Corn Board  
Thomason (PI)  
04/01/17-06/01/18  
Support for corn performance evaluation, agronomy and industry support.  
Role: PI

Small grain variety testing and management studies  
VA Small Grains Board  
Thomason (PI)  
07/01/16-06/30/16  
Support for wheat and barley performance evaluation, agronomy and industry support.  
Role: PI

Biologically based fertilizer recommendations to meet yield expectations and preserve water quality  
USDA-NIFA  
Franzleubbers (PI)  
01/01/14-09/01/17  
Evaluation of new techniques to improve the accuracy and efficiency of nitrogen rate recommendations in the Mid-Atlantic region.  
Role: Co-PI

Quantifying soil health: measuring the impacts of tillage and cover crop practices on nutrient retention and soil physical, biological and chemical properties  
USDA_NRCS  
Stewart (PI)  
07/01/16-06/30/18  
Discovery and translation of new tools to help measure and describe short-term improvements in soil health.  
Role: Co-PI
Biographical Sketch

Pratap Tokekar

Electrical and Computer Engineering, Virginia Polytechnic Institute and State University
e-mail: tokekar@vt.edu, tel: +1-540-231-5096

(a) Professional Preparation

College of Engineering Pune, India; Electronics & Telecommunication Engineering; B.Tech., 2008
University of Minnesota, Minneapolis MN; Computer Science; Ph.D., 2014
University of Pennsylvania, Philadelphia PA; Mechanical Engineering & Applied Mechanics; Post-doctoral Researcher, 2014–2015

(b) Appointments

Assistant Professor, Virginia Tech, Dept. of Electrical & Computer Engineering Aug. 2015–present

(c) Publications

Related Publications


Other Publications


(d) **Synergistic Activities**


2. Guest Editor for a special issue on Active Perception for the Autonomous Robots journal (2016-17).

3. Organized lab visits for high schools students along with the National Society of Black Engineers and Center for Enhancement of Engineering Diversity at Virginia Tech.


5. Robotics display exhibit at Math & Science Family Fun Fair organized by the University of Minnesota for K-12 students.
Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME: Richard E. Veilleux

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>Completion Date</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tufts University, Medford, MA</td>
<td>B.S.</td>
<td>6/1970</td>
<td>Math/Psychology</td>
</tr>
<tr>
<td>University of British Columbia, Vancouver, BC</td>
<td>M.Sc.</td>
<td>6/1976</td>
<td>Plant Science</td>
</tr>
<tr>
<td>University of Minnesota, St. Paul, MN</td>
<td>Ph.D.</td>
<td>6/1981</td>
<td>Hort/Genetics</td>
</tr>
</tbody>
</table>

A. Personal Statement

I have worked on genetics and biotechnology of many different horticultural crops with emphasis on potato. Recent effort has been devoted to the potato genome, first providing suitable plant material for generating a reference sequence, then subsequent studies on copy number variation among potato lines.


B. Positions and Honors

<table>
<thead>
<tr>
<th>Position</th>
<th>Institution</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gary Professor of Horticulture</td>
<td>Virginia Polytechnic Institute &amp; State University</td>
<td>2010-present</td>
</tr>
<tr>
<td>Professor, Horticulture</td>
<td>Virginia Polytechnic Institute &amp; State University</td>
<td>1992-present</td>
</tr>
<tr>
<td>Associate Professor, Horticulture</td>
<td>Virginia Polytechnic Institute &amp; State University</td>
<td>1987-1992</td>
</tr>
<tr>
<td>Assistant Professor, Horticulture</td>
<td>Virginia Polytechnic Institute &amp; State University</td>
<td>1981-1987</td>
</tr>
</tbody>
</table>

B. Contributions to Science
Appendix I. Biosketches

The following publications represent efforts on genomic contributions in three different horticultural crops, from sequencing to implementing genomic research.


