



CFAES

SCHOOL OF ENVIRONMENT AND NATURAL RESOURCES

HIGHLIGHTS

2017 & 2018



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

ABOUT US

The School of Environment and Natural Resources (SENR) at The Ohio State University creates science-based knowledge and fosters environmental sustainability through teaching, research and outreach. SENR is a distinct, interdisciplinary academic unit administratively housed within the College of Food, Agricultural, and Environmental Sciences (CFAES). By integrating the natural and social sciences, we promote discovery and leadership through a comprehensive approach to better understand and address environmental and natural resource challenges locally, regionally and globally.

We are dedicated to the use and management of natural resources in an economically efficient, environmentally compatible, and socially responsible manner. Our programs are delivered by faculty with expertise in various aspects of aquatic and water resources, environmental social sciences, forestry, rural sociology, soil science, and wildlife ecology. Through our outreach we also spread that information across the state of Ohio. Our graduate and undergraduate students, and our faculty and staff make the School an exciting place for research, learning and service.

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A NOTE FROM THE DIRECTOR

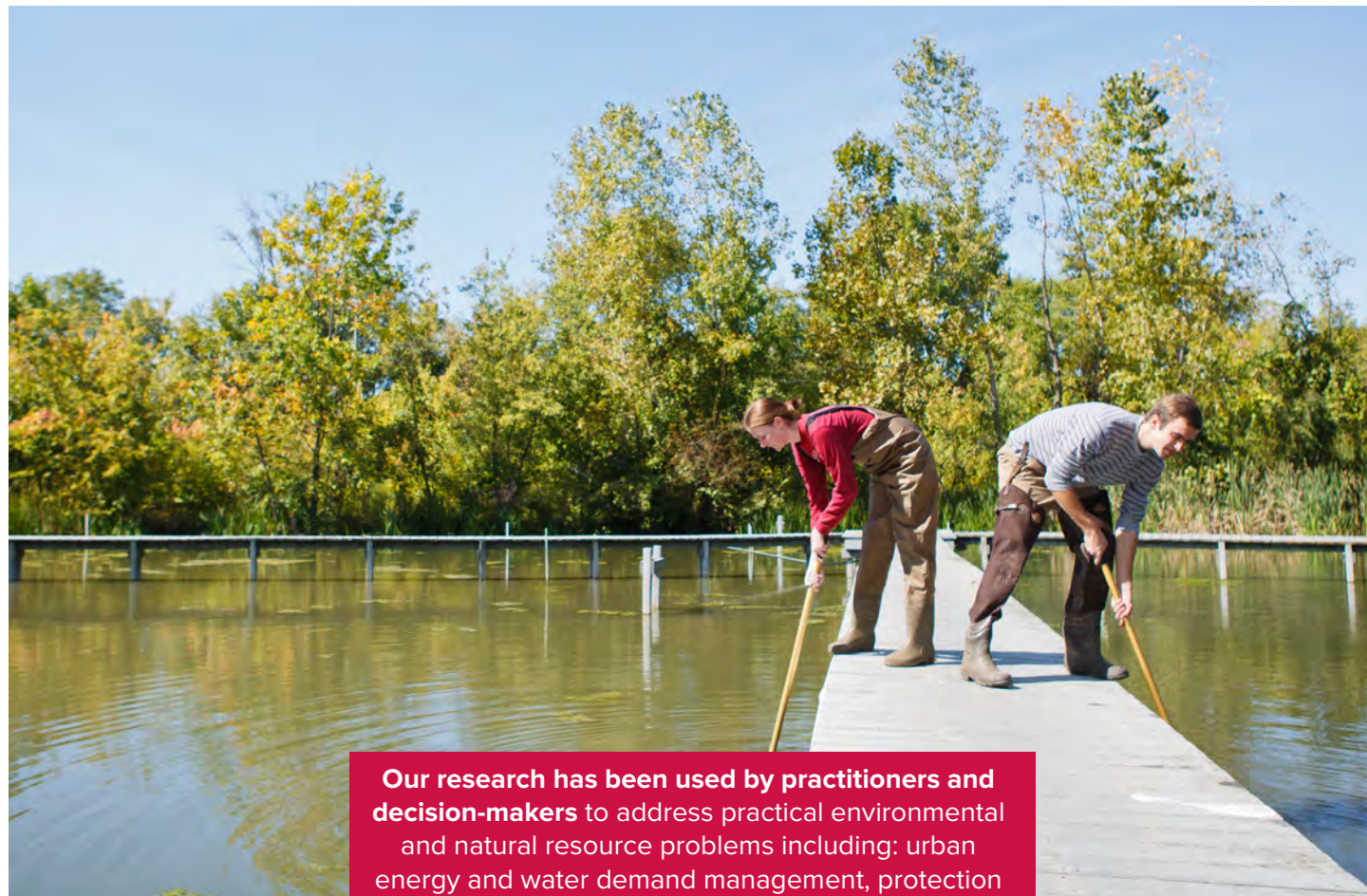
A Year of Celebration and Looking Ahead – 50 Years of the School of Environment and Natural Resources



As the School of Environment and Natural Resources wraps up its 50th Anniversary and moves into its next half century, I am delighted to share with you this report of highlights from the last 18 months. The school is alive with activities and I hope these materials give you a flavor of the growth and impact we are experiencing. We remain committed to providing a high quality student experience, we are seeking new ways to better serve our stakeholders and environmental professionals, our research activities have grown in recent years and our team is deepening its focus on the important issues impacting Ohio and our World. I am particularly pleased to share in this year's highlights a set of programmatic impact statements that succinctly describe signature areas of activity in the school and some of the impact. It is a joy to work with such a motivated community of students, faculty and staff. I am hopeful for the future and optimistic that the school and all of its partners can make a difference.

*Jeff S. Sharp
Director, School of Environment and Natural Resources*





Our research has been used by practitioners and decision-makers to address practical environmental and natural resource problems including: urban energy and water demand management, protection of endangered species, and sustainable food and farming systems.



RESEARCH

School of Environment and Natural Resources faculty, staff and students are engaged in a dynamic research portfolio integrating the natural and social sciences within the context of natural resource use and management for a sustainable environment. Many of the School's research initiatives are organized into centers and laboratories. Some of these include:

- **The Carbon Management and Sequestration Center (CMASC)** (cmasc.osu.edu) has the mission to make soil/agriculture integral to any strategy of addressing global issues including food and nutritional security, climate change adaptation and mitigation, water renewability and quality.
- **The Environmental and Social Sustainability (ESS) Lab** (ess.osu.edu) aims to advance the state of knowledge and disseminate findings for concepts and methods concerned with environmental and natural resource issues, as well as to conduct innovative and valuable research that helps frame thinking and debate about environmental and natural resource challenges.
- **The Terrestrial Wildlife Ecology (TWEL) Lab** (twel.osu.edu) works to contribute information and expertise to support effective stewardship of Ohio's wildlife resources and promotes understanding of ecological and social factors that effect wildlife and natural resources nationally and internationally.

The school's research portfolio includes broad support from federal and state agencies, private industry, and foundations. Our faculty, staff and graduate students were awarded 44 grants totaling nearly \$6 million in research investments in 2017.

The scholarly and societal impact of our research initiatives is broad. We publish in top tier environment and natural resource journals spanning topics covering forestry, soils, environmental policy and politics, water and water management, climate, resource management, wildlife and wildlife management, aquatics and fisheries, sustainability, and ecological restoration.

\$6m

in grant activity in 2017 from sponsors such as the National Institute of Food and Agriculture, Ohio Soybean Council, Ohio Corn and Wheat, Ohio Division of Wildlife, U.S. Fish and Wildlife Service, National Science Foundation, U.S. Department of Agriculture, U.S. Forest Service, Great Lakes Commission, Environmental Protection Agency, Bureau of Land Management and others.

Learn more about SENR's research impact at go.osu.edu/senrimpact

351



publications, 2017-2018. For a full list, visit senr.osu.edu/research/publications



182

public events hosted by the Olentangy River Wetland Research Park (water.osu.edu) in 2017, resulting in improved research- related communication and education, stakeholder involvement, water-quality assessment, securing funding, and policy.



The interdisciplinary research focus of our faculty and staff provide unique opportunities to engage undergraduates in a wide range of applied research experiences on topics including **community development, ecosystem restoration, environmental policy, environmental law, environmental science, fisheries, forestry, natural resource management, parks and recreation, soil science, sustainable agriculture, sustainable business management, water science and wildlife.**

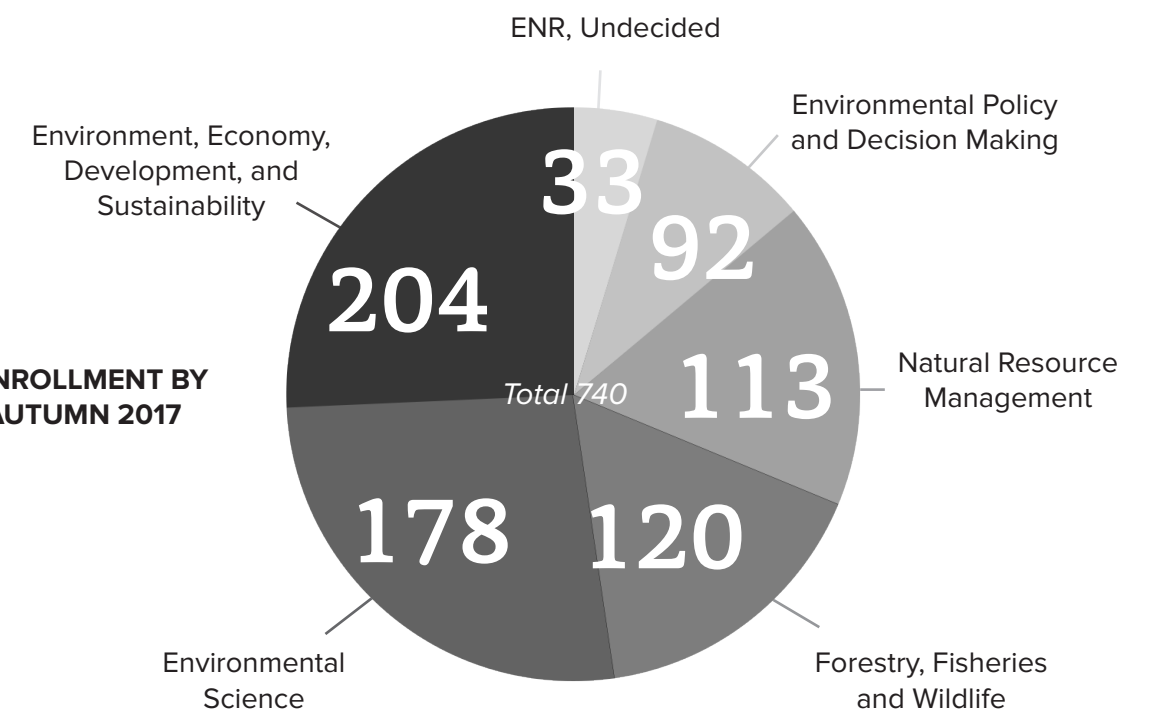


TEACHING

One of the most dynamic ways SENR prepares students for careers and graduate study is to engage them in experiential learning activities that help students integrate the concepts and skills they have gained in the classroom. Our main venues for experiential learning are capstone courses, internships, and field-based studies, all of which have seen notable success in 2017 and 2018. These programs simultaneously fulfill the teaching, research, and outreach missions of the school.

SENR's Honors and Undergraduate Research Programs provide support for undergraduates to conduct mentored research. Our focus on hands-on, student-centered learning has led to gains in students' understanding of the research process and ability to conduct research and work independently. Our students regularly present research at conferences, coauthor journal articles, and have been competitive for jobs, scholarships and fellowships, and graduate school applications in STEM disciplines.

STUDENT ENROLLMENT BY MAJOR - AUTUMN 2017



In 2017 and 2018, SENR Undergraduate Enrollment is at an all-time-high. In 2018, **756 undergraduates were enrolled** in a SENR major, nearly double the number in 2009.

98%

first year retention rate of the SENR Scholars Program (university: 94 percent) and an 82 percent four-year graduation rate (university: 62 percent)





\$126k

in scholarship support awarded to 85 SENR students in 2017, thanks to the generosity of our donors.



ONLINE COURSE OFFERINGS

Course Number	First Offering	Semesters Offered	Campuses Offered	Average SP Enrollment
ENR 2100	SU15	SP, SU	Columbus, Marion	455
ENR 3300	SP17	SP, SU	Columbus	51
ENR 3900	AU17	AU, SP	Columbus	47
RURLSOC 1500	SP17	AU, SP, SU	Columbus, Wooster	103

SENR's first online course, ENR 2100, was introduced in 2015. Average semester enrollment of 455 and demand for online learning sparked the idea to incorporate more SENR courses online, and in 2017, three more courses were introduced as distance learning (ENR 3300, ENR 3900, and Rural Sociology 1500). SENR plans to continue giving students the option by offering more courses online in the coming years.



"Within SENR, there is a greater interest in education abroad than the university at large; **39.1 percent of SENR undergraduates participate in education abroad compared to the university average of 20 percent.**"

Learn more about SENR's teaching impact at go.osu.edu/senrimpact

To make a lasting impression, consider donating to the **SENR Experiential Learning Fund**, which supports curricular and co-curricular learning outside the traditional classroom to provide hands-on real world experiences for students in the School of Environment and Natural Resources. Please visit senr.osu.edu/giving for more information.



167

total number of courses offered Autumn 2017 - Summer 2018



\$39,195

average starting salary reported by SENR graduates

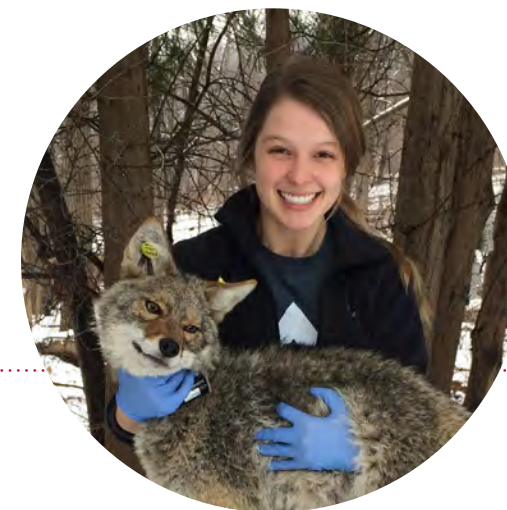


Master of Environment and Natural Resources (MENR) is a non-thesis degree that is appealing both to individuals already working in the field of environment and natural resources who are seeking promotion as well as individuals working in other fields who wish to enter the field of environment and natural resources in an applied or management-related way.



350

acres of outdoor learning including aquatic research opportunities at the Olentangy River Wetland Research Park (ORWRP).



7

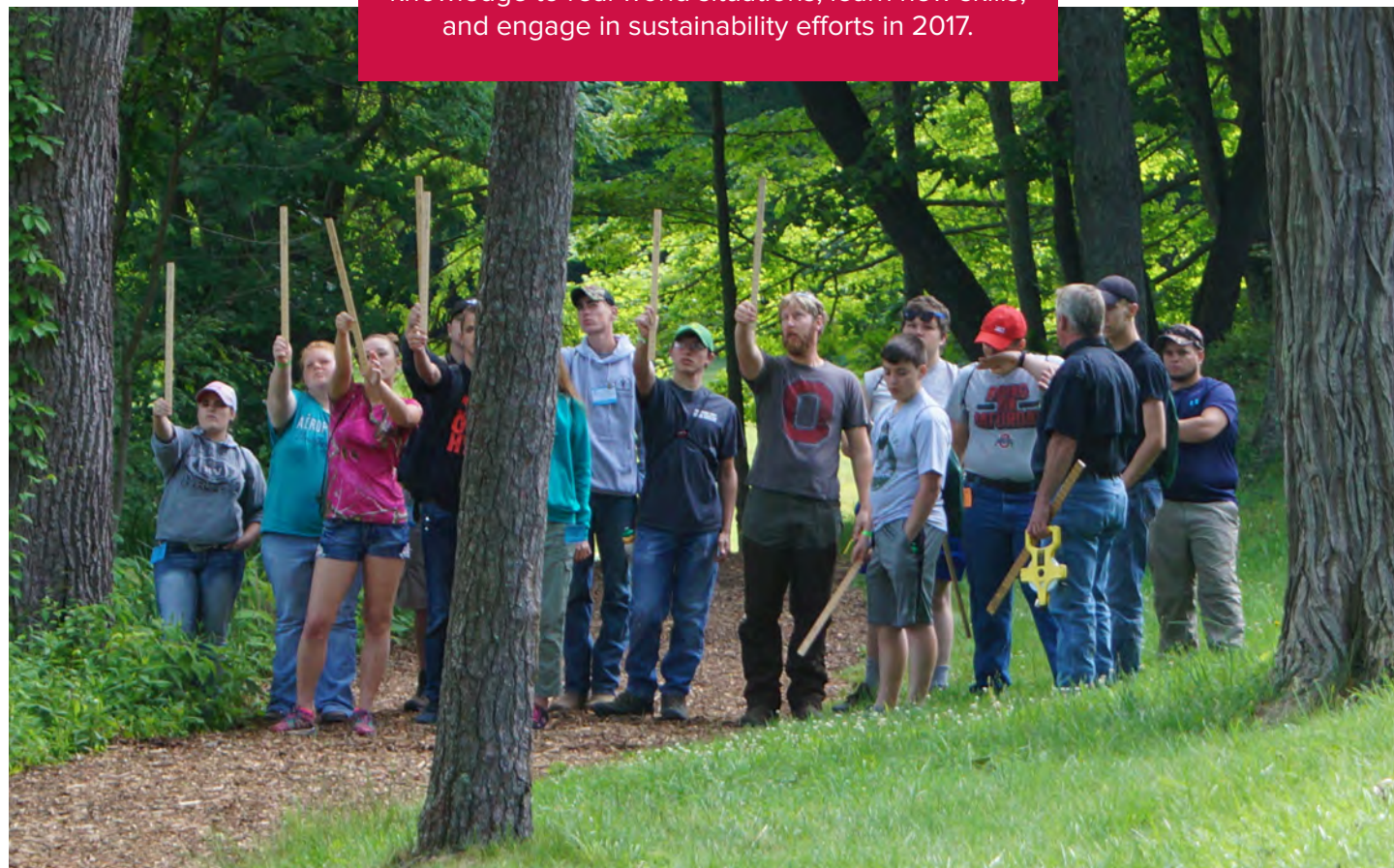
specializations in the **Environment and Natural Resources Graduate Program (ENRGP)** :

Ecological Restoration
Ecosystem Science
Environmental Social Sciences
Fisheries and Wildlife Science
Forest Science
Rural Sociology
Soil Science

In 2017, 15 graduate students were awarded fellowships and 22 in 2018. These include **University, College, Enrichment, and OARDC fellowships.**



Over 1,100 youth had opportunities to learn about natural resources and environmental issues, participate in hands-on exploration, apply knowledge to real world situations, learn new skills, and engage in sustainability efforts in 2017.



EXTENSION AND OUTREACH

SENR Extension/Outreach faculty and staff provide information on critical environmental and natural resource issues and are committed to high quality, accessible education programs. We carry the knowledge of the university statewide through research-based educational and outreach programs. Ohio State Extension faculty and staff in the school partner with individuals, communities, businesses, and organizations to promote the conservation and management of our natural resources. We also collaborate with local and state government and private industry to inform and develop environmental and natural resource plans and policy. Our collaborations include, but are not limited to, the Ohio Department of Natural Resources, Ohio Environmental Protection Agency, and Ohio's Watershed groups. We encourage you to visit us often to stay informed and up-to-date on our educational programs, networking opportunities and newly released publications (senr.osu.edu/research/publications).

"Our efforts have resulted in new city-campus partnerships and provided support for efforts to enhance community sustainability and resilience at home and abroad."

Learn more about SENR's impact at go.osu.edu/senrimpact

29,017

hours of service from OCVN naturalists



350

individuals attended the Ohio Woodland, Water and Wildlife Conference Tree Diagnostic Workshop



11k

individuals reached through aquatic invasive species programs

ENVIRONMENTAL PROFESSIONALS NETWORK

epn.osu.edu

Directed by Dr. Joe Campbell, the Environmental Professionals Network (EPN) is a service of SENR. This network connects environmental professionals both in-person and online. EPN hosts monthly breakfast programs focused on innovative and pressing environmental topics, such as: controlling nutrient runoff and protecting water quality, achieving clean energy goals, and pests and invasive species. Through this network, participants also have free access to many online networking capabilities, such as marketing, querying, information sharing, and more. Participants are also encouraged to create and share content such as job postings, documents, reports and event announcements.



participants at the Annual Signature EPN Event in 2018

HIGHLIGHTS OF THE 2017-2018 ACADEMIC YEAR:

- Attained milestone of 1,900 online participants
- Maintained average breakfast program attendance of 96 participants
- Saw additional collaborations from EPN participant networking
- 719 unique Ohio State students and over 1,000 members of the broader community participated in an EPN event
- Co-sponsored events with various local partners including the Columbus Metropolitan Club and the Water Management Association of Ohio



Left: Dr. Nadaya Zhexembayeva, Chief Reinvention Officer at We Exist Reinvention Agency exploring the concept of sustainable supply chains through the lens of reinvention with analysts from Patagonia, Owens Corning, and Jeni's Splendid Ice Creams. Right: EPN panel concluding a program at the 4-H center.



ALUMNI ENGAGEMENT



The Environment and Natural Resources Alumni Society (ENRAS) is a non-profit society affiliated with The Ohio State University Alumni Association. ENRAS represents graduates from the School of Environment and Natural Resources and promotes the following:

- **Advancing the professions in the fields of the environment and natural resources.**
- **Augmenting the educational and career development of graduates, students, and others associated with the school.**
- **Promoting the education, growth and development of its students, faculty, staff, and alumni, friends, stakeholders and supporters affiliated with the School of Environment and Natural Resources.**

ENRAS publishes the Alumni Connection, a bi-annual newsletter, and maintains a social media presence on Facebook, LinkedIn, and Twitter with the goal of connecting SENR alumni, friends, stakeholders and supporters. An Executive Council with representation from different majors and graduating classes of the School of Environment and Natural Resources provides leadership to the ENR Alumni Society. The ENR Alumni Society has received the OSUAA Scarlet Level Outstanding Alumni Society Award three years in a row: 2016, 2017 and 2018. The Scarlet level is the highest award level that the Ohio State Alumni Association gives to its Alumni clubs and societies. We are very proud of the dedication from our ENR Alumni in their work to serve the School of Environment and Natural Resources, our students, the college and university, our communities and our environment.

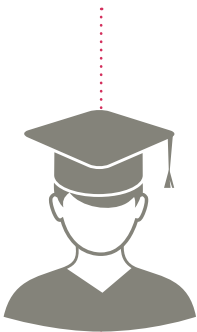
ALUMNI GIVING:

1,216

made a gift in the 2017 Fiscal Year (12%)

\$700,809

in giving in the 2017 Fiscal Year



ALUMNI FACTS:

60%

living in Ohio

9,865

living alumni

1,496

current Sustaining Alumni Members

Connect with other alumni and stay involved with a passionate and diverse Ohio State community. Email enras@osu.edu or find us on Facebook!



School of Environment and Natural Resources hosts a wide variety of events related to Extension and outreach, teaching, research, and alumni. If you would like to attend one of our upcoming events visit our calendar at senr.osu.edu/events .

8/15/2017	EPN Breakfast - Conservation on Farms	Environmental Professionals Network (EPN)	
8/24/2017	ENRAS Social Gathering	Environment and Natural Resources Alumni Society (ENRAS)	
8/31/2017	Seminar Series- Freedom Farmers: Urban Agriculture and Rebuilding	SENR	
9/12/2017	EPN Breakfast Club - Agriculture and Water Quality Issues	EPN	
9/15/2017	Fascinating Woodland Fungi	Ohio Woodland Stewards (OWS)	
9/27/2017	Lunch and Learn Series - Leading Environmental Volunteers	SENR/OCVN	
9/28/2017	Seminar Series - Joe Campbell: Maji Marwa	SENR	
10/6/2017	Fascinating Woodland Fungi	OWS	
10/10/2017	EPN Breakfast Club - Privatizing Public Drinking Water Utilities	EPN	
10/11/2017	OCVN Webinar - Volunteering at the WILDS	Ohio Certified Volunteer Naturalists (OCVN)	
10/12/2017	After Emerald Ash Borer Webinar	OWS	
10/14/2017	Capturing Nature's Wonders Photography Workshop	OWS	
10/16/2017	Environmental Film Series - An Inconvenient Sequel	SENR Film Series	
10/18/2017	Forest Health - Invasive Species	OWS	
10/18/2017	Lunch and Learn Series - Lessons Learned from a Park District Volunteer Coordinator	SENR/OCVN	
10/23/2017	Environmental Film Series - The Messenger: Imagine a World Without Birdsong	SENR Film Series	
10/26/2017	Seminar Series - Jennifer Tank: Coastal Dead Zones	SENR	
10/30/2017	Environmental Film Series - Chasing Coral	SENR Film Series	
11/1/2017	Lunch and Learn Series - Leading Citizen Science	SENR/OCVN	
11/2/2017	Seminar Series - Mike Waddington: Managing Boreal Wildfires	SENR	
11/6/2017	Environmental Film Series - The Penguin Counters	SENR Film Series	
11/7/2017	EPN Breakfast Club - Wild Cats	EPN	
11/13/2017	Environmental Film Series - Sonic Sea	SENR Film Series	
11/16/2017	Seminar Series - Jacopo Baggio: Individuals, Networks and Institutions	SENR	
11/20/2017	Environmental Film Series - From the Ashes	SENR Film Series	
11/28/2017	Alumni Society Meeting	ENRAS	



Lunch and Learn - Leading Environmental Volunteers

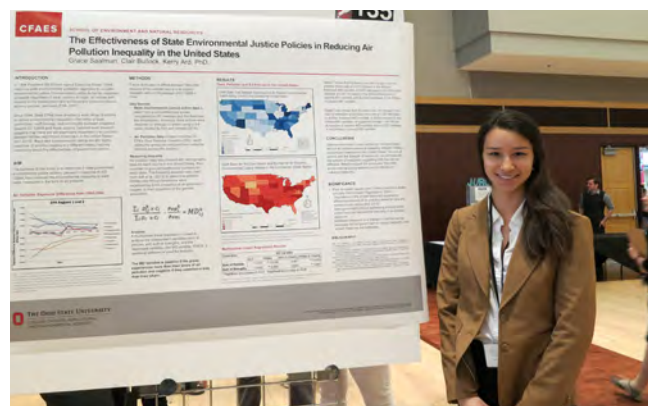
Fascinating Woodland Fungi

Environmental Professionals Network Field Trip to Mechanicsburg: In Good Taste Catering

11/30/2017	Seminar Series - Audrey Sawyer: Surface and Groundwater Exchange	SENR	
12/5/2017	EPN Breakfast Club- Beyond Boundaries, Rural, Urban, Political : Acting on Shared Interests Can Promote Prosperity and Sustainability	EPN	
12/8/2017	Wildlights Event	ENRAS	
12/13/2017	Dragonfly Research with Jim Lemon	OCVN	
1/9/2018	EPN Breakfast Club - Land Grant to Land-Grant: Lessons In Sustainability	EPN	
1/25/2018	Seminar Series - Raj Paroda: Addressing Second Generation Challenges of the Green Revolution While Managing Natural Resources and Climate Change	SENR	
2/8/2018	Seminar Series - Jennifer Rehage: Recreational Fisheries	SENR	
2/13/2018	EPN Breakfast Club - For the Love of Rivers	EPN	
2/22/2018	Seminar Series - Cathy Rakowski Confronting Ethical Issues for Research	SENR	
3/6/2018	EPN Breakfast Club - Flooding: A National, State and Local Issue	EPN	
3/8/2018	Seminar Series - Shoshannah Inwood : Health Insurance and National Farm Policy	SENR	
4/5/2018	Seminar Series - Daniel Raimi : The Fracking Debate	SENR	
4/6/2018	Investigations in Population, Place and the Environment: Social Lawn Art	SENR	
4/16/2018	Environmental Science Student Symposium	SENR	
4/16/2018	EPN Signature Event - Sustainability Through Reinvention	EPN	
4/27/2018	Managing Wildlife Conflict Around Your Home	OWS	
5/8/2018	EPN Breakfast Club - Perspective on the Maple Industry	EPN	
5/18/2018	Woodland Pollinators	OWS	
5/19/2018	RendeZoo	ENRAS	
5/23/2018	Trees on Tap	OWS	
6/12/2018	EPN Field Trip to Mechanicsburg: In Good Taste Catering	EPN	
6/28/2018	Name That Tree!	OWS	
7/10/2018	EPN Field Trip: Wetlands, River, Restoration at the OSU Wetlands	EPN	
7/12/2018	Make a Woods a Home For Wildlife	OWS	
7/26/2018	Selling Timber - A Class for Woodland Owners	OWS	

RECOGNITION

School of Environment and Natural Resources (SENR) faculty, staff and students received honors, recognition and awards in 2017-18.



FACULTY, STAFF RECOGNITION

SPRING 2017



Molly Bean

- Selected as participant in the 2016-2017 The Women's Place Staff Leadership Series at The Ohio State University
- Invited to participate in the Spring 2017 CFAES Leadership Development Program

Ramiro Berardo, National Socio-Environmental Synthesis Center's Commendation for Exemplary Social-Ecological Synthesis Case Study Award for "The Maumee River Watershed and Algal Blooms in Lake Erie" (in coauthorship with Ajay Singh)

Nicole Hoekstra, Third Place Winner in the Research Assistant/Associate Poster Competition at the 2017 OARDC Annual Research Conference, April 20, 2017 for "Can Vacant Lots Buffer Ecosystem Service Loss in Cities?"

Jeffrey Jacquet was named a Fellow, Subsurface Energy Resource Center, The Ohio State University



Rattan Lal

- Honoris Causa degree, Universitat de Lleida, Spain
- Renewable Natural Resources Foundation 2017 Sustained Achievement Award
- Highly Cited Researchers 2017 – Agricultural Sciences, Thomson Reuters
- Received Elsevier Atlas award for his journal article "Food Security in a Changing Climate"



Brian Lower

- Admitted into The Academy of Teaching, The Ohio State University
- Alumni Award for Distinguished Teaching, Alumni Association, The Ohio State University

Lauren Pintor, Rodney F. Plimpton Outstanding Teacher Award, The Ohio State University, College of Food, Agricultural, and Environmental Sciences

Nicole Sintov, Excellence in Reviewing Award, Journal of Resources, Conservation, and Recycling

Kathy Smith, "Outstanding Individual in Conservation Education Award" by the Ohio Forestry Association for her contributions to "Building Ohio State: From Forest to the Renovation of the Thompson Library"



Robyn Wilson

- Selected to participate in the CFAES Leadership Development Program
- 2017 Science Defender, Union of Concerned Scientists

FACULTY, STAFF RECOGNITION

(continued)

AUTUMN 2017



Joe Donnermeyer, received the Lifetime Achievement Award from the Division of Critical Criminology and Social Justice at the annual meeting of the American Society of Criminology (ASC) in Philadelphia on November 16.

The award is presented to a member of the Division for “sustained and distinguished scholarship, teaching and service in the field of Critical Criminology.”



Left: **Richard Moore**, received the Public Policy Award from the American Anthropological Association in November.

Right: **Robyn Wilson**, received the 2017 Society of Risk Analysis (SRA) Chauncey Starr Distinguished Young Analyst Award at the Annual Meeting of the Society for Risk Analysis held in Arlington, VA.

Steve Culman received the 2017 Foundation for Food and Agriculture Research’s New Innovator in Food and Agriculture Research Award. The New Innovator in Food and Agriculture Research program supports promising scientists who demonstrate not only a commitment to catalyzing innovation in food and agriculture, but also a dedication to mentoring students.

Rattan Lal, awarded international research fellowships through USDA’s Borlaug International Agricultural Science and Technology Fellowship Program. By working with a distinguished visiting international scholar from a developing or middle-income country, [faculty] broaden their own network of international collaborators as well as focus on long-term research endeavors that promote improved food security and economic growth.

FACULTY, STAFF RECOGNITION

(continued)

SPRING 2018



Suzanne Gray

- Received the 2018 Alumni Award for Distinguished Teaching at The Ohio State University.
- Elected to serve as President-Elect for the Ohio Chapter of the American Fisheries Society at the annual joint meeting of the Ohio Aquaculture Association and the Ohio Chapter of the American Fisheries Society in January.

SUMMER 2018

William (Bill) Peterman received the 2018 recipient of the Raymond D. Semlitsch Research Award by the Herpetologists’ League.



Nicholas Basta, Roger Williams, and David Hix, received the 2018 North American Colleges and Teachers of Agriculture (NACTA) Educator Award at the 2018 NACTA annual meeting in Ames, IA in June.

William (Bill) Mitsch received the first Odum award for Ecological Engineering Excellence.

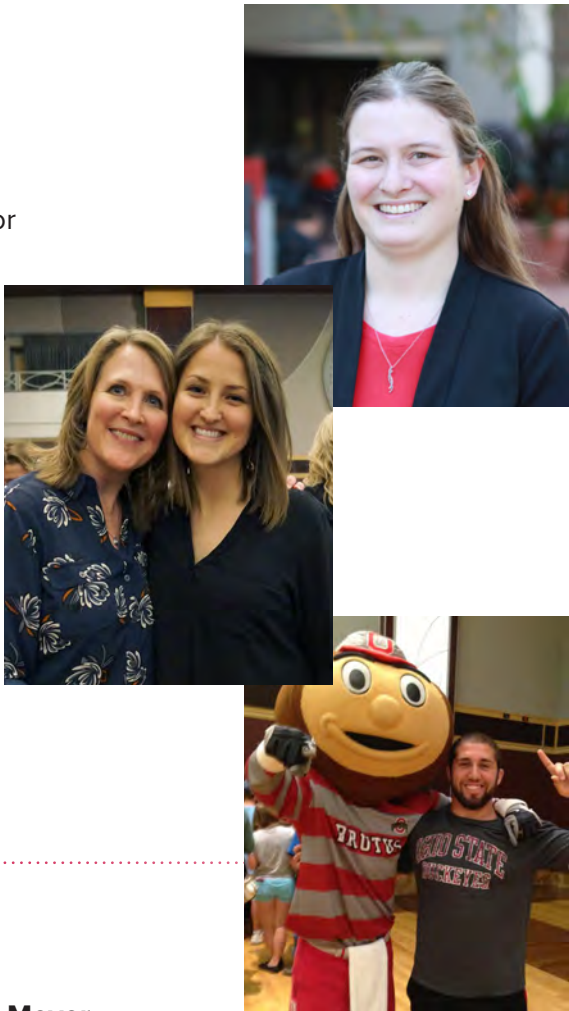
The Universidad Internacional Menéndez Pelayo (UIMP) recognized **Rattan Lal** with the UIMP 2018 Medal of Honor for his outstanding academic merit.

STUDENT RECOGNITION

UNDERGRADUATE STUDENT RECOGNITION & SCHOLARSHIP

2017 Environment and Natural Resources Distinguished Senior Awards:

- **Emma Brown**, Environmental Science (ES) major
- **Cheryl Fladung**, Environment, Economy, Development and Sustainability (EEDS) major
- **Molly Hardesty**, Environmental Policy and Decision-Making (EPDM) major
- **Dustin Kitchen**, Natural Resources Management (NRM) major
- **Mara Momenee**, Environment, Economy, Development and Sustainability (EEDS) major
- **Samuel Reed**, Environmental Science (ES) major



2018 Environment and Natural Resources Distinguished Senior Awards:

- **Katie Brown**, ES major
- **Sarah Fischer**, EEDS major
- **Sarah Miles**, EPDM major
- **Chas Parise**, Forestry, Fisheries, and Wildlife (FFW) major
- **Ris Twigg**, EPDM major

2017 Denman Forum:

Ashlee Balcerzak
Advisor: Steven Lower
Use of Magnetic Bacteria to Remove Phosphorus from Eutrophic Waters
**Awarded 3rd place in Ecological and Environmental Sciences: From Farming to Fisheries and Beyond

Elizabeth Bertolini
Advisor: Suzanne Gray
The Effect of Lake Erie Algal Blooms on the Emerald Shiner

Scott Meyer
Advisor: Lauren Pintor
Giving Up Density As an Approach To Identify a Difference in Foraging Behavior Between Native and Invasive Crayfish Species

Samuel Reed
Advisors: Peter Curtis and Roger Williams
A Cross-Comparison of Deer Impact on Canopy Structural Complexity Across Boreal and Deciduous Biomes

STUDENT RECOGNITION

(continued)

2017 Denman Forum (continued):

Hailey Tiarks
Advisor: Suzanne Gray
The Influence of Turbidity On Eye and Brain Morphology In an African Cichlid

Kira Edic
Advisor: Christopher Tonra
Breeding Success in Relation to Nestling Physiological Stress in Prothonogary Warblers at Hoover Reservoir in Delaware County, Ohio

Makayla McKinney
Advisor: Suzanne Gray
The Influence of Water Quality on Parasite Loads in African Cichlid Fish Communities

Andrew Wilk
Advisor: William Peterman
Effects of Habitat Patch Size on the Abundance of Red-Backed Salamanders (Plethodon Cinereus)



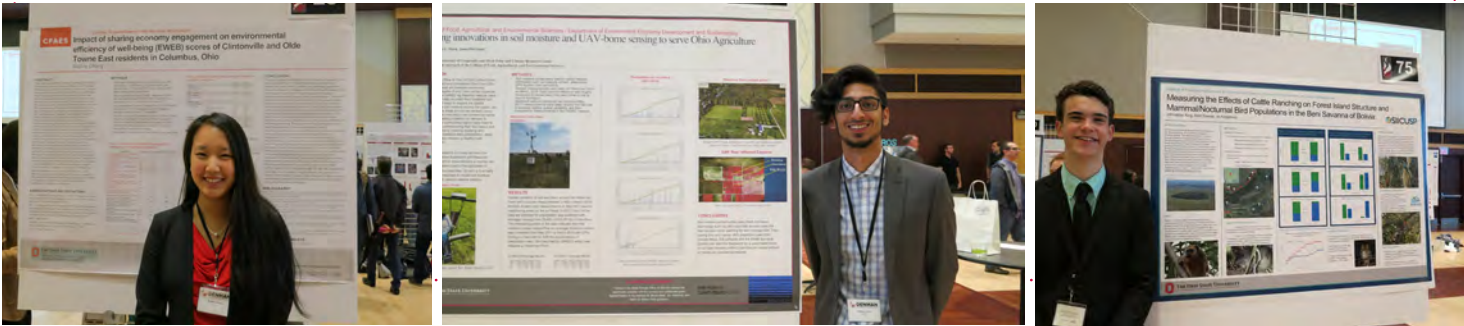
2018 Denman Forum:

Sophie Chang
Advisor: Jeremy Brooks
Impact of Sharing Economy Engagement on Environmental Efficiency of Well-Being (EWEB) Scores of Clintonville and Olde Towne East Residents in Columbus, Ohio

Nischay Soni
Advisor: Sathya Gopalakrishnan
Exploring Innovations in Soil Moisture and UAV-Borne Sensing to Serve Ohio Agriculture

Johnathan King
Advisor: Matt Davies
Measuring the Effects of Cattle Ranching on Forest Island Structure and Mammal/Nocturnal Bird Populations in the Beni Savanna of Bolivia

Grace Saalman
Advisor: Kerry Ard
The Effectiveness of State Environmental Justice Policies in Reducing Air Pollution Inequality in the United States



STUDENT RECOGNITION

(continued)

2017 CFAES Research Forum:

Ashlee Balcerzak

Advisor: Steven Lower

Use of Magnetic Bacteria to Remove Phosphorus from Eutrophic Waters

**Placed 2nd in the Environmental and Plant Sciences category.

Scott Meyer

Advisor: Lauren Pintor

Giving Up Density As an Approach To Identify a Difference in Foraging Behavior Between Native and Invasive Crayfish Species

**Placed 3rd in the Environmental and Plant Sciences category.

Hailey Tiarks

Advisor: Suzanne Gray

The Influence of Turbidity On Eye and Brain Morphology In an African Cichlid

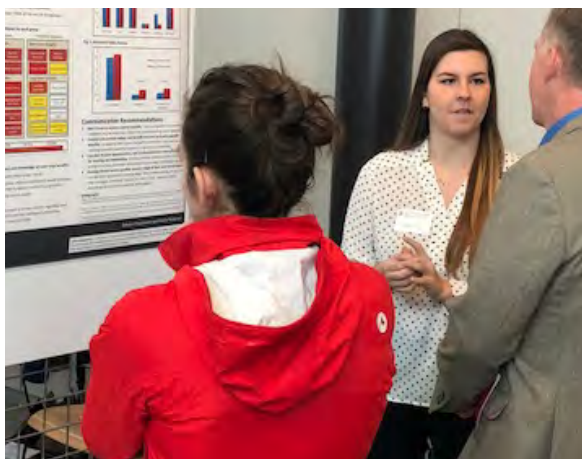
**Placed 1st in the Environmental and Plant Sciences category.

Andrew Wilk

Advisor: William Peterman

Effects of Habitat Patch Size on the Abundance of Red-Backed Salamanders (Plethodon Cinereus)

**Placed 4th in the Environmental and Plant Sciences category.



2018 CFAES Research Forum:

Environmental & Plant Sciences

1st place – **Katherine Denune** (*Bottom*), EEOB student, research advisor: Chris Tonra

2nd place – **Krystal Pocock** (*Right*), research advisor: Lauren Pintor

Social Sciences

3rd place- **Olivia Carros** (*Left*), research advisor: Robyn Wilson

STUDENT RECOGNITION

(continued)

2017 Celebration of Students Banquet:

Outstanding Seniors

- **Lydia Bednarski**, EEDS major
- **Sam Reed**, ES major
- **Carolyn Voigt**, EEDS major

Newcomb Scholars

- **Mara Momenee**, EEDS major
- **Cheryl Fladung**, EEDS major
- **Dominique Provencher**, EEDS major

Lee Johnston Leadership Award

- **Marisa (Ris) Twigg**, EPDM major
- **Sarah Fischer**, EEDS major

Ray A. Miller Council Award

- **Daniel Niemann**, FFW major

Internship Award

- **Helena Rudoff**, an EEDS major received the CFAES Internship Award for her participation in the Washington Academic Internship Program.



2018 Celebration of Students Banquet:

Outstanding Seniors

- **Ashlee Balcerzak**, ES major

Lee Johnston Leadership Award

- **Andrew Wilk**, FFW major
- **Marisa (Ris) Twigg**, EPDM major
- **Marie McConnell**, EPDM major

STUDENT RECOGNITION

(continued)

Six SENR students were awarded the Office of Energy and Environment Sustainability Scholarship in December 2017:

- **Lauren Trapani**, EEDS
- **Matthew Griffin**, EEDS
- **Maria Fredericks**, EPDM
- **Mike Fackler**, EEDS
- **Sarah Davis**, EEDS & CRP, dual degree
- **Mary Boltri**, ENV SCI

Other Recognition in 2017:

Sarah Fischer, first prize winner for her poster, “Smart Columbus: Barriers to Electric Vehicle Adoption in Columbus, Ohio” at The National Council for Science and the Environment Conference “Student Sustainability Leaders: Networking Our Future” on September 23, 2017.



Tal Shutkin (left), majoring in EPDM named a 2017 Udall Scholar in May.

Kevin Fisher (right), majoring in ES, was awarded the RAS “Yellow Book” Undergraduate Student Travel Grant from Aquaculture America 2017.



The Student Sustainability Council received the Green Collaborative Achievement Award, which recognizes a group of entities or individuals who have shown effectiveness in producing environmental accomplishments through a collaborative effort, from the Mid-Ohio Regional Planning Commission (MORPC). Michelle Wentling and Marie McConnell (EPDM major), Sustainability Council president and vice president, respectively, accepted the award. It was presented primarily at this spring’s Time for Change Week, a series of student-organized events to raise awareness and activism about energy, environment and sustainability issues.

2018 Undergraduate Recognition Highlights:

Forestry, Fisheries & Wildlife majors **Kandace Glanville** and **Tyler Fickerwere** awarded the Dr. David Osborne Award for best student presentation at the Ohio Avian Research Conference, Oct. 20 (for bird-building collision monitoring). Co-advised by Matthew Shumar and Chris Tonra.

TerrAqua received the Rachel Carson Award for Civic Engagement at the 5th Annual Civic Engagement Banquet hosted by the Office of Student Life at The Ohio State University on Tuesday, October 23. Advised by SENR’s Eugene Braig.

Sarah Fischer received the 2018 Green Biz Emerging Leader award in February 2018.

STUDENT RECOGNITION

(continued)

2017 Graduate Recognition:

- **Paige Kelly** was elected to the Rural Sociological Society Council.
- **Matthew Bright** was awarded first place in the graduate student poster competition for his poster, “Long-term Crop Productivity, Carbon, and Nutrient Dynamics in a Native Shrub (*Guiera senegalensis*) Cropping System of the Sahel” in Phoenix for the ASA Semi-Arid Dryland Cropping Systems Community.



Thomas Delomas (left), a PhD student in the Fisheries and Wildlife Science specialization area, received the US-AS-Merck Best Presentation award for, “A New Protocol for Exploring the Potential Growth Rate of Zebrafish Larvae and Juveniles at Aquaculture America 2017.

Anne Junod (right), was elected to the Council of the International Association for Society and Natural Resources (IASNR).



2018 Graduate Recognition & Scholarship:

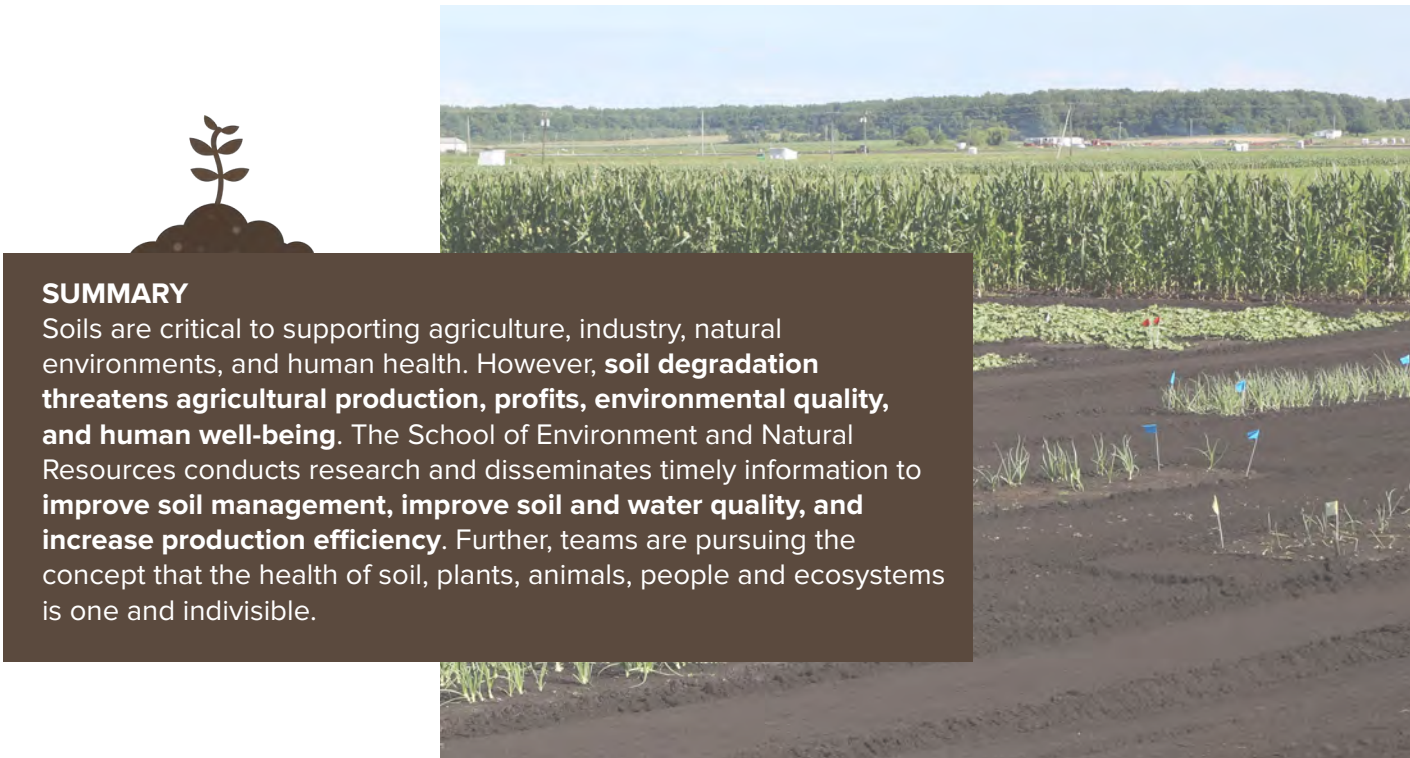
- **Thomas Delomas** was awarded a Presidential Fellowship by the Graduate School at The Ohio State University.
- **Jo Kingsbury**, a PhD student, was awarded the 2018 International Association of Wildland Fire (IAWF) scholarship.
- **Henry Anton Peller**, a PhD student, won the BCFN YES! international contest to improve the sustainability of our food system and was recognized at the 9th International Forum on Food and Nutrition for his project.
- **Elizabeth Berg**, a MS student, was named a 2019 John A. Knauss Marine Policy Fellowship Finalist (and placed as a Fellow in October).
- **Florence Becot**, a PhD student, received the Ronald Wimberley Student Paper Award at the 2018 Rural Sociological Society Annual Meeting, July 26-29, 2018 for “Disentangling French and US farmers’ health needs and access to care: An application of Bourdieu’s Theory of Practice.”
- Florence also received the 2018 SAFRIG Paper Award at the 2018 Rural Sociological Society Annual Meeting, July 26-29, 2018 for “Disentangling French and US farmers’ health needs and access to care: An application of Bourdieu’s Theory of Practice.”
- **Anne Junod**, a MS student, received the Master’s Thesis Award for “Processes of Public Risk: Foucauldian Discourses, Social Amplification, and Civic and Policy Responses in Energy Transportation Communities” at the 2018 Rural Sociological Society Annual Meeting.

Protecting and Restoring Soil Resources to Enhance Human and Ecological Health

Impact Statement 2017

INVESTIGATORS

Steve Culman, Brian Slater, Nick Basta, Libby Dayton, Rattan Lal, Richard Dick, Sakthi Subburayalu, Matt Davies, Scott Demyan



SUMMARY

Soils are critical to supporting agriculture, industry, natural environments, and human health. However, **soil degradation threatens agricultural production, profits, environmental quality, and human well-being**. The School of Environment and Natural Resources conducts research and disseminates timely information to **improve soil management, improve soil and water quality, and increase production efficiency**. Further, teams are pursuing the concept that the health of soil, plants, animals, people and ecosystems is one and indivisible.

SITUATION

Soil resources contribute critical ecosystem services (including maintaining biodiversity and productivity, filtering, and storing water) and contributes to the hydrologic cycle, nutrient cycling, carbon sequestration, and provides support for plants and engineering structures. **The long-term health of the soil resource is threatened** by human-induced and climate change impacts: decline in soil structure, accelerated soil erosion, soil compaction, soil contamination, soil organic matter (SOM) loss, replacement of soil with impervious surfaces, and impairment of soil physical, chemical, biological and ecological functions. **Soil functions support a number of industries and activities**, including agriculture, forestry, and recreation, with important economic consequences. Significant water resource challenges including water quality are responsive to soil conditions and management. **Maintaining soil health is critical to sustaining human and ecosystem health and quality of life.**

RESPONSE

We address soil resource health through integrated applied research in the laboratory and field, outreach, and classroom venues.

OUR MAJOR SOIL FOCUS AREAS:



Soil resource management for sustainable agriculture:

We research soil carbon sequestration, efficient nutrient management, use of by-products for enhancing soil conditions, soil microbial systems and enzymes in the rhizosphere, tillage systems and cover crops, and soil information systems.

Soil health in the urban space:

We develop methods for assessing soil health in disturbed and managed environments, research bioavailability of contaminants such as lead and arsenic, analyze soil contributions to the carbon cycle, and soil restoration for urban farming.

Soil services in natural ecosystems:

We develop methods to assess soil resilience and disturbance using remote sensing, soil condition assessment, and restoration strategies in wetlands, forests, grasslands, croplands and other habitats/ecosystems.

IMPACT

Our research provides the basis for a **new phosphorus index** used by producers and policymakers to target practices on fields impacting nutrient runoff. We are working with farmers to revise agronomic fertilizer recommendations to **increase profitability and improve water quality by minimizing over-application of fertilizers**. Research on reuse of wastes has established that dredge materials can be used effectively in soil blends for application in urban agriculture. **Digital soil mapping research** has contributed to improved spatial information for land use planning, and remote-sensing methods for mapping crop residues. Research on carbon sequestration has increased understanding of climate change mitigation and adaption potential. We are working with industry/private sector representatives to meet their goal of emission neutral products. In Senegal, research has shown that intercropping with native shrubs contributes to carbon sequestration, and productivity. **Work on active fractions of soil carbon** has advanced our understanding of how rapid and affordable tests could be used by landowners and farmers to better manage soil. We have focused outreach efforts on soil health and **have started a new Extension signature program, Healthy Soils, Healthy Environment**. **Innovative outreach workshops** have targeted Ohio State county soil and water educators in soil health and urban soil management (125 participants), and on-site wastewater system designers (100 participants).

Repairing and Restoring Natural Ecosystems

Impact Statement 2017

INVESTIGATORS

Matt Davies, Brian Slater, Scott Demyan



SUMMARY

Globally accelerating rates of ecosystem degradation and habitat loss pose significant challenges for ecosystem managers and affect the range of natural goods and services to humans. Human-induced disturbances to ecosystems include **resource exploitation, altered wildfire activity, grazing and agriculture, invasive species, soil erosion and the effects of climate change**. Ecosystem restoration provides a means to repair the damage caused by humans and our work is having impacts across multiple continents.

SITUATION

Climate change threatens to cause significant changes to natural ecosystems and habitats by altering the conditions under which plants and animals have to survive. Changes in climate are, however, taking place alongside growing human impacts on the natural environment. For example, increasing wildfire activity **threatens to change the character of multiple ecosystems from rare sagebrush-steppe habitats in the western United States to carbon-storing peatlands in northern Europe**. Agricultural land-use in sensitive landscapes, such as those found associated with volcanically-derived soils in Iceland **can be rapidly degraded by over-grazing by livestock**. Natural resource exploitation can also generate substantial environmental impact. Mineral extraction in many parts of Ohio has led to soil contamination and poor soil health. This can require costly remediation and reclamation but many historic efforts to restore natural ecosystem in such settings have met with limited success.

RESPONSE

The School of Environment and Natural Resources (SENR) develops methods to restore ecosystems and tackles issues including:

- **Managing disturbance:** projects in forest, sagebrush, peatland, grassland and rock-face ecosystems are investigating how human disturbances affect ecosystem stability. Particular attention continues to be given to managing prescribed and wild fires
- **Soil resilience:** working with Soil Conservation Service of Iceland, we are studying the dynamics of soil development to evaluate land protection and vegetation enhancement.
- **Degraded landscapes:** in Ohio we are researching methods to reclaim areas used for disposal of contaminated waste rock from coal separation plants, and to restore former strip-mines.
- **Campus sustainability:** learning projects are informing restoration of water courses and sustainable landscape design

Our restoration curriculum, aligned to the Society for Ecological Restoration’s certification, is delivering new basic, advanced skills-based courses to produce the next generation of restoration leaders.



IMPACT

Our work has regional, national and international impact. In Ohio we have assessed how varying soil cover depths applied over acid-toxic mine waste affect vegetation establishment, runoff, and water quality. Resulting reductions in the amount of soil used can mitigate offsite soil-collection impacts reducing by half the area disturbed for soil borrowing and reducing operator costs. **We catalogued extant, degraded and destroyed peatlands across Ohio and completed the first major inventory of their ecology**. In the sagebrush steppe of the northwestern United States, we responded to another damaging fire year by tracking unique long-term monitoring plots. **This data yielded vital information to inform managers** about how repeated wildfires and species invasions are altering the ecosystem. In Bolivia we have provided conservation managers with information on how livestock grazing and wildfire alters the abundance of threatened bird species. Studies in Iceland have established that **soil resilience is greatly enhanced by land protection, vegetation enhancement and forest cover development**. Farmers and landowners are voluntarily participating in group projects to protect land and improve management, taking ownership of positive outcomes and providing leadership to activate others in the process. Our Ecosystem Restoration specialization continues to grow. As part of this program students have developed restoration plans for external and internal stakeholders, informing practice on the ground.

Tackling Grand Challenges: *Using Interdisciplinary-Systems Approaches to Address Complex Environmental and Natural Resource Problems*

Impact Statement 2017

INVESTIGATORS

Ramiro Berardo, Jeremy Brooks, Jeremy Bruskotter, Douglas Jackson-Smith, Jeff Sharp, Nicole Sintov, Robyn Wilson



SUMMARY

Limitations of disciplinary approaches to complex problems have catalyzed interest in new models that link scientists, practitioners, and decision-makers in the pursuit of effective solutions. The School of Environment and Natural Resources (SENR) has been at the forefront of developing new, synthetic approaches to **improve the sustainability and resiliency of energy and food systems**. Our work has contributed to the development of practical tools and solutions to **pressing societal problems in Ohio, nationally, and across the globe**.

SITUATION

Conventional mono-disciplinary approaches to scientific research have produced dramatic gains in human knowledge and innovation. However, they have struggled to account for feedbacks, interactions, and unanticipated consequences associated with complex systems. This is especially true for environmental and natural resource problems, which always involve **tradeoffs between competing interests and values in society** and often have no straightforward scientific or technical solution. Examples include water quality problems caused by both urban and agricultural activities, flooding from extreme storms, biodiversity conservation, and work to create more resilient and sustainable food and energy systems. **In response, scientists have increasingly worked in interdisciplinary teams** and in collaboration with practitioners and stakeholders to develop methods, models, and processes that are **better able to inform effective environmental and natural resource policy**.

RESPONSE

SENR faculty have been leaders at The Ohio State University and nationally in the use of interdisciplinary systems approaches to address complex environmental problems. Examples include: **interdisciplinary studies** to design effective collaborative governance institutions to address water and land use problems in the United States and abroad; efforts to **merge insights from cultural evolutionary theory** into the study of coupled ‘socio-ecological systems’; integration of **behavioral and physical models to explain patterns** of nutrient loss and changes in aquatic ecosystem services in the western Lake Erie watershed; participation in **interdisciplinary teams** to arrest loss of the world’s terrestrial megafauna; and modeling to identify environmental and socioeconomic **tradeoffs associated with forest ecosystem restoration**. SENR faculty have also led efforts to build Ohio State’s growing community of scholars with expertise in transdisciplinary approaches to urban and rural environmental problems.

OUR WORK HAS BEEN USED BY PRACTITIONERS AND DECISION-MAKERS TO ADDRESS PRACTICAL ENVIRONMENTAL AND NATURAL RESOURCE PROBLEMS.

IMPACT

SENR faculty have generated tens of millions of dollars from extramural sources that has had significant impacts both within and outside the academic community. At Ohio State, these projects have expanded the capacities of interdisciplinary teams of scientists, and produced innovative coupled human-natural systems models and peer-reviewed published research. **These efforts also provide critical opportunities to train undergraduate and graduate students how to work effectively in interdisciplinary teams**. Externally, our **work has been used by practitioners and decision-makers** to address practical environmental and natural resource problems including: urban energy and water demand management, protection of endangered species, and sustainable food and farming systems. For example, our models of farmer decision-making coupled with hydrological **models of nutrient loading are enabling policy makers to use more effective approaches** to reducing phosphorus loading to Lake Erie. Local and state water managers are better able to predict how future trends in population and housing will affect water demand and water quality. **The work of our faculty is not limited to domestic topics**. For instance, international research produced by our faculty has allowed decision-makers to assess and evaluate the effectiveness of ongoing institutional efforts to regulate the use of (and access to) natural resources in areas subject to ecological degradation in South America.

Protecting Ohio’s Water Resources

Impact Statement 2017

INVESTIGATORS

Mažeika Sullivan, Douglas Jackson-Smith, Anne Baird, Eugene Braig, Matt Davies, Libby Dayton, Robyn Wilson, Lauren Pintor, Suzanne Gray, Rachel Gabor, Ramiro Berardo, Richard Dick



SUMMARY

Alarming losses in biological, chemical, and physical water quality threaten human health and well-being and environmental integrity across Ohio. To address this challenge, The School of Environment and Natural Resources (SENR) assembled a team of professionals with expertise in the natural and social sciences, education, and outreach. This work continues to lead to improvements in water quality in many ways including **reducing nutrient loads, restoring aquatic ecosystems, and protecting biodiversity.**

SITUATION

Ohio’s water resources provide a **wide range of important services**, including drinking water and irrigation, power, fisheries, scenic value and recreation, and ecosystem function. Changes in population, land use, and climate have exerted **increasing stress on water quality**, often with serious effects on environmental condition and human health. For example, the frequency and severity of harmful algal blooms (HABs) in Lake Erie resulted in the loss of Toledo’s water supply in 2014 and continued to impact the lake’s fishery and recreation industries. A legacy of dam construction and urban runoff, the spread of invasive species, and degradation of riparian areas have impacted the health of streams, rivers and wetlands. Aging rural septic systems are an increasing source of groundwater contamination. **Sustaining and improving water quality is vital to Ohio’s quality of life, economy, and environment.**

RESPONSE

SENR has multidisciplinary expertise (aquatic and soil sciences, sociology, decision science) and does applied research to advance three goals:

- Reduce Nutrient Loads:** We used surveys and instrumented fields to develop farmer decision-support tools to guide land management decisions and inform water-quality policy.
- Restore Impaired Ecosystems:** We monitored water quality before and after dam removals, conducted an extensive inventory of the location, hydrology, chemistry and ecology of Ohio’s peat bogs, and compared water quality and biodiversity in coastal wetlands to understand the effects of restoration efforts.
- Protect Biodiversity:** We raised rare and threatened fishes in captivity to help restore extirpated/endangered populations.



IMPACT

Our efforts have led to innovative solutions to water-quality challenges and directly shape policy and management decisions. Results from our Lake Erie research **helped identify efficient strategies to achieve the 40 percent target reduction in phosphorus loading into the Western Lake Erie Basin.** The revised Ohio Phosphorus Risk Index (On-Field Ohio!) will provide farmers with local data to make management decisions. Our work **helped managers prioritize programs** to manage Ohio’s remaining peat bogs, and secured funding to restore a rare peat-forming wetland. We have propagated and released rare juvenile fish into central Ohio waterways in coordination with USFWS and Columbus Metroparks. Our work also **increased the knowledge and skills of students, managers, scientists, and stakeholders** engaged in water protection. **The ORWRP hosted 182 activities in 2017**, engaging 2,400 OSU students and staff as well as participants from outside OSU in trainings, service projects, and retreats, including water-quality programming for underrepresented groups in STEM. Our educational programs about aquatic invasive species reached over **11,000 individuals**, and two important policy measures were vetted through the Ohio Aquatic Invasive Species Committee. 17 participants completed the Ohio Watershed Academy. Significant gains in new knowledge were reported in effective meeting and group management, communication and education, stakeholder involvement, water-quality assessment, securing funding, and policy.

Living with Wildlife:

Informing Conservation through Partnerships, Stakeholder Engagement, and Science

Impact Statement 2017

INVESTIGATORS

Robert Gates, Marne Titchenell, Jeremy Bruskotter, Mazeika Sullivan, Stanley Gehrt, Stephen Matthews, Christopher Tonra, William Peterman, Alia Dietsch and Gabriel Karns

SUMMARY

Over 5 million Ohioans engage in wildlife-based recreation, contributing \$3.3 billion to the economy. Wildlife also promotes physical and spiritual well-being and is a sensitive indicator of environmental quality and ecosystem capacity. As wildlife management increases in size and complexity, the School of Environment and Natural Resources (SENR) works with scholars, managers, and stakeholders to share information and build collaborations, **ensuring sustainable wildlife populations** and habitats that are valued and conserved now and in the future.

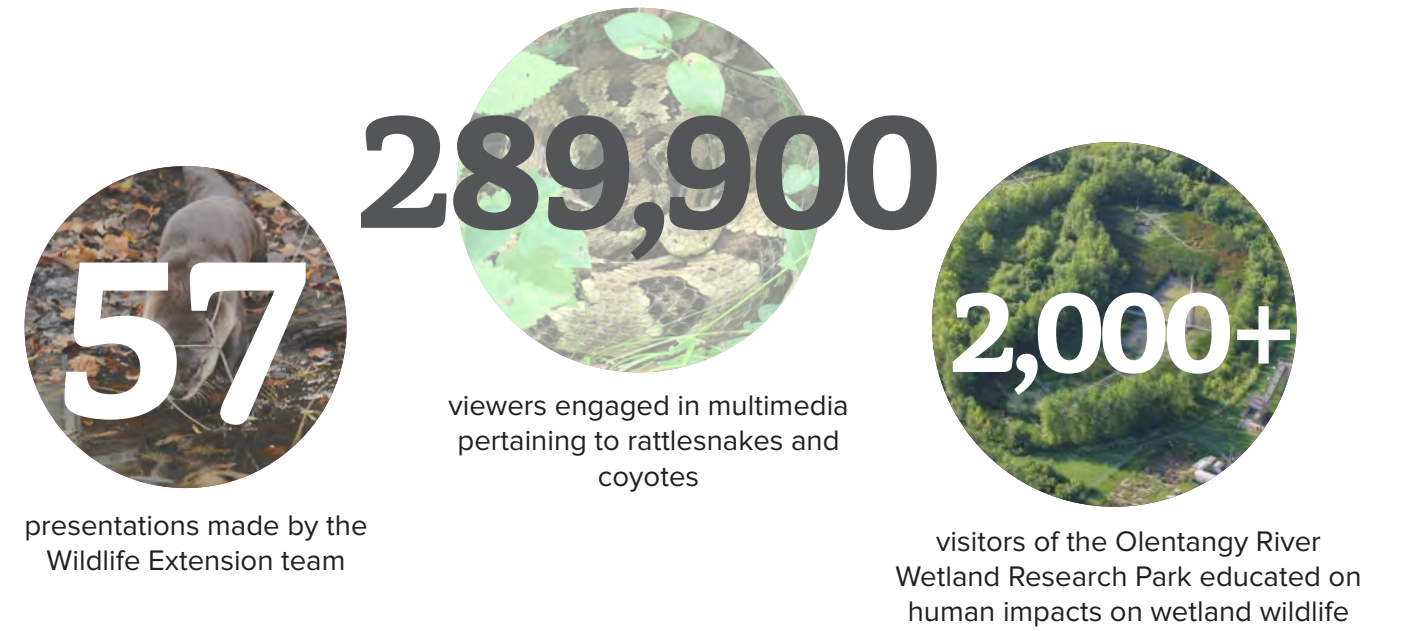


SITUATION

Human-wildlife relationships reflect interactions of natural and social systems. Problems develop as natural and cultural environments change. **Government agencies and NGOs are challenged by competing interests of diverse stakeholders and scientific uncertainties about the systems they manage.** Among the most pressing issues facing wildlife conservation are: biodiversity loss, invasive species, changing climate, unsustainable hunting levels, human-wildlife conflicts, and diminishing public support for wildlife programs. Fulfilling the land grant mission of The Ohio State University we provided science-based research and training for current and future wildlife professionals, community leaders, and private landowners. In 2017, we focused our efforts on impacts of energy and resource development, sustainable use of natural resources, human-wildlife conflicts, and conservation of wildlife diversity on public and private lands across Ohio.

RESPONSE

Our Terrestrial Wildlife Ecology Lab, Ohio Biodiversity Conservation Partnership, and Ohio State Extension programs supported science-based conservation via partnerships with agencies and stakeholders. SENR faculty and staff engaged industry to test best practices to manage energy right of ways for pollinators and other wildlife. We assisted the Ohio Division of Wildlife in **developing a socially and ecologically sustainable plan for deer harvest management.** We studied river otters, a former extirpated species, to identify sustainable management strategies. We did research on rattlesnakes, amphibians, and forest birds to develop ecologically sustainable management plans for forests where fire and tree harvest are used for restoration. We studied **effects of water quality on aerial insect-eating birds** in rivers and streams. We disseminated information through extension programs like the Ohio Community Wildlife Cooperative and organized a workshop aimed at reducing wildlife-livestock conflicts.



IMPACT

Adopting best practices for managing energy right-of-ways helped improved habitat for pollinators and promote biodiversity on greater than 360,000 acres, which helped to achieve national pollinator conservation goals. Deer conservation and management helped strike a balance between approximately 500,000 hunters that contribute \$853 million to the Ohio economy and Ohio farmers whose crops are depredated. Our river otter research improved the ability of managers to balance population and harvest goals while minimizing human-wildlife conflicts in 42 counties. Considering impacts of forest restoration on rattlesnakes and other wildlife influenced the use of fire and tree harvest on 3.3 million acres of public land in southeast Ohio. Studies of imperiled aerial insect-eating birds in seven central Ohio counties demonstrated effects of land use and water quality. Research impacts were magnified by our Wildlife Extension team, which delivered 57 presentations on human-wildlife conflicts to a 4,372 professionals, volunteers, and homeowners. Multimedia pertaining to rattlesnakes and coyotes received 289,900 views. The Ohio Community Wildlife Cooperative facilitated networking and dissemination of science-based knowledge through an annual conference attended by community leaders, city planners, and resource managers from 90 Ohio municipalities and park districts. Over 2,000 visitors to the Olentangy River Wetland Research Park learned about human impacts on rivers and wetlands inhabited by aerial insect-eating birds.

Beneficial Reuse of Agricultural, Industrial and Municipal Byproducts for Environmental Sustainability

Impact Statement 2017

INVESTIGATORS

Nick Basta, Elizabeth Dayton, Scott Demyan, Steve Culman, Matt Davies, Shane Whitacre

SUMMARY

A team within the School of Environment and Natural Resources (SENR) is researching beneficial reuse of industrial, municipal, and agricultural wastes, including foundry sand, water treatment residuals, and biosolids. The team works closely with regulatory agencies to craft science-based regulations and reuse policy. Millions of tons of materials have been diverted from costly non-sustainable landfilling and incineration practices, and degraded land in Chicago and Ohio has been restored, with significant economic and societal benefits.

SITUATION

Approximately 10 billion tons of industrial, municipal, and agricultural solid waste (byproducts) are generated annually in the U.S. Most of this **waste is disposed of in costly landfills or incinerated**. Ohio and other industrial Midwestern states generate a large amount of the industrial waste, and their cities generate municipal waste. **Many of these wastes can be reused** to restore land degraded by urbanization, mining, or other former industrial activity. **Wastes can be incorporated directly into degraded soils** or blended (with compost, manures, or foundry sand) to make high quality topsoil for land restoration. Beneficial reuse of wastes allows Ohio industry to become more competitive, municipalities to become more resourceful, and facilitates startup industries and jobs in Ohio focused on production and marketing of soil blend materials and restoration of the degraded land. Our group’s research focuses on development of beneficial reuse of solid waste consistent with OEPA (Ohio Environmental Protection Agency) and USEPA regulations.

MANY OF THESE
WASTES CAN BE
**REUSED TO
RESTORE LAND
DEGRADED BY
URBANIZATION,
MINING, OR
OTHER FORMER
INDUSTRIAL
ACTIVITY.**

RESPONSE

SENR applies novel methodology to study use of by-products through land application, and traces fate of by-products, including:

- Use of biosolids and municipal waste blends to **restore ecosystem function** in degraded urban and contaminated soils.
- In conjunction with the USDA, USEPA, **development of methodology to evaluate suitability** of municipal wastes and byproducts, including biosolids-blend, for land application.
- Development of soil blend “recipes” to satisfy specifications for **reuse of dredge material** in manufactured soils.
- Incorporation of Cleveland dredge and compost as a **management strategy to improve soil health** and urban agricultural food production while **reducing soil contamination and protecting human health**.
- Development of a characterization scheme for safety, fertility, pH and soil-like characteristics such as texture, organic matter and plant available water **for beneficial reuse of drinking water treatment residuals** as topsoil or as soil blending material.

RESULTS OF THE DRINKING WATER
TREATMENT RESIDUALS ARE BEING
INCLUDED IN THE **OHIO-EPA BENEFICIAL
USE GUIDELINES** UNDER DEVELOPMENT

IMPACT

Over a wide range of soil blend texture and organic matter contents, Toledo Harbor dredge performed well as a landscape soil. **We developed predictive relationships** that can be used to tailor dredge-based soil blends to meet desired performance specifications. Results of the cost-benefit analysis showed that when financial, social, and environmental impacts are considered for each alternative, open lake placement has a unit cost of \$30.09 per cubic yd, and an optimized processing center has a unit cost of \$0.55 per cubic yd. Since the unit cost is negative for the optimized processing center, it results in a net benefit. Results of the drinking water treatment residuals research are being included in Ohio-EPA Beneficial Use Guidelines under development.

Currently, a small amount of City of Cleveland dredge is blended with yard clippings and sold as topsoil. Our research results show most, not some, of the **dredge can be blended with compost and incorporated into vacant urban lots in Cleveland hence solving the “what to do with all this dredge” problem ahead of a 2020 deadline**. Ohio EPA knows some of the urban lots have historical contaminants and is very interested in an urban soil management solution which can be applied for urban agriculture without having to test each lot. Incorporation of dredge blend into urban lot soil is a soil management solution that meets OEPA needs.

Learning By Doing: Preparing Students Through Experiential Learning Impact Statement 2017

INVESTIGATORS

Jeremy Brooks, Steve Culman, Alia Dietsch, Greg Hitzhusen, David Hix, Gabe Karns, Trish Raridan-Preston, Chris Tonra, Bill Peterman, Suzanne Gray, Matt Davies, Joseph Campbell

SUMMARY

One of the most dynamic ways SENR prepares students for careers and graduate study is to engage them in experiential learning activities that help students integrate the concepts and skills they have gained in the classroom. Our main venues for experiential learning are **capstone courses, internships, and field-based studies**, all of which have seen notable success in 2017. These programs simultaneously fulfill the teaching, research, and outreach missions of the School.



SITUATION

A growing body of research demonstrates that hands-on experiences in which students apply theoretical ideas to real world puzzles is important to the learning process. **Employers indicate that they want college graduates to have more practical experience in collaborative, multi-disciplinary teams addressing real-world problems** as a way to transition students from their formal studies into successful careers, and research shows that the first job of over 50 percent of students after graduation is a direct result of an internship. Historically, environment and natural resources curricula have capitalized on opportunities to use outdoor settings to expose students to natural landscapes and systems, and to interact with professional natural resource managers. The complexity of contemporary sustainability challenges also invites integrative, experiential study which benefits from the immersive, real-world experiences provided by capstone courses, internships, and field study courses.

RESPONSE

Each of the five SENR majors includes experiential learning options designed to solidify ideas, concepts and tools learned in the classroom. These include:

Capstone courses where student teams tackled real-world problems:

- EEDS (Environment, Economy, Development, and Sustainability) students collaborated with Ohio State and municipal leaders to analyze sustainability priorities and recommend best practices.
- FFW (Forestry, Fisheries, and Wildlife) and NRM (Natural Resource Management) students provided resource management plans for the Ohio State Mansfield campus as well as Columbus Metro Parks.
- ES (Environmental Science) and EPDM (Environmental Policy and Decision Making) students designed a restoration management plan for the Ohio State- Columbus campus.

Field studies courses that enhance learning:

- Forest Ecosystems students performed ecological assessments as part of an iterative, intensive learning cycle.
- Avian Wildlife Biology and Management students did a field project with hands-on radio-tracking experience at the Olentangy River Wetland Research Park.

The Agronomic Crop Research Experience (ACRE) internship program provided hands-on training with county Extension educators and state specialists.

IMPACT

- EEDS capstone projects influenced Ohio State, Worthington, and Smart Columbus decision-makers (video); the “Campus as a Living Laboratory Archive” generated 6,000+ project report downloads in 2017.
- FFW/NRM capstone projects expanded a campus management plan for Ohio State-Mansfield’s Ecolab, established long-term forest monitoring plots, and partnered with Extension to plan silvicultural demonstration areas and estimate a sugar maple stand’s sugaring potential.
- ES capstone students designed a restoration management plan for the Mirror Lake landscape. The project built on existing restoration work; results were pitched to University managers and Ohio State Facilities Operations and Development staff.
- The ACRE internship program achieved goals of training the next-generation of agronomists, empowering locally-directed on-farm research, and identifying solutions to critical agronomic issues in Ohio, as high-lighted in a summary program report.
- Forest Ecosystems students gained fundamental understanding and indispensable field skills; instructors presented papers at national and international meetings about their instructional approach.
- Avian Wildlife Biology students gathered and analyzed data on wild birds at the Olentangy Wetlands to estimate overwinter survival. Several students commented the practical experience assisted in obtaining wildlife field internships.
- The impact of capstone courses, internships, and field-based studies on student career outcomes is evidenced by graduate data.

Preparing the Next Generation of Scientists: *Expanded Opportunities for Undergraduate Research*

Impact Statement 2017

INVESTIGATORS

School of Environment and Natural Resources (SENR) Faculty, Staff, Graduate Students and Undergraduate Students

SUMMARY

The School of Environment and Natural Resources’s Honors and Undergraduate Research Programs provide support for undergraduates to conduct mentored research. **Our focus on hands-on, student-centered learning has led to gains in students’ understanding of the research process** and ability to conduct research and work independently. Our students regularly present research at conferences, coauthor journal articles, and have been competitive for jobs, scholarship and fellowships, and graduate school applications in STEM disciplines.



SITUATION

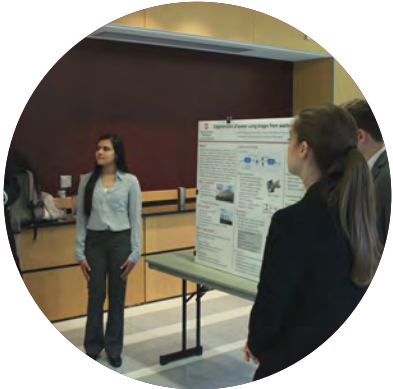
The 21st century economy demands higher levels of technical and scientific training and employers and graduate schools increasingly expect undergraduates to have hands-on experience designing, conducting, and synthesizing research. This is particularly true in environmental and natural resource management, where expertise from multiple disciplines is required to provide science-based solutions to complex problems. The applied and interdisciplinary research focus of SENR faculty and staff provide **unique opportunities to engage undergraduates in a wide range of applied research experiences** on topics including community development, ecosystem restoration, environmental policy, environmental law, environmental science, fisheries, forestry, natural resource management, parks and recreation, soil science, sustainable agriculture, sustainable business management, water science and wildlife.

RESPONSE

To enhance the student experience at Ohio State and help prepare our students for future careers, SENR has aggressively developed and promoted research opportunities for undergraduates. Currently, there are **39 students engaging in undergraduate research** through SENR’s honors program, **12 students earning research distinction**, **16 students earning undergraduate research credit**. These programs help our students develop global awareness, encourage original research topics, enrich their academic experience, develop leadership skills and instill a commitment to community service. **Students acquire training in a wide range of research methods**, and learn to communicate their results orally and in writing by presenting papers or posters at scientific meetings and by serving as coauthors on the published papers. These efforts encourage our students to gradually transition into independent scientists who are able to actively participate in research that is highly interdisciplinary in nature.



Honors undergraduate students conducting research



Our focus on hands-on, student-centered learning has led to gains in students’ understanding of the research process and ability to conduct research and work independently.



IMPACT

Our undergraduate student research programs have helped a large number of students achieve their goals of working as professional scientists. They have presented their work at scientific meetings, published in peer-reviewed journals, participated in summer fellowship and internship programs and won awards and scholarships for their work. Six undergraduate students presented their research at the 2017 CFAES Undergraduate Research Forum. Four of these students won awards for their work. Nine students presented at the 2017 Denman Forum and one of these students won an award for their work. One students was awarded \$3,300 from the OARDC Undergraduate Seeds Grant Program. Four students were awarded \$3,500 each from Ohio State’s Undergraduate Research Office, Summer Research Fellowship Program. Six students were awarded small research grants (\$6,400 total) through a newly, developed SENR Small Grants for Undergraduate Research Program. One student was awarded the Udall Undergraduate Scholarship (\$7,000). Two students published research with their faculty mentors in peer-reviewed journals. And finally, one undergraduate honors student was awarded a full NSF Graduate Research Fellowship to support their graduate studies.

Building Global Environmental Awareness through Education Abroad

Impact Statement 2017

INVESTIGATORS

Amanda McCann, Eric Toman, Brian Slater, Joseph Campbell



SUMMARY

Education abroad increases global awareness, cultural competence and is an indicator of continued academic success. Nationally, individuals that participate in education abroad have higher GPAs and job placement rates than those who do not. The School of Environment and Natural (SENR) provides international curricular opportunities for undergraduate students to increase awareness of environmental issues. SENR provides education abroad opportunities in **Australia, China, Dominican Republic, Iceland, New Zealand, and Tanzania.**

SITUATION

Environmental issues including climate change, food and water, energy use, and resource management have profoundly wide reach and impact human and natural systems on a global scale. To effectively address the issues, it is increasingly important that undergraduate students understand the ways these systems interact on local, regional, and global levels.

WITHIN SENR, THERE IS A **GREATER INTEREST IN EDUCATION ABROAD** THAN THE UNIVERSITY AT LARGE



RESPONSE

SENR students explore the social and natural impacts of environmental issues in various international contexts. **The intersection of water, energy, food, and health systems is addressed** through a community development lens in rural Tanzania. For both the Dominican Republic and Tanzania programs, attention is paid to **global poverty, wealth distribution, race and gender.** In China, students research **forest management** practices. **Students study the impact of climate change** on the vulnerable ecosystems including the Great Barrier Reef in Australia. In Iceland, students learn about **renewable energy, the effects of soil erosion and land degradation** on human and natural systems, and the environmental, social, and financial impacts of increased tourism. In New Zealand, students explore the challenges of balancing financial reliance on tourism with the desire to preserve the natural environment.

IMPACT

Within SENR, there is a greater interest in education abroad than the university at large; **39.1 percent of SENR undergraduates participate in education abroad compared to the university average of 20 percent.** Of 53 surveyed students across SENR education abroad programs in 2016-2017, 86.7 percent indicated that their education abroad program significantly added to their understanding of the host country and issues. 60 percent indicated that their understanding of international issues greatly increased based on their participation in education abroad through SENR. Upon returning from Australia, one student began research studying the impacts of ocean acidification on coral reefs in Hawaii. As a result of participation in Sustainable and Resilient Tanzanian Community (SRTC), seven of 28 participants secured international internships with the Kilimanjaro Hope Organization, Tanzanian NGO over two years.

Enhancing the Undergraduate Student Experience Through Extra-Curricular Activities

Impact Statement 2017

INVESTIGATORS

Renee Johnston, Esther DeBusk, Amanda McCann, School of Environment and Natural Resources (SENR) Academic Team and Club Advisors



SUMMARY

Extra curricular involvement opportunities and engagement are expanding in the School of Environment and Natural Resources. Engagement in these opportunities has increased the effectiveness of SENR in **recruiting and supporting future professionals**, while also directly connecting students with the land-grant mission of the The Ohio State University.

SITUATION

Involvement in extra-curricular activities has a direct correlation with **higher retention rates, better graduation rates, and ultimately better job outcomes for students involved**. These opportunities are particularly effective in recruiting and supporting underrepresented minorities and first generation students on the pathway into STEM careers. Through these experiences, students develop soft and hard skills, a professional network, and leadership experience. As post-graduate employment become more and more competitive, these outcomes are essential in helping students acquire positions within their field. Extra-curricular opportunities also connect students with means to participate in The Ohio State University’s land-grant mission as undergraduates, **serving the state through the application and dissemination of knowledge**.

RESPONSE

The School of Environment and Natural Resources provides a variety of opportunities for students to engage in development and learning outside of the classroom. Student organizations have been part of the SENR community since its beginning and there are currently **13 active organizations based out of the School**. In their first and second year, students are also able to participate in one of two living-learning communities focused on environmental and natural resources themes, the SUSTAINS Learning Community and the Environment and Natural Resources (ENR) Scholars.



IMPACT

In 2017, over 1,000 Ohio State students (ENR majors and beyond) participated in activities with extra-curricular opportunities through the School of Environment and Natural Resources. The Soil Judging Team, one of our oldest student organizations, provides students opportunities for hands-on, professional skill-building related to soil resources and ecosystem services, including regional and national competitions. The Fish and Wildlife Society, Forestry Forum, Peace Corps Club, and Net Impact connect students directly with professional networks and opportunities in their intended careers, while the Sierra Club Student Coalition and Students for Recycling seek to create change in the campus and Columbus communities. The SUSTAINS Learning Community and ENR Scholars are **highly effective in recruitment, retention, and community outreach**. While the overall university yield rate for Autumn 2017 was 31 percent, the ENR Scholars yield rate was 44 percent, including a 69 percent yield rate with first generation students. Additionally, the **ENR Scholars program boasts a 98 percent first year retention rate** (University: 94 percent) and an 82 percent four-year graduation rate (University: 62 percent). Through SUSTAINS and ENR Scholars, students participated in over 3,000 hours of service learning in 2017, primarily focusing on the Columbus community. Through these activities outside of the classroom, SENR is expanding Ohio State’s land-grant mission and impacting both students and the state.

Youth Environmental Programs

Impact Statement 2017

INVESTIGATORS

Suzanne Gray, Greg Hitzhusen, Kristi Lekies, Brent Macolley, Trish Raridan-Preston, Marne Titchenell, Christopher Tonra



SUMMARY

The School of Environment and Natural Resources (SENR) offers educational and experiential learning opportunities for youth and teachers across Ohio and internationally. These activities are designed to increase awareness and knowledge of natural resources and environmental issues, promote learning of science, and engage youth in sustainability behaviors. Methods include presentations, programs, camps, field trips, teacher workshops, peer teaching, community media, and consultation. **Over 1,100 youth were served in 2017.**

SITUATION

The natural environment provides opportunities for education, recreation, physical and emotional well-being, a sense of wonder, and valuable ecosystem services. However, climate change and environmental degradation present challenges that are expected to increase in severity in the years ahead. Engaging children and youth in environmental education and experiential activities can help to foster lifelong appreciation of the natural world and increase knowledge of natural resources and environmental concerns in Ohio, the United States, and the world. Schools and community organizations express interest in collaboration with SENR to reach youth, share and obtain expertise, and make connections locally and globally.



RESPONSE

Collaborations with schools and organizations across Ohio and internationally enable SENR to reach diverse groups of teachers and youth. Outreach through media promotes education on environmental topics to the larger community. Activities include:

- Presentations on bats, avian ecology, and camping to over **400 youth** at Central Ohio elementary and high schools
- **23 programs on wildlife and forestry** for 475 youth, including **Camp Canopy**, a week-long summer camp for high school students
- **School field trips for 150 students** at the Wilma H. Schiermeier Olentangy River Research Wetland Research Park
- Water Across the World project to **enhance over 100 students’ understanding of water quality** in Ohio and Uganda, promote science learning, and develop training activities and materials for teachers
- **Youth Beat Radio** program aired weekly on two Columbus Community Radio stations
- **Consultation on outdoor programming** and evaluation to ten schools and organizations

IMPACT

Over 1,100 youth had opportunities to learn about natural resources and environmental issues, participate in hands-on exploration, apply knowledge to real world situations, learn new skills, and engage in sustainability efforts in 2017. SENR education activities serve youth from elementary through high school age, from rural and urban areas, and those with special needs. **For some youth, the activities provide first-time experiences with wetlands, wildlife, using scientific methods, and interacting with SENR faculty and Extension specialists.** The Water Across the World project creates an opportunity for rural Ohio youth to engage in peer teaching, learning, and cultural exchange with youth in Uganda on water quality issues through video and online communications. Workshops and materials developed for teachers extend knowledge to additional students. Learning opportunities also exist for SENR undergraduate and graduate students who plan and lead Water Across the World and other youth education activities. **SENR youth education creates and strengthens collaborations with community partners** including the Muskingum Soil and Water Conservation District, schools, and local organizations. Youth Beat Radio, which involves SENR alumni, SENR students, and high school students in production, broadcasts information on environmental issues to community audiences. Consultation activity is beneficial for schools and organizations in planning programs, sharing resources, and evaluation.

Building Capacity Among Environmental and Natural Resources Professionals and Volunteers

Impact Statement 2017

INVESTIGATORS



Anne Baird, Stacey Fineran, Kathy Smith, Marne Titchenell, Joe Campbell, Molly Hardesty, Kristi Lekies, Maggie Lewis

SUMMARY

The School of Environment and Natural Resources (SENR) is a leader in training students in environmental and natural resource management. As these graduates assume positions in public and private organizations, access to professional practice graduate education, continuing education programs and opportunities to network with other professionals is important to their ability to work effectively. SENR provides a broad range of capacity building programs/services to support this growing community of environmental professionals and volunteers.

SITUATION

Every sector of society is affected by environmental and natural resource management issues. Those who choose an environmental career or who choose to volunteer their services to address these issues in their communities look to land-grant institutions for unbiased, research-based information and educational programs to enhance their knowledge, skills and to grow and diversify their professional networks. Given the diverse disciplinary and applied scientific experience of our faculty and staff, **SENR is well positioned to be a leader at the state and national levels** to help in building capacity among professionals and volunteers working to address complex environmental and natural resource issues. Like all academic units, the challenge for SENR is to leverage our scientific expertise to provide high value applied programs and services that will have **real, measurable impacts** on these individuals and in the communities and organizations in which they live and work.



RESPONSE

SENR has six core programs to support the state’s environmental and natural resources (ENR) community: **Environmental Professionals Network (EPN)** maintains an on-line community, networking breakfasts and larger signature events with respected presenters. **Master of Environment and Natural Resources (MENR)** is a professional practice graduate degree program serving in-career and career-transition professionals and recent graduates. **Ohio Environmental Leaders Institute (OELI)** provides educational programs for ENR professionals on leadership, collaboration, and communication. **Ohio Certified Volunteer Naturalist (OCVN)** is a NR outreach and service program, offering a quarterly webinar series and conference. **Ohio Woodland, Water, and Wildlife Conference (OWWWC)** is a forum for professionals to gain knowledge on natural resource management and research. **Environmental Education (EE)** lunch and learn series is a professional experience for students, focused on building students’ capacity to educate, lead, and manage park volunteers.



IMPACT

EPN has approximately 2000 online participants and monthly programs average over 130 attendees from diverse employment sectors and students. Feedback shows **collaborations and partnerships have been created, grants, internships, and jobs gained**, and projects are initiated and sustained. MENR graduates have worked with a wide range of entities, such as federal, state, and local governmental, NGOs and private sector companies. The program serves 18 graduate students per year, who seek to increase their scientific understanding of environmental issues. OELI had three sessions in 2017 attended by 27 participants and offered a “Big Table” community dialogue for 30 participants, who reported **increased knowledge and confidence in communicating science, collaboration, and professional leadership skills**. OCVN had 495 certified naturalists contribute 29,017 hours of service totaling more than \$696,000. 160 new participants took the OCVN course and 28 participated in webinar series. Certified naturalists reported knowledge gains in wildlife identification and skills needed for participation in an upcoming survey. OWWWC had more than 350 natural resources professionals, **responsible for management of almost 66,000 acres across the state**, attend the OWWWC Tree Diagnostic Workshop. These programs offer CE credits through the SAF, ISA and ODA pesticide credits. EE lunch and learn series had 24 student participants attended. Participants reported significant knowledge gains at all three sessions in their key volunteer management content areas.

Managing Ohio’s Forest Resources

Impact Statement 2017

INVESTIGATORS

Bob Gates, David Hix, Stephen Matthews, Sayeed Mehmood, Kathy Smith, Roger Williams



SUMMARY

Ohio’s forests are transforming due to changes in natural disturbance regimes, including introduction of invasive species and absence of disturbance such as fire. Young forest habitat is disappearing as forests age. Re-introducing natural disturbance and reducing forest canopies along agricultural fields have been used successfully to mitigate these problems. The Ohio Woodland Stewards Program has **provided critical resources to help private landowners, agencies and NGOs manage their forestlands.**

SITUATION

Ohio has approximately 8 million acres of forest land, of which 85 percent is in private ownership and the remaining 15 percent managed by state and federal agencies. These forests have undergone changes in species composition and structure due to pressure from new forms of disturbance, including the spread of non-native insects, diseases and plants, and the absence of natural wildfires. In addition, Ohio’s forests are getting older, and the loss of young trees has reduced habitat on which many wildlife species depend. Scientific research is needed to document these changes and the effectiveness of strategies to reverse them, including managing forests in an early successional state; developing “soft” habitat edges along maturing woodlots near open lands to conserve edge and early succession-dependent wildlife; and educating private landowners on how to manage forests under these conditions.



RESPONSE

The School of Environment and Natural Resources (SENR) faculty and staff have played a lead role **researching the changing condition of Ohio’s forests, and developing effective management strategies** to improve their productivity and ecosystem functions. Our long-term studies have demonstrated that our oak forests are becoming dominated by species uncharacteristic of historic forests. We have **studied partial removal of forest canopy and the use of prescribed fire in oak forests** to reverse this trend and enhance early successional wildlife habitat. Our Ohio Woodland Stewards Program has produced fact sheets and reports to inform private woodland owners about effective strategies to manage woodlot edges on agricultural lands, and assist NGOs and state agencies as they manage more heavily forested regions of the state. We have tracked trends in timber prices, and compiled data from diverse sources to document the importance of the forest sector and forest products industries to the state’s economy.



IMPACT

Our work has contributed directly to the success of a wide range of local, state and federal forest management initiatives. **Our data have been used to develop science-based habitat restoration projects** for private-woodland owners in southwestern Ohio as part of the National Bobwhite Conservation Initiative. By compiling information on understory plants in oak forests, we have assisted the U.S. Forest Service and others to **develop strategies to identify and anticipate changes in forest composition and non-native invasive species encroachment patterns.** Our work on forest canopy regeneration in oak forests has provided **evidence to guide the appropriate timing, frequency and severity of introduced disturbances.** The Woodland Stewards Program’s materials on non-native invasive species have been used to deliver **hundreds of workshops** for over 1,790 natural resource professionals and over 8,100 landowners in Ohio, Indiana, Kentucky, Pennsylvania and Michigan. Our smart phone app to help identify and report invasive species has been downloaded more than 9,400 times in Ohio with several hundred reports a year since it went live in late 2013. The SENR **Ohio Timber Price Report is used by a wide spectrum of stakeholders** including landowners, consultants, loggers, state employees and industry. Our recent report on the economic contribution analysis of Ohio’s forest industries has been widely used by state agencies and industry leaders.

Building Stronger Communities: Enhancing Sustainable Economic Development and Social Well-Being at Home and Abroad

Impact Statement 2017

INVESTIGATORS

Jeremy Brooks, Joseph Campbell, Linda Lobao, Kerry Ard, Jeffrey Jacquet, Greg Hitzhusen, Cathy Rakowski



SUMMARY

Communities across the globe face numerous challenges to becoming more sustainable, including poverty, lack of social services, absence of infrastructure, and pollution that disproportionately affect people of lower socio-economic status. The School of Environment and Natural Resources **conducts research to understand the causes and consequences** of these problems and develop teaching and outreach programs to foster **innovative solutions** for enhancing social well-being and resilience.



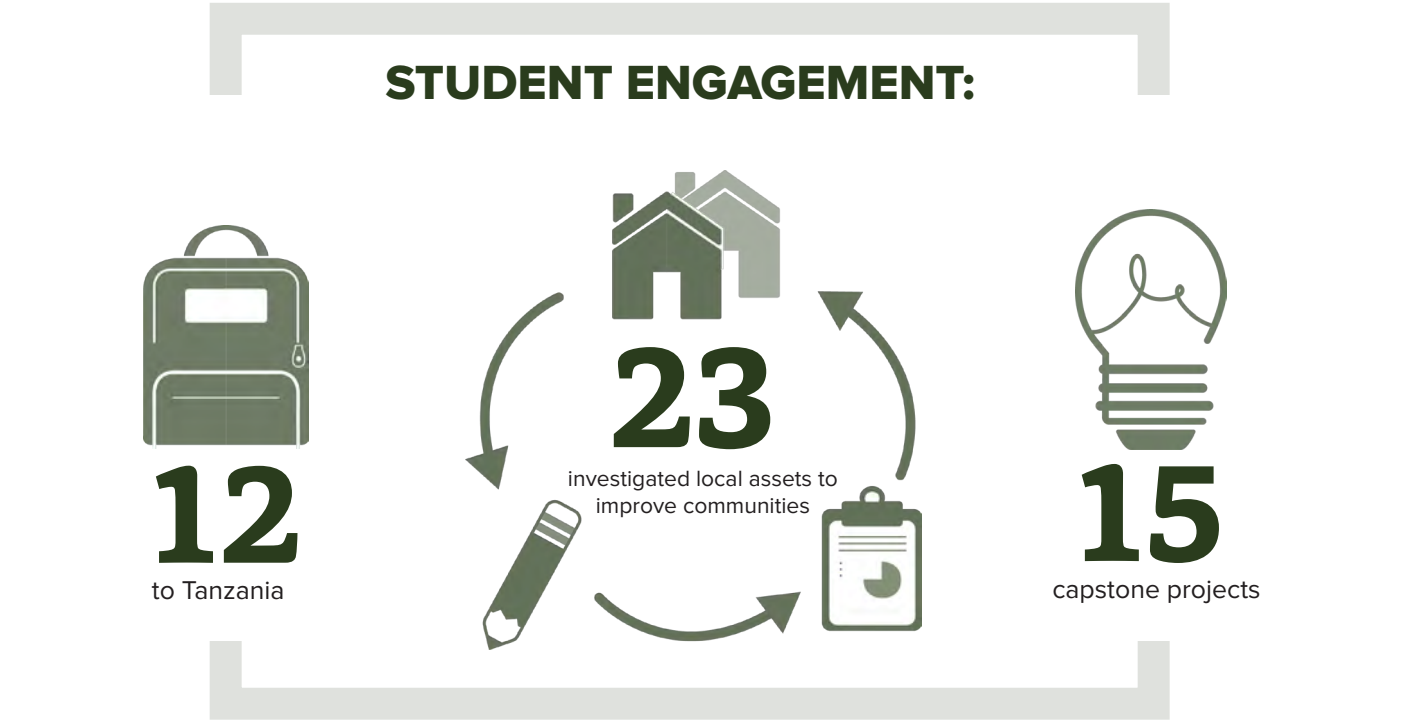
Joe Campbell (right) working with leaders in Marwa, Tanzania, on the community water project.

SITUATION

Despite having many pockets of vibrant economic development, this **growth has not been shared equally**, and Ohio consistently ranks among the bottom states in many measures of social and economic well-being. Columbus ranks 59th in well-being among 382 U.S. metropolitan areas and ranks in the bottom five in environmental health. More broadly, **billions of people in the developing world lack access to basic services and are vulnerable to global climate change**. A fundamental challenge for sustainable development is how to reconcile the tension between economic growth, inequality, and environmental degradation. Addressing this challenge requires an understanding of both the tradeoffs and potential complementarities between economic, social, and environmental sustainability. **Collaborative and participatory approaches** that build on community assets and directly address differences in social, economic and political power are required to promote forms of development that benefit all citizens.

RESPONSE

The School of Environment and Natural Resources brings scientific research and outreach expertise to understand the distribution of poverty and prosperity across communities and to help develop policies to promote the well-being of people and places. Our research often highlights the interactions between social and environmental health. Recent examples include studies of how **changes in consumption patterns can improve well-being** and limit environmental impacts, comparisons of the social and environmental impacts of traditional and **renewable forms of energy development**, and documentation of **community perceptions of “green”** approaches to storm water management. Our sustainable community development efforts include: a service-learning course on the intersection of food, energy, and water in Tanzania; **a capstone course** where Ohio State students work with Smart Columbus staff to solve sustainability planning and implementation problems; and an **internship program** with the Mayor’s Office of Environmental Stewardship.



IMPACT

Our work has been disseminated through journal publications, reports, presentations, and has demonstrated the important role local governments play in promoting economic development, energy development, sustainability, and well-being. **Our efforts have resulted in new city-campus partnerships** and provided support for efforts to enhance community sustainability and resilience at home and abroad. For example, we tracked how a large public green infrastructure program has affected water quality and broader neighborhood dynamics and well-being in Columbus neighborhoods, and documented how a refugee farming project has impacted the economic and social well-being of immigrants and refugees in the city. In both cases, our research has allowed city managers to better accomplish their social and environmental goals. Supported by competitive external grants, our courses, capstones, and internship programs have provided numerous opportunities for **hands-on training and practical experience** for graduate and undergraduate students to learn the challenges and opportunities of community development. Last year, **12 students** worked to design a community-based water treatment project in Tanzania, **15 capstone projects** led to sustainability projects that are being implemented in local communities and on Ohio State’s campus, **and 23 students have collected data** on local assets to guide decision-making and planning in communities and community-based organizations.

Supporting Sustainable Energy Transitions: Understanding the Links Between Energy and Society

Impact Statement 2018

INVESTIGATORS

Ramiro Berardo, Stacey Fineran, Jeffrey Jacquet, Nicole Sintov, Robin Wilson

SUMMARY

Energy and people are connected across numerous scales. Human behaviors both impact and are impacted by transitions in energy systems, particularly in the face of climate change and new technologies. **School of Environment and Natural Resources (SENR) faculty are national leaders in research on energy production, distribution and consumption to understand the relationships between society and energy systems.** We also developed teaching and outreach programs to enhance energy literacy and increase social well-being amid energy transitions.

SITUATION

Ohio has historically been a leader of the production and use of energy. Ohio’s coal industry fueled the industrial revolution while our coal and nuclear energy continue to power the region’s largest population and industrial centers. More recently, Ohio has hosted shale development via hydraulic fracturing, large wind farm development, and large-scale solar arrays. These energy transitions affect all residents, landowners, and consumers, though the distribution of costs and benefits from production and consumption of energy is spread unevenly across the state. Research is needed to guide public policy to maximize social, economic, and environmental outcomes. Despite its importance, many residents have little understanding of the state’s energy systems. Research, teaching, and outreach programs are required to mitigate problems associated with the production of energy and to increase energy literacy to allow consumers to make informed decisions about their own behavior.

RESEARCH IS
NEEDED TO GUIDE
PUBLIC POLICY TO
**MAXIMIZE SOCIAL,
ECONOMIC, AND
ENVIRONMENTAL
OUTCOMