MISSOURI TRANSECT

MISSOURI EPSCoR

The Transect

Missouri EPSCoR Newsletter

Winter 2016

Researchers Build Robots to Collect Data on Field Crops • Seeing Plants in a New Light • Mapping Community Resiliency and Vulnerability • New Exhibit Will Highlight Local and Regional Agriculture • New Radar to Provide Illumination on Mid-Missouri Storms • First Computer Science Institute for Women Held at Danforth Center • Missourians Get Hands Dirty Digging Into Soil Science

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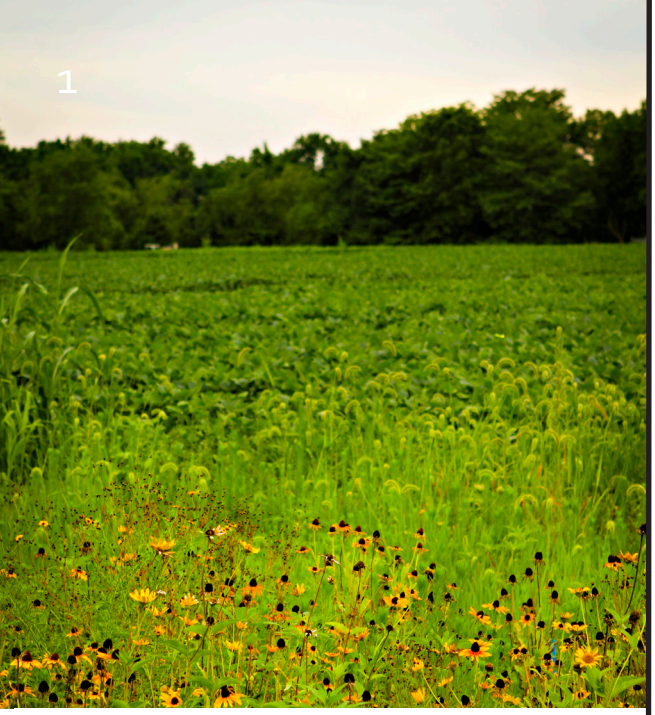

MISSOURI EPSCoR

What is Missouri EPSCoR?

The Experimental Program to Stimulate Competitive Research (EPSCoR) is designed to fulfill the mandate of the National Science Foundation (NSF) to promote scientific progress nationwide. Missouri became eligible to apply for EPSCoR funding in 2012. The program aims to provide strategic opportunities to stimulate sustainable improvements in R&D infrastructure, capacity and competitiveness, and to advance science and engineering capabilities for discovery, innovation and knowledge-based prosperity - capabilities that will benefit Missourians from all regions - urban to rural - and from all economic levels.

Message From the Director

Welcome to the inaugural issue of *The Transect*, the annual newsletter of the Missouri EPSCoR.

A transect cuts across something. In the life sciences, we use transects as a tool to measure and represent change across a specified environment or habitat. As you will read, cross-cutting projects that measure and visualize change are the focus of this newsletter.

This first issue showcases the projects of the Missouri Transect. Launched in 2014, this statewide collaborative research effort aims to understand how climate change impacts communities, agriculture, and natural ecosystems across the State of Missouri. The goal is to generate a panoply of resources -- technological, human, institutional, and intellectual -- that can support our State's capacity to respond to climate change, now and into the future. The projects of the Missouri Transect necessarily cut across the state, scientific disciplines, environments, and institutions.

As you will read, we have made great strides. A Doppler radar, installed at the University of Missouri's South Farm Research Center this past June, is ensuring residents in mid-Missouri get better warning of dangerous weather while also giving scientists a new tool to predict daily, seasonal, and annual variability in climate. An advanced imaging tool used to diagnose disease in humans is being adapted to detect early signs of drought-induced stress in crops. A new citizen science project, Missourians Doing Impact Research Together, or MO DIRT, has started crowdsourcing the collection of data on soil health and reciprocal soil-climate interactions across the state. Initial steps have been taken in the creation of a statewide climate indicator system that will allow individual Missouri communities to better assess their vulnerability and resilience to climate change.

Together, these projects highlight that when people with ideas can come together and can access the necessary resources, we see the results in the form of new jobs, better crops, breakthroughs in research, and innovations in learning.

John C. Walker, Ph.D.
Project Administrator
Missouri EPSCoR

Missouri Transect: Climate, Plants and Community

Project Overview

Missouri Transect will enhance research in the transect from climate to plants to community. These interconnected areas build on research strengths in Missouri and, more importantly, establish a platform for infrastructure investments to fill critical needs. As evidenced by the severe drought of 2012 that afflicted Missouri and other areas of the United States, water availability is the most significant environmental limitation on plants, directly and acutely affecting productivity and consequently the broader society. Climate change will cause periods of drought to become progressively more severe and frequent, which will exacerbate plant water usage and deplete soil moisture, resulting in greater risk of future drought and increased economic and societal impacts.

Missouri Transect builds on established capabilities in plant sciences, remote sensing and imaging, atmospheric and environmental sciences, economics approaches, and the social sciences to better understand and predict the responses of plants and society to climate change.

Infrastructure investments in people, technology, approaches, and ideas will enable us to better understand, model, and predict (1) short- and long-term trends in temperature and water availability in the state; (2) the impact of these trends on the productivity of our state's native flora and agricultural crops; and (3) how different stakeholder communities are likely to respond to these changes. In addition to advancing our research capabilities, the proposed research infrastructure investments will enhance our educational efforts to develop and diversify Missouri's STEM workforce.

Research **Education & Outreach** **Cyberinfrastructure**

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Several MO Transect projects and seed grants focus on aerial imaging using unmanned aerial vehicles (drones) for monitoring seasonal changes in agricultural crops and native prairies.

Photo credit: CAFNR

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Researchers Build Robots to Collect Data On Field Crops

Imagine that you are in the middle of a cornfield. Your task is stop at each plant and collect data on temperature, humidity and light intensity, as well as on the angle, color and area of the leaves. You have the necessary equipment and training, but there is one catch: you are blindfolded.

As you may have imagined, this scenario is an inefficient one; it is difficult to collect data on crops without knowing exactly where the plants are. This is the major challenge Dr. Gui DeSouza and his team at the University of Missouri are working to overcome as they engineer an automated ground vehicle, or AGV, that can navigate and collect data on fields of crops as independently, accurately, and efficiently as possible.

AGVs can navigate autonomously or semi-autonomously in an open environment. Often these environments are fairly structured, as is the case in factories and hospitals, where the robots can follow strict routes and pass many fixed markers that help them navigate. Sometimes, however, they can be rather unstructured. Crop fields fall into this latter category.

Most AGVs designed for use in unstructured, outdoor environments are programmed to rely on GPS for navigation. GPS, however, does not provide the level of detail DeSouza's AGVs need to collect data from plants. Even if markers are placed on the plants, he says, this still only gives the robot a general idea of where to collect data.

DeSouza's solution is to give the AGVs the ability to recognize plants and rows. He plans to do this by mounting cameras and advanced imaging technologies that will allow them to navigate up and down and through rows of crops using camera vision. DeSouza and his team plan to continue building and testing prototypes over coming years until they successfully engineer this sensitive camera technology and can begin implementing the AGVs in data collection.

The new technology will help members of Missouri Transect's Plant Team collect detailed data on entire fields more efficiently and without having to control the AGV's every move.

In addition to AGVs, DeSouza's team is working on a new technology for crop inspection. They call it the Vinoculer, for ViGIR triNOcular observER, and it is an observation tower for imaging using two (stereo) RGB (red-green-blue infrared) high-resolution cameras and one IR camera. The Vinoculer is new, unique technology in that it can be used for aerial inspection of crops, without the trouble or expense of flying UAVs. It compensates for its more restricted field of view by being mobile and easily transported to different areas of a larger field. When completed, it will be used to identify groups of plants under stress and command the Vinobot to get closer to that area for individual plant phenotyping.

University of Missouri graduate student Ali Shafiekhani works on the Vinocular (above) and on the AGV with a fellow researcher (below)

Photo credits: MU ViGIR Lab

Seeing Plants In a New Light

Humankind's wonderment at the color and light we see in the world around us makes it easy to forget that our species can only perceive a small sliver of the light spectrum.

"Human eyes see light with three different receptors that define three major colors," says Mikhail Berezin, assistant professor of radiology at Washington University School of Medicine. "Some fish can see four different colors, certain butterflies five."

The use of hyperspectral imaging in agriculture, however, is relatively new. Which is why, when Berezin heard about the opportunity to participate in Missouri Transect, he saw the potential to take this technology in a new direction.

"I proposed the idea to use optical imaging in plants for early diagnostics of stress, similar to the approach of using optical imaging in early diagnostics of diseases in humans," he says.

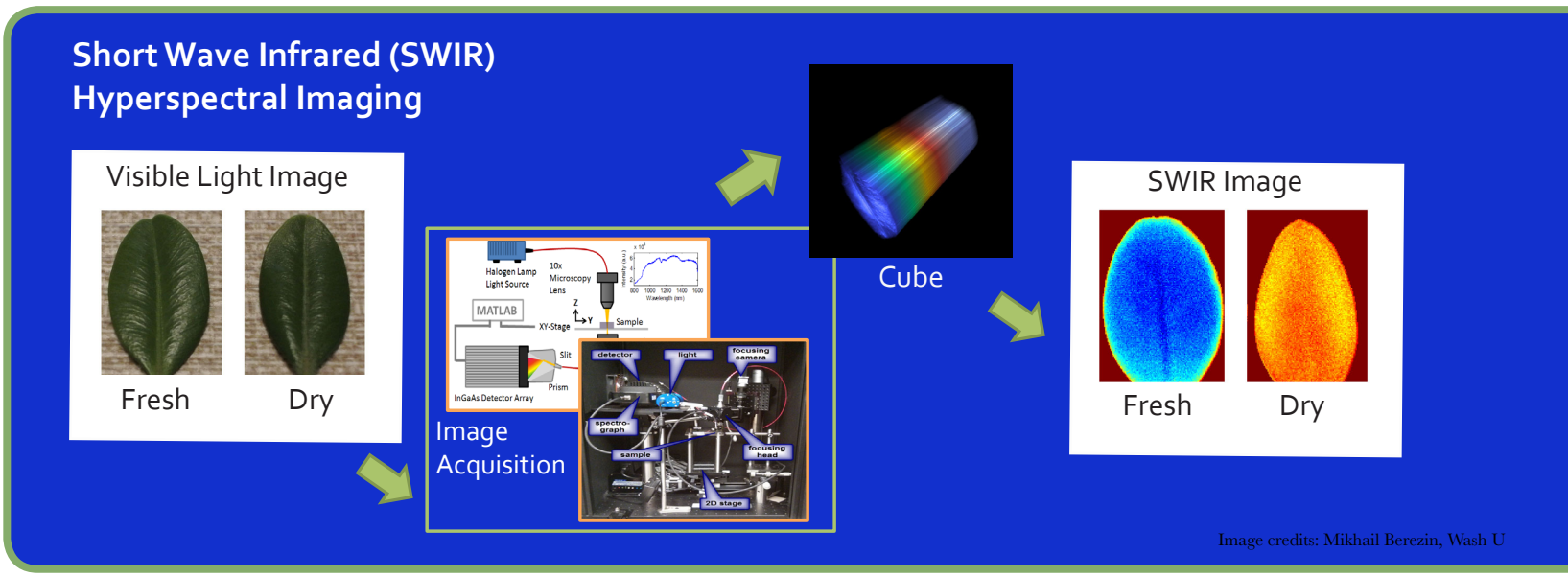


Image credits: Mikhail Berezin, Wash U

Hyperspectral imaging systems, on the other hand, can see hundreds of colors. Berezin and his team are using this technology that sees 512 different colors in shortwave infrared to shed new light on plant health during times of drought.

Hyperspectral imagining technologies work by collecting and processing information from across the electromagnetic spectrum. The goal, says Berezin, is to reveal things we can't normally see with a simple two-dimensional photo or a single spectrum.

"For example, the spectral profile of an object can reveal much about its physical or chemical properties," he explains. Hyperspectral imaging is being widely used, from medicine to astronomy. It's likely you've encountered a hyperspectral image if you've seen astronomical pictures from the Very Large Telescope operated by the European Southern Observatory in northern Chile. In his own research, Berezin uses the technology as a means to detect pathologies in liver and damage to the nervous system, among other biomedical applications.

Berezin is enthusiastic about becoming more involved in plant science, and this research may eventually lead to greater scope in monitoring of plant growth and health in agriculture.

"I always wanted to reach out to other scientific communities," says Berezin.

Besides being an integral member of Missouri Transect's Plant Team, Berezin is also working with the Science Outreach and Education Team to develop new computer science opportunities for students. This summer, he participated in the Computer Science Institute for Women, which is expanding the role of women in the field. His lab is also working with high-school students to develop educational animation and interactive movies explaining the principles of photochemistry and optical imaging in life science.

Mapping Community Resiliency and Vulnerability

What is community resiliency?

The Community and Regional Resilience Institute defines resilience as the ability to anticipate risk, limit impact, and bounce back rapidly through surival, adaptability, evolution, and growth in the face of turbulent change. This includes a community's ability to minize any disaster's disruption to everyday life and its local economy.

Photo credit: CAFNR

How does one measure the holistic strength of a community in the face of climate change variability?

Over the course of the past year, Brian Dabson from then MU Institute of Public Policy and his colleagues on the Missouri Transect Community Team have been creating a system to answer this question by examining various indicators at the regional and national level.

The goal of the Community Team is to 'ground' the science coming out of the Climate and Plant Teams, says Dabson. How will the climatic changes that affect plants also affect the communities that rely on those plants?

Dabson is working with Sonja Erickson, Kathy Miller and a team at the University of Missouri's Center for Applied Research and Environmental Systems. Building on methods initially developed by researchers at the University of South Carolina, the team has devised an index that acts as a composite measure of human resilience and vulnerability to economic, social, environmental and infrastructural changes.

The major challenge during the first year of research, Dabson reflects, was identifying appropriate indicators and what kind of data would support them from the plethora of available options. For example, social indicators might include data on education levels, health, and degree of civic engagement, while economic indicators might include level of economic activity, degree of entrepreneurship, and how many businesses are locally owned versus not. Infrastructural considerations might include medical care capacity and evacuation routes. "It was important to select indicators that would be reliable and independent from one another, so as not to skew assessment of overall resiliency towards any one factor," says Dabson.

Once the team selected an appropriate set of indicators, they scaled the community's rankings on each one and added them together to produce the most complete picture possible. Visually, this picture looks like a map, or a series of colorful maps. These maps show the overall resiliency and vulnerability by county or just one category of indicator, such as social (as seen on the map pictured). The maps range in scale from the state to the entire country.

This research is part of an ongoing project for Dabson, who is measuring community and regional resiliency for a national, regional, and county Resilience Index. He knew that looking at these multiple dimensions of resiliency might be an exciting complement to the work of the plant and climate scientists working within Missouri Transect.

"When this opportunity came along, I floated the idea that it might be interesting to anchor some of the work that we do with the community team to the idea of resilience at the county and regional level within Missouri so that we have a way in which we can help communities cope with some of the stresses and strains that come with climate change variability," says Dabson.

In the next year of research, Dabson plans to focus on testing the accuracy of the new index, conducting a "ground truth" of its indicators in communities across the state.

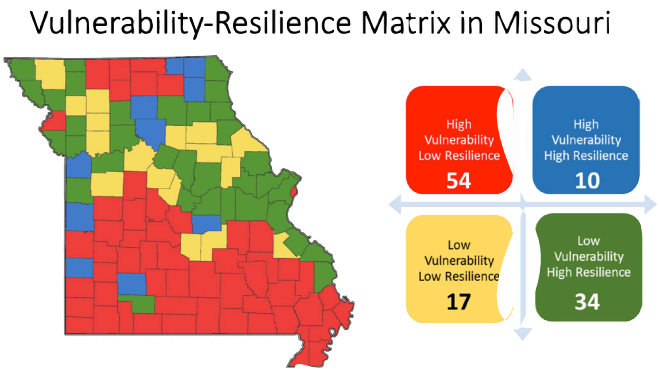


Image credit: Brian Dabson, Institute of Public Policy

This map uses different colors to indicate levels of social vulnerability and resilience in counties throughout Missouri

New Exhibit Will Highlight Local and Regional Agriculture

Photo credit: GAFNR

Missouri is a state built on agriculture. Even the heart of St. Louis, Missouri's largest metropolitan area, is only a stone's throw away from large expanses of farmland in Missouri and Illinois. Despite this physical closeness to arable land, many Missourians are unaware of how their food system—starting with scientific advances, production, processing, distribution, and consumption—actually works.

This gap in agriculture knowledge is what the new, cutting-edge Agriculture Exhibition set to open at the Saint Louis Science Center in 2016 will seek to close. The exhibition will promote the message that "All of us have a role to play in the stewardship of our food supply, today and in the future."

Cindy Encarnación, Ph.D., senior director of STEM content at the Saint Louis Science Center, conveys a palpable enthusiasm and belief that this exhibit will enable visitors to develop a more personal connection with agriculture

"We're really excited about the potential of this exhibition to give new meaning to 'where your food comes from.' Most people are familiar with the food products they see at grocery stores or markets, but don't have an inkling as to the where, how, and who of agriculture that made those food products possible. With the interactive exhibits and memorable experiences we're developing, we will be able to encourage everyone to think about how agriculture impacts their lives."

An artist's rendering of the outdoor exhibit, including technology in food production (Image credit: SLSC)

The development of this personal connection could happen in a number of ways, given the diverse array of features the exhibition will include. The exhibition will consist of different zones with educational themes ranging from the basic science of how plants work to the technology that makes modern agriculture possible. In other zones, visitors will learn about agronomics, water resources, plant genetics, soil, bees, livestock, climate, and fermentation.

The exhibition places a high value on interactivity, so visitors can look forward to unique and immersive experiences. For example, in "Play the Rain," visitors learn about water resources and make decisions about water use; another exhibit will highlight the use of technology in food production—visitors will be able to climb up into a combine cab and see drones and field robots in action. Perhaps the "crown jewel" of the exhibition is a huge interactive map of Missouri and Illinois, where visitors can use embedded media to explore places of agricultural significance and get to know the people in agriculture who make it possible to grow, package, and transport our food.

An artist's rendering of an indoor space at new exhibit (Image credit: SLSC)

Just as the seasons change, and the agricultural landscape with them, so will the exhibit. The Science Center staff will work with Missouri Transect researchers, farmers and agribusiness companies to identify stories and technology to highlight in the exhibit. By working with farmers and other agriculture professionals, the Science Center will be doing its utmost to represent the entire process and a diversity of perspectives, from field to table.

SAINT LOUIS sciencecenter

The Saint Louis Science Center is located at 5050 Oakland Avenue in St. Louis, Missouri and seeks to make science fun through informal, interactive learning experiences. Visit the Science Center's website at **www. slsc.org** or follow the Science Center on twitter **@SLSC** for information about current and upcoming exhibits, visiting hours, and more!

New Radar To Provide Illumination on Mid-Missouri Storms

Climate scientists know all too well that there are many ways to examine any given storm, from the storm's location and its various vertical layers, to the speed at which it moves and the type and amount of precipitation it brings. University of Missouri climatologist Dr. Neil Fox hopes that the new Doppler radar installed at the University of Missouri in July 2015 will help make all of this information and more available to scientists and the general public.

The Doppler radar, which is located at the university's South Farm, will play the important role of filling a gap in radar coverage of Mid-Missouri. The National Weather Service, in addition to researchers, will utilize the data collected by the radar. The nearest Doppler radars are located in St. Louis and Kansas City. While these radars provide some data on weather in the middle of the state, the new radar will generate much more detailed information, especially regarding ground-level conditions. "We can get very fine scale observations," says Fox. He hopes that the radar will "demonstrate the value of this kind of radar in this kind of location," between major urban centers.

Fox, who is Associate Professor of Atmospheric Science in School of Natural Resources, will oversee use of the radar, and provide expertise on processing and analyzing the data it yields. This will include collaborations not only with climatologists, but also with experts in other disciplines such as plant scientists, soil scientists, and biological engineers. Besides monitoring weather, the radar may be capable of collecting data on environmental phenomena as diverse as migrating butterflies. Fox hopes to communicate with other scientists about what the radar can and cannot do, and in doing so open the door to potential collaborations.

Fox also anticipates utilizing the radar in an educational capacity by getting students involved with the data at both the undergraduate and graduate levels. He plans on creating undergraduate research opportunities, presenting case studies of certain storms tracked by the radar and teaching students to "work with the data and explore how much you can do with it."

Photo credit: CAFNR

First Computer Science Institute for Women Held at Danforth Center

Did you know…

74% of middle-school age girls are interested in STEM but only 0.4% of female college freshmen choose computer science as a major.

Women earn 57% of all bachelor's degrees but only 12% of these degrees are in computer science.

The number of women in the computer science field has decreased from the 1980s, but these jobs are some of the highest paying out there for women.

Students at the CSIW learn how to run code using Raspberry Pi Computers (Photo credit: DDPSC)

Each summer, one EPSCoR-affiliated institution in Missouri will host a multi-day workshop to target young women interested in careers in computer science and in the science-technology-engineering-mathematics (STEM) fields. The Computer Science Institute for Women (CSIW) fits the vision statement of the Missouri Transect to "enhance the state's infrastructure for science and technology, stimulating Missouri's economy and leading to job creation" by giving young women the tools and inspiration to emerge as leaders in STEM.

The inaugural CSIW was held on July 20-22, 2015 at the Donald Danforth Plant Science Center (DDPSC) with sixteen participants, including high school, undergraduate and doctoral students, and other young women interested in coding and bioinformatics. Five instructors from DDPSC and Washington University led sessions on **Raspberry Pi** microcomputers, phenotypic and genomic analysis, and challenges and opportunities to enter computer science and STEM fields as women. Other fun activities during the workshop included a scavenger hunt around the DDPSC campus using the mobile **RePhoto app**. Invited speakers, including Missouri EPSCoR scientists, and postdoctoral associates from the DDPSC, and a research associate from Washington University, gave talks about their research and described their paths into programming.

Many described their experience in coding as "self-taught" in order to run their own data analysis and therefore expedite their results.

The group had a great time learning a variety of topics from the presentations. One student remarked that it was "very cool using the tools that scientists actually use." They enjoyed the hands-on activities to learn coding. They felt like they learned about the real world applications of computer science in a positive and encouraging environment.

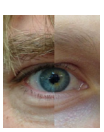
The next CSIW will be held at the University of Missouri campus in Columbia on June 27-28, 2016. In addition to learning coding, career pathways, and phenotypic and genomic analysis, participants will also explore computer science applications in climate research.

What is Raspberry Pi?

A Raspberry Pi computer is a $35 device that you can use to learn programming languages like Python. RaspberryPi.org defines the Raspberry Pi as "a credit-card sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing, browsing the internet and games. It also plays high-definition video. We want to see it being used by kids all over the world to learn programming." Learn more at **www.raspberrypi.org** or follow the organization on Twitter **@Raspberry_Pi**.

What is RePhoto?

RePhoto is an image capture application explicitly designed to support repeat photography -- the process of taking a new image from exactly the same perspective as a previous image. In rePhoto this is made easier by showing the previous picture semi-transparent so that a new picture can be more accurately aligned. It was created by Missouri Transect researcher Robert Pless and a team at Washington University. Learn more at **projectrephoto.com** and download the app at the iPhone app store or Google Play.



Images from projectrephoto.com

Missourians Get Hands Dirty Digging Into Soil Science

Dr. Sandra Arango-Caro knows that it can be challenging to get people excited about soil. Luckily, it's a challenge she is excited to dig into.

Students participate in a MO DIRT citizen science activity (Photo credit: MO DIRT)

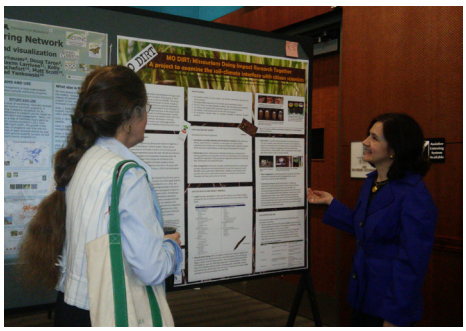
Arango-Caro is an Education Programs Facilitator at the Donald Danforth Plant Science Center in St. Louis, who works with Dr. Terry Woodford-Thomas, Driemeyer Director of Science Education and Outreach there. Together, they lead a new citizen science education program called Missourians Doing Impact Research Together (MO DIRT). Through this program, citizens across the state will be further educated on soil health and learn about potential reciprocal soil-climate interactions and the importance of soil to our lives at the state, community and household levels.

As the word "together" implies, MO DIRT is a project based on communities. The three main components of MO DIRT are a soil science curriculum for K-12 students, independent research projects by high school students, and citizen soil health surveys. Volunteer citizens, in addition to trained scientists, will collect and analyze soil samples for variables that influence soil dynamics and are indicators of soil health. Some of these variables are soil and air temperature, soil moisture, soil respiration, soil organic matter, and soil nutrients among others. MO DIRT offers training sessions to prepare volunteers to conduct soil health surveys over time representing a variety of habitats (forest, prairie, croplands, cattle fields, etc.). This will create a sustainable system for the ongoing collection of data by citizens that can be used both for educational and scientific research purposes.

Like scientists, citizen scientists need the proper equipment and tools to do research. Therefore, MO DIRT is distributing soil kits to educators across the state. These kits include equipment and material to measure physical and chemical properties of the soil as well as its biological activity. Included are air and soil thermometers, soil samplers, materials to measure soil respiration, metal rings to determine bulk density and water content, and chemical reagents to determine the amounts of nutrients and carbon directly available to soil microbes.

The time is right to launch MO DIRT, as 2015 was the "International Year of Soils," as designated by the United Nations with the goal of bringing attention to how soil plays such an important role in all of our lives. MO DIRT has been introduced to the public at schools, scout events and statewide agricultural educational days with activities and demonstrations about "The Living Soil" and "The Breathing Soil." The first training sessions were offered in St. Louis and Rolla in Fall 2015. The website for MO DIRT will offer guidelines and tools for the participants of all ages, interest and experience, as well as a web-based portal to enter collected data.

Citizen science encourages volunteers to take ownership in monitoring and contributing to scientific studies, including the assessment of the environmental health of their own communities and state. It is not a new concept. Its roots reach over one hundred years back, to a time when amateur scientists—sometimes called "independent scientists" or "gentleman scientists"—were prominent players in the scientific community, before it became standard for scientists to be affiliated with formal research institutions such as museums or universities. In the 21st century, as the Internet and smart-phone apps have become more user-friendly and widespread, citizen science has found renewed vigor as a global movement with active projects in many countries. Today, groups from around the world share their citizen science projects at the National Citizen Science Conference. Arango-Caro was invited to share MO DIRT at the February 2015 conference, which occurred in San Jose, CA.



Dr. Sandra Arango-Caro presents about MO DIRT to a conference attendee at the Citizen Science Conference in February (Photo credit: MO DIRT)

She considers MO DIRT to be a decisive initiative at the state level in a time when farmers, educators, conservationists, and community leaders are becoming more aware of the importance of soil, not only in terms of food security, but in climate regulation. The fact that soil scientists are expanding their knowledge on the biology of soil implies a whole new focus that establishes a more direct link between communities and soil. What better way to continue this approach than with the participation of citizens who can provide a great force for data collection while becoming more knowledgeable and better advocates for soil health and conservation.

Citizen science needs citizens like you! Anyone interested in MO DIRT is very welcome to participate in this new Missouri citizen science initiative. Please contact Terry Woodford-Thomas at ***tthomas@danforthcenter.org*** *for more information.*

Photo credit: CAFNR

Spotlights

New Team Member Spotlight: Amy Walsh

When Dr. Amy Walsh joined Missouri EPSCoR in January 2015, she hit the ground running.

Walsh programs, analyzes, and generally manages the database that stores and organizes the data collected by the Climate and Plant teams for reporting to the NSF—no small task.

Walsh came to the Midwest from the East Coast with a diverse background in math and computer science. After earning undergraduate and graduate degrees in both fields, she spent time as an adjunct professor at New York University before three years of working at the Department of Defense as a mathematician. When Walsh moved to Missouri, she taught in the University of Missouri's Math Department, before beginning her work for Missouri EPSCoR.

Walsh in her office at the University of Missouri

Walsh has already earned high praise from her EPSCoR colleagues for her work on the database. The database is run on Drupal, a content management system similar to Wordpress. Drupal serves as a platform to construct websites, and allows for the addition of different modules to improve functionality, such as the reporting software. This reporting platform is the fundamental infrastructure for data collected by Missouri EPSCoR scientists and plays important roles, such as helping enable them to synthesize their data for research papers.

Walsh says she enjoys the diverse challenges of the job.

"I like the fact that it has a lot of different aspects to it," she says. "It's not just pure software engineering. It includes system administration as well as handling, curating, and managing data."

Walsh appreciates being part of a project that is making a difference for Missourians.

"I'm really interested in the goal of the project to study climate variability in Missouri and its potential effects on communities. I also really enjoy the community outreach aspect of the projects as well," she says.

Walsh is an integral member of the outreach efforts. She worked with the Climate Team to help coordinate the data transfer to the server for the new Doppler radar and for weather sensors. With the Education Team, she will be setting up websites so teachers can download ecology lessons and learning modules. In the vast mosaic of research and education that constitutes the Missouri Transect project, it is the innovation and hard work of people like Walsh that is the grout holding everything together.

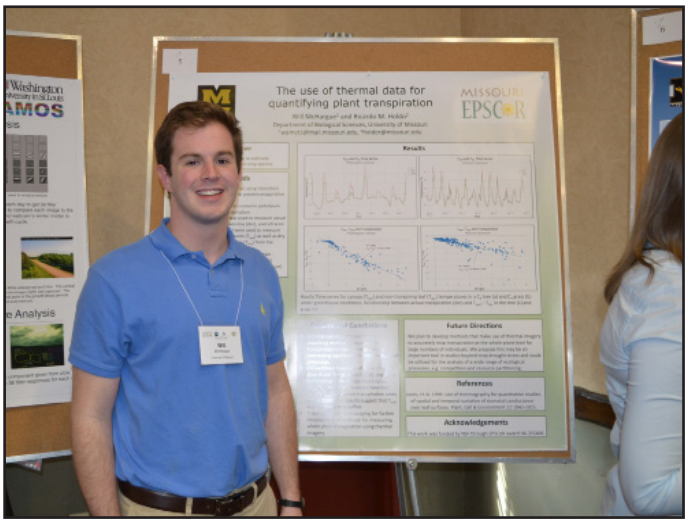
Photo credit: CAFNR

Student Spotlight: Will McHargue

University of Missouri undergraduate Will McHargue has a unique composite of academic pursuits: a degree in Biomedical Engineering, a self-taught knowledge of computer programming and a passion for plant science. In November 2014, McHargue's search for a research experience that would allow him to explore these various interests lead him to an opportunity in Missouri Transect scientist Dr. Rico Holdo's lab. Under Holdo's mentorship, McHargue is conducting research for the first time, studying tools and methods for analyzing transpiration in plants.

McHargue's research project, entitled "The use of thermography for quantifying plant transpiration," centers on the comparison of mass changes in plants due to transpiration which causes temperature changes in leaves. Species studied include *Philenoptera violacea* and *Panicum maximum*, which are a tree and a grass native to Africa, respectively. Dr. Holdo's expertise as a savannah ecologist affords McHargue a deeper knowledge of these species, and the fact that the species have very different metabolisms from one another make them suitable subjects for comparison, and good proxies for similar species in tallgrass prairie ecosystems. The project has allowed McHargue to develop skills that range from setting up instrumentation to receiving and analyzing data from plants. In the process he has become familiar with such technologies as infrared thermometers, thermal imaging cameras, and soil moisture sensors.

McHargue presented his project alongside other student researchers at the Missouri EPSCoR Statewide Meeting in June 2015, and was awarded fourth place in the poster competition. McHargue found the experience to be highly beneficial and enjoyed the chance to receive feedback from Missouri Transect members in a wide range of areas during the poster session. "It was great to see the collaborations EPSCoR encourages. It reminds me of the bigger picture," says McHargue of the conference.



McHargue presents his research at the Missouri EPSCoR Statewide Meeting

In fact, McHargue is vocal about his enthusiasm for the wide-ranging, interdisciplinary scope of Missouri Transect. Hailing from a family of educators—his three sisters are all teachers—he says that he especially appreciates the education and outreach components of EPSCoR's goals, and enjoys being involved in a project that works to present technical information to the general public in a way that is exciting and accessible.

McHargue completed an internship at the Donald Danforth Plant Science Center this summer and will continue to work in Holdo's lab this fall, with an eye towards future interdisciplinary work. "I work with plants with Dr. Holdo, but my interests extend beyond that," he explains in reference to his interest in neurobiology and computer science. Indeed, it seems that McHargue's work in the Missouri Transect may be the first of many interdisciplinary projects to come.

Photo credit: CAFNR

The Plant Imaging Consortium

What is PIC?

The Plant Imaging Consortium (PIC) brings together experts in plant biology, radiochemistry, phenomics, imaging, and computational biology at institutions in Arkansas and Missouri. PIC aims to improve research infrastructure for high-throughput phenotyping (HTP) and molecular imaging (MI) in Arkansas, Missouri, and beyond, and strengthen education and workforce development in biology, chemistry and computational science. PIC is funded by the National Science Foundation EPSCoR for three years, beginning on August 1, 2014.

PIC Workshops

High Throughput Screening (HTS) Workshop

At Arkansas State University, Dr. Argelia Lorence led a formal, hands-on workshop in phenomics to offer common standards and to train plant scientists on the Scanalyzer HTS technology.

Participants at the HTS Workshop

19 participants at 5 institutions (9 males and 10 females; 11 from Arkansas and 8 from Missouri)
2 Faculty
5 Postdocs
9 PhD students
2 Master's students
1 Undergraduate

Species phenotyped: Arabidopsis, rice, maize, tobacco, tomato, soybean, water hemp

Radiotracer Imaging Technology (RIT) Workshop

At Washington University in St. Louis, Dr. Yuan-Chuan Tai led a three-day workshop to offer basic training on radiotracer imaging technology to potential PlantPET Imager users.

14 participants at 6 institutions (6 males and 8 females; 4 from Arkansas and 10 from Missouri)
2 Faculty/senior scientists
5 Postdocs
5 Graduate students
2 Staff/Technicians

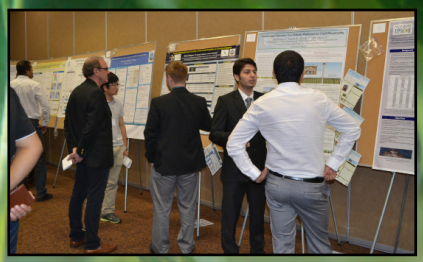
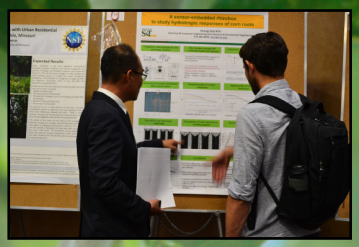
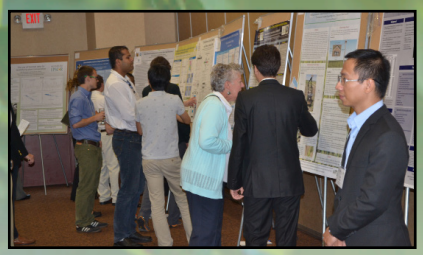
Participants at the RIT Workshop

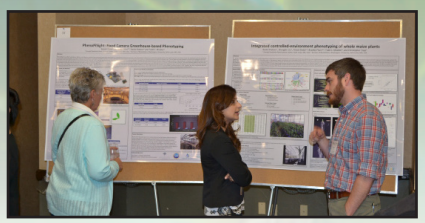
PIC Outreach

The consortium supports education in science and technology by providing research opportunities to undergraduate and graduate students, and by offering outreach programs for primary and secondary schools, including dissemination of the Mutant Millets hand-on teaching module, developed at the Danforth Plant Science Center in St. Louis, MO.

Learn more about PIC at plantimaging.cast.uark.edu and follow them on Twitter (@PlantImaging) and Facebook (Plant Imaging Consortium)

Photo credit: CAFNR






Images from the Statewide Meeting poster session

STATEWIDE MEETING

June 10-12, 2015, marked a unique gathering of scientific minds from across the state of Missouri. Over the course of three days, engineers, plant scientists, computer scientists, educators, administrators and student researchers assembled at the Stoney Creek Hotel & Conference Center in Columbia for the first annual Missouri EPSCoR Statewide Meeting.

Since receiving National Science Foundation funding on August 1, 2014, members of Missouri EPSCoR have undertaken research and educational activities within the framework of two overarching projects: the Missouri Transect: Climate, Plants, and Community and the Plant Imaging Consortium. Within the Missouri Transect, five teams (three research, an education team and a cyberinfrastructure team) are doing work across the state at various institutions. The Statewide Meeting provided members of all teams a valuable opportunity to interact with one another and learn about others' work and results. It also created a space in which members could form future collaborations and engage in discussion about how to best advance toward the goal of improving the state's STEM capabilities for "innovation and knowledge-based prosperity."

The conference opened on June 10 with an introduction from the former University of Missouri System President Timothy M. Wolfe and a keynote address from Chief Scientist at The Climate Corporation, Dr. David Fischhoff. Presentations on June 11 included leaders of the Climate, Plant, Community, Education, and Cyberinfrastructure teams; the Statewide Committee Chair Dr. Keith Gary, Vice President at the Kansas City Area Life Sciences Institute; and Missouri EPSCoR External Advisory Board Chair, Dr. Eugene Takle. Student researchers presented their research during a poster session. Researchers had time to meet within and amongst teams to share their progress and get feedback for upcoming stages of their projects.

The conference culminated on June 12 with presentations by team leaders to the External Advisory Board. The External Advisory Board is comprised of researchers from around the country who are at the top of their field, with expertise in the array of research in the Missouri Transect, who then made recommendations for the future of the program.

Missouri EPSCoR members and all those who interact with the program look forward to reaping the benefits of new collaborations stimulated by the conference in the coming year.

MISSOURI EPSCoR

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Photo credit: CAFNR

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