D. Additional Information: Research Support

NSF Plant Genome Buell (PD) 10/12-08/17
Unraveling the Heterozygosity, Allelic Composition, and Copy Number Variation of Potato
Role: PI

USDA/CSREES Porter (PD) 9/16-10/17
Integrated potato breeding and variety development to enhance pest resistance and marketing opportunities in the eastern United States
Role: PI
Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME
Vinatzer, Boris, A

POSITION TITLE
Professor

EDUCATION/TRAINING

<table>
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<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(s)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Bologna (Italy)</td>
<td>MS</td>
<td>1996</td>
<td>Plant Science</td>
</tr>
<tr>
<td>University of Bologna (Italy)</td>
<td>PhD</td>
<td>2000</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>The University of Chicago</td>
<td>Postdoctoral training</td>
<td>2000-2004</td>
<td>Molecular Plant Pathogen Interactions</td>
</tr>
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</table>

A. Personal Statement

My training and professional expertise in conducting highly productive research projects in the field of molecular plant sciences, my experience in teaching, mentoring and advising undergraduate and graduate students, and my expertise in administration in my current role as department head have prepared me for participation in the "Crop Improvement for Global Food Security" area as part of the Global Systems Science Destination Area.

B. Positions and Honors

Positions and Employment
1995-1999  Graduate Fellow at the University of Bologna (Italy)
1996-1997  Visiting Scientist at Texas A&M University (5 months)
1998   Visiting Scientist at the Swiss Federal Institute of Technology (7 months)
1999   Visiting Scientist at Southern Illinois University (6 months)
2000-2004 Postdoctoral fellow at The University of Chicago
2004-2010  Assistant Professor, PPWS, Virginia Tech
2010-2016  Associate Professor, PPWS, Virginia Tech
2015-current Interim Department Head, PPWS, Virginia Tech
2016-current Professor, PPWS, Virginia Tech

Professional Memberships
Since 2004  Member, American Society for Microbiology
Since 2004  Member, American Phytopathological Society
Since 2008  Member, International Society for Molecular Plant-Microbe Interactions

Awards and Honors
March 2017  Distinguished Service Award, Potomac Division of the American Phytopathological Society
May 2010  R.G. Henderson Award for Outstanding Faculty (Department-level award)
April 2008  NSF Faculty Early Career Development (CAREER) award
July 2002  Postdoctoral Ruth L. Kirschstein NIH National Research Service Award
July 1995  Graduation with 110/110 "con lode" (maximum distinction) from the University of Bologna (Italy)

C. Contribution to Science

My research has contributed to elucidating the molecular underpinning of the interaction between bacterial plant pathogens and plants, the evolution of bacterial plant pathogens, and the genetic and functional diversity of airborne bacteria with ice nucleation activity.
A selection of 10 peer-reviewed publications since 2010 out of 38 (Corresponding authors in bold)


Book Chapters


D. Additional Information: Research Support

Completed Research Support
Science Applications International Corporation 2008-2009
Developing Highly Discriminatory Molecular Markers from Whole Genome Sequences for Use in Microbial Forensics
Five Pseudomonas syringae genomes were sequenced to identify single nucleotide polymorphisms that can be used for molecular marker design in microbial forensics applications.
Role: PI
NSF-IOS 0746501 2008-2013
CAREER: What is behind the worldwide success of Pseudomonas syringae pv. tomato: a comparative evolutionary genomics investigation
This study aims at unraveling the evolution of P. syringae isolates with different host ranges and at identifying the genes in P. syringae pv. tomato that make pv. tomato strains such successful tomato pathogens.
Role: PI

Ongoing Research support
NSF-IOS 1354215 Vinatzer (PI) 05/01/14-04/30/18
Leveraging Pathogen Diversity for Gaining Insights into Molecular Plant – Microbe Interactions
The goal of this study is to take advantage of natural genetic variants existing within pathogen populations to unravel virulence mechanisms in plant pathogenic bacteria to identify new targets for plant disease control.
Role: PI

NSF-DEB 1643288 Vinatzer (PI) 01/01/13-06/30/17
Dimensions: Collaborative Research: Research on Airborne Ice Nucleating Species (RAINS).
The goal of this study is to study the phylogenetic, genetic, and functional diversity of airborne bacterial species with predicted roles in the water cycle to gain a deeper understanding of how bacteria adapt to life the atmosphere and possibly influence quantity and frequency of precipitation.
Role: PI

Virginia Agricultural Council 671 Vinatzer (PI) 07/01/16-06/30/18
The goal of this study is to identify and characterize bacterial strains for use in plant disease control with a focus on the apple disease fire blight caused by Erwinia amylovora.
Role: PI
Appendix I. Biosketches

BIOGRAPHICAL SKETCH

NAME: Westwood, James H

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>Completion Date</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concordia College, Moorhead, MN</td>
<td>B.A.</td>
<td>05/1982</td>
<td>Biology</td>
</tr>
<tr>
<td>University of Minnesota, St. Paul, MN</td>
<td>M.S.</td>
<td>05/1986</td>
<td>Plant Physiology</td>
</tr>
<tr>
<td>Purdue University, West Lafayette, IN</td>
<td>Ph.D.</td>
<td>05/1994</td>
<td>Horticulture</td>
</tr>
</tbody>
</table>

A. Personal Statement
My research focuses on parasitic plants, which I find to be the most intriguing of organisms. Parasitic plants have evolved amazing adaptations that enable them to locate suitable host plants and then establish physiological connections in order to feed on these hosts. From a fundamental standpoint, my research on host-parasite interactions produces insights into aspects of plant biology and ecology that have broad implications for agriculture in which crop plants grow in competition with each other and with weeds. This is one important aspect of plant growth in the larger context of interactions with other biotic (microbes, pathogens, etc.) factors in their environment. Understanding and optimizing these interactions is part of developing smart crops and smart farms. I have been involved in numerous collaborative projects over my career, primarily as lead PI on the Parasitic Plant Genome Project. This is an NSF-funded project that has been running since 2007 (two iterations, together totaling $4.9 million) and includes four universities and dozens of people. This experience has provided excellent training in how to implement large, complex research project. Below are some key publications representing milestone developments in my work to understand parasitic plant biology.


B. Positions and Honors

Positions and Employment
2012 to present  Professor, Plant Pathol., Physiol. & Weed Sci. (PPWS), Virginia Tech, Blacksburg, VA.
Appendix I. Biosketches

2005 to 2012  Associate Professor, PPWS, Virginia Tech, Blacksburg, VA.
1999 to 2005  Assistant Professor, PPWS, Virginia Tech, Blacksburg, VA.
1997 to 1998  Research Scientist, PPWS, Virginia Tech, Blacksburg, VA.
1994 to 1996  Research Associate, PPWS, Virginia Tech, Blacksburg, VA.
1989 to 1994  Graduate Research Assistant, Dept. of Horticulture, Purdue Univ., West Lafayette, IN.

Other Experience and Professional Memberships

American Association for the Advancement of Science (AAAS)
International Society for Molecular Plant-Microbe Interactions (IS-MPMI)
International Weed Science Society (IWSS)
Weed Science Society of America (WSSA)
Associate Editor, Weed Science (2002 to 2008; 2011 for symposium proceedings)

Honors

2016  Virginia Tech College of Agriculture and Life Sciences Excellence in Basic Research Award.
2015  Visiting Professor, Inner Mongolia University, Hohhot, China.
2013  Honorary Member, International Parasitic Plant Society.
2013  Henderson Award for outstanding faculty member in PPWS.

C. Contributions to Science

1. Parasitic plant evolution. My research has used modern genomics approaches to study parasite-host interactions. A primary interest has been the evolutionary origin of parasitism in plants and how ancestral plants may have acquired the capacity for parasitism, as well as the changes that have occurred since then as a result of a parasitic lifestyle.


2. RNA mobility among plants. My laboratory first reported the phenomenon of mRNA transfer between plant species in 2007. Since then we have been working to understand the regulation and functional implications of this process.


3. Weeds in agriculture. My work in parasitic plant evolution has led me to consider evolution of conventional weeds as well. I have been able to apply my expertise in molecular biology and genomics to questions of weed resistance to herbicides.


D. Additional Information: Research Support

Recent Research Support

- Westwood, J. Generating transgenic Cuscuta as a tool for studying plant interactions. NSF EDGE $560,531. 1/1/17 to 12/31/19. (My role: PI)
- Askew S.D., D. Haak and J.H. Westwood. Characterizing Herbicide-Resistant Annual Bluegrass. Virginia Agricultural Councll. $12,000. 07/01/15 – 06/30/16. (My role: Co-PI)
- Clarke, C. and J.H. Westwood. Identification of host plant immune functions that control resistance and susceptibility to the parasitic plant Phelipanche aegyptiaca. NIFA Postdoctoral Fellowship Program. $150,000. 2014 – 2016. (My role: Project supervisor)
Appendix I. Biosketches

RANDOLPH HAMILTON WYNNE
Professor
Virginia Tech, Department of Forest Resources and Environmental Conservation
319 Cheatham Hall, Blacksburg, VA 24061
Tel.: (540) 231-5525; Fax: (540) 231-3698; Email: wynne@vt.edu

EDUCATION
University of North Carolina at Chapel Hill   B.S. Env. Science & Engineering 1986
University of Wisconsin-Madison   M.S. Environmental Monitoring 1993
University of Wisconsin-Madison   Ph.D. Environmental Monitoring 1995

CURRENT POSITIONS
Professor, Virginia Tech Forest Resources and Environmental Conservation, 2008-present
Program Co-Lead, Interdisciplinary Graduate Program in Remote Sensing, 2012-present

HONORS/AWARDS (ALL SHARED WITH COLLEAGUES)
• First Honorable Mention for the 2005 American Society for Photogrammetry and Remote Sensing Talbert Abrams Award for best 2004 article in PE&RS
• Second Place, American Society for Photogrammetry and Remote Sensing Leica Geosystems Award for Best Scientific Paper in Remote Sensing in 2006
• First Place, American Society for Photogrammetry and Remote Sensing ERDAS Award for Best Scientific Paper in Remote Sensing in 2008

PROFESSIONAL ACTIVITIES
• Member, Landsat Science Team, 2006 to present
• Co-Author, Introduction to Remote Sensing, 5th edition, Guilford
• Senior Associate Editor, Remote Sensing

PROJECT MANAGEMENT EXPERIENCE
Principal investigator for over $10,000,000 in grants and contracts on which all deliverables were met with quantifiable science outcomes.

RECENT REFEREED ISI PUBLICATIONS
Appendix I. Biosketches


DIVERSITY HIGHLIGHTS

- CNRE Diversity Award, 2008.
- Virginia Tech Human Diversity and Community Committee, 2008-2010.

STUDENT ADVISING

I have completed 24 graduate students as major professor, 11 M.S. (two co-chaired) and 13 Ph.D. (five co-chaired) Five graduate students are currently under my direction, four Ph.D. and one M.S. I also have the normal load of undergraduate advising in the department (Environmental Resource Management and Environmental Informatics majors).
Bingyu Zhao  
Associate Professor  
Department of Horticulture, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061  
Phone: 540-231-1146, Fax: 540-2310383, E-mail: bzhao07@vt.edu

Education
Qingdao Agricultural University, Shandong, China, Agronomy B.S., 1994  
Chinese Academy of Agricultural Sciences, Beijing, China, Plant Genetics & Breeding M.S., 1997  
Kansas State University, Manhattan, KS, USA, Plant Pathology Ph.D. 2004  
University of California, Berkeley, CA, USA, Molecular Plant Pathology, Post-doc, June 2004-May 2007

Professional Experience
June 2013 – present, Department of Horticulture, Virginia Tech, Blacksburg, VA, Associate professor  
June 2007 - June 2013, Department of Horticulture, Virginia Tech, Blacksburg, VA, Assistant professor  
2004-2007, University of California-Berkeley, CA, USA, Post-doctoral researcher  
1999-2004, Department of Plant Pathology, Kansas State University, USA, Graduate Research Assistant  
1998-1999, Institute of Crop Breeding and Cultivation, Chinese Academy of Agricultural Sciences (CAAS), Beijing, China, Research Assistant Professor  
1997-1998, Institute of Crop Breeding and Cultivation, CAAS, Beijing, China, Research Associate  
1996-1998, International Rice Research Institute (IRRI), Manila, Philippines, Visiting Scholar supported by the Rockefeller Foundation

Selected Honors and Awards
2009, National Science Foundation Faculty Early Career Development (CAREER) Award  
1996, Graduate Scholarship from Rockefeller Foundation

Memberships and Service in Professional Societies
American Phytopathological Society (APS)  
American Society for Plant Biology (ASPB)  
International Society for Molecular Plant-Microbe Interactions (IS-MPMI)  
President of Potomac Division of American Phytopathological Society (2013-2014)

Publications
Appendix I. Biosketches


15. Linkai Huang, Haidong Yan, Xiaomei Jiang, Xinquan Zhang, Xiu Huang, Yu Zhang, Jiamin Miao, Bin Xu, Tayler Frazier, Bingyu Zhao*, (2014). Evaluation of candidate reference genes for normalization of quantitative RT-PCR in switchgrass under various abiotic stress conditions Bioenergy Research (s12155-014-9457-1).


Book Chapter:

Appendix I. Biosketches


Ph.D. Advisors:
Scot Hulbert (Washington State University) and Jan Leach (Colorado State University).

Post-doctoral Advisor:
Brian J. Staskawicz (University of California, Berkeley)

Graduate students and Postgraduate-Scholar Advisees:
Six Ph.D. students (Kunru Wang, Zhibo Wang, Taylor Frazier, Shuchi Wu, Sy Traore, Bin Xu),
two visiting graduate students (Jiamin Miao, Lingkai Huang),
one MS student (Madhavi Dere),
six post-doc researchers/visiting scholars (Guoqiang Wu, Yiming Liu, Hong Zhu, Qiang Cheng, Zhiyong Yang, Changhe Zhou).
Appendix 2, SmartPlants and SmartFarms for Global Food, Feed, and Fiber Security

**Figure 1**: Integration of Virginia Tech programs (ovals) with the three major components of our theme.

Institutes
- FLSC, ICTAS, BI, ICE

**SmartPlants: Breeding for Environmental Stress Resistance**
- CALS, CNRE, COS

**SmartFarms and Forests: Phenotyping, Environmental Modeling, Precision Agriculture**
- CALS, CNRE, COS, COE

**VT-shaped graduate & undergraduate students**
- CALS, CNRE, COS, COE

**Destination Areas/SGAs**
- IIHCC, DADS, IS, CT+E, ESM, ESCHC, IE, Policy

IGEPS
- TPS, IGC, GBCB, RS, WI

VT Off Campus
- ARECs, IALR, NCR

Virginia Cooperative Extension Service

CALS International

Center for Science Communication

Undergraduate Minors
- CALS, CNRE, COS, COE

**VT-shape graduate & undergraduate students**
- CAFS, GFS, PHS

**VT MANRRS and MAOP**

VT Engage

**Figure 2**: The SmartFarm Concept

---

**SmART Farm**


Drones will survey and treat fields. Surveillance. Coordination.

Robots will till and plant fields. Pest control.

Farm data will be accessed through the cloud. Mobile devices. Anytime. Anywhere.


Crops and their microbes will be designed. Yield. Resistance.

Adapted from www.nesta.org.uk/blog/precision-agriculture-almost-20-increase-income-possible-smart-farming
Appendix 2, SmartPlants and SmartFarms for Global Food, Feed, and Fiber Security

Figure 3: The SmartPlant Concept

- Plant perceives and interacts with other organisms (insects, neighboring plants, etc.)
- Plant tolerates drought, heat, salinity, nutrient deficiency
- Resistance to pathogens
- Roots associate with beneficial microbes
- \( \text{N}_2 \text{ fixation} \)
- Efficient use of water and nutrients
- Plant signals stress to drones

Table 1: Preliminary list of hires

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<thead>
<tr>
<th>Discipline-bridging faculty positions (DA faculty lines)</th>
<th>Brief Description</th>
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<tbody>
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<td><strong>Position Title</strong></td>
<td><strong>Brief Description</strong></td>
</tr>
<tr>
<td>Digital Phenotyping</td>
<td>Design of devices to enable high-throughput phenotyping and environmental data monitoring in large or small-scale farms</td>
</tr>
<tr>
<td>Bioanalytics</td>
<td>Development of tools to manage, integrate, and analyze large, complex datasets from field phenotyping experiments</td>
</tr>
<tr>
<td>Agricultural Robotics</td>
<td>Design of tools to increase farming efficiency</td>
</tr>
<tr>
<td>Crop Ecosystems Modeler</td>
<td>Develop models to predict crop performance under environmental stress, to inform precision agriculture</td>
</tr>
<tr>
<td>Resilient Food Systems</td>
<td>Uses a systems approach to develop a community-based applied research program focused on resilient food system development (processes and policies)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discipline-strengthening faculty positions (College/Department lines)</th>
<th>Brief Description</th>
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<tbody>
<tr>
<td>Breeding/Bioengineering (multiple hires)</td>
<td>Developing crop germplasm/microbial populations to enhance resistance to environmental stressors</td>
</tr>
<tr>
<td>Plant Systems Biologist</td>
<td>Plant environmental stress analysis at a systems level</td>
</tr>
<tr>
<td>Computational Epidemiology</td>
<td>Predict emergence and spread of devastating diseases</td>
</tr>
<tr>
<td>Climate Scientist</td>
<td>Climatological factors that influence crop production</td>
</tr>
<tr>
<td>Soil Scientist</td>
<td>Soil health research to ensure the continued capacity of soil to function as a vital living ecosystem</td>
</tr>
<tr>
<td>Science Communication</td>
<td>Enhance students’ abilities to connect and communicate across disciplines and with industry partners, employers and employees, and food producers and consumers</td>
</tr>
</tbody>
</table>
Hiring Announcement, SmartPlants and SmartFarms for Global Food, Feed, and Fiber Security, Virginia Tech

Virginia Tech is building transdisciplinary teams to tackle the world’s pressing problems through research, education, and engagement. Destination Areas provide faculty and students with new tools to identify and solve complex, 21st-century problems in which Virginia Tech already has significant strengths and can take a global leadership role. The initiative represents the next step in the evolution of the land-grant university to meet economic and societal needs of the world.

To support our Destination Area Initiative in Global Systems Science, Virginia Tech will invest significantly in a thematic focus on SmartPlants and SmartFarms for Global Food, Feed, and Fiber Security. Virginia Tech seeks to leverage its traditional strengths in plant science, engineering and environmental sciences by developing transdisciplinary teams to think beyond the boundaries of traditional agriculture and forestry and develop ecologically sound systems that emphasize long-term sustainability. One area of emphasis will be to design plants, and associated microbes, to optimize yields under environmentally unfavorable conditions. Another area of emphasis will be to develop Smart Farm infrastructure to support high throughput phenotyping, agroecosystem modeling, and precision agriculture. These research strengths will be integrated into reimagined undergraduate and graduate curricula to educate and train students with disciplinary depth and significant research/experiential learning, complemented by broad understanding of the socio-political and economic factors that affect food production, distribution, and consumption.

A major component of this effort will be searches for world-class, “discipline-bridging” faculty with expertise in the following areas:

- Digital Phenotyping: Design of devices to enable high-throughput phenotyping and environmental data monitoring in large or small-scale farms
- Bioanalytics: Development of tools to manage, integrate, and analyze large, complex datasets from field phenotyping experiments
- Agricultural Robotics: Design of tools to increase farming efficiency
- Crop Ecosystems Modeler: Develop models to predict crop performance under environmental stress, to inform precision agriculture
- Resilient Food Systems: Systems approaches to develop a community-based applied research program focused on resilient food system development (processes and policies)

These searches will be conducted in conjunction with discipline-strengthening hires in areas such as Crop Breeding and Microbial Biodesign, Plant and Microbial Systems Biology, Computational Epidemiology, Climate Science, Soil Science, and Science Communication, for a total of 15-20 hires over the upcoming five years. Additional investments will include construction of a new building with state-of-the art facilities for lab-based phenotyping, along with development of the Smart Farm infrastructure referenced above. These investments, combined with our traditional strengths, will place Virginia Tech in a leading position to address one of the signature challenges of this century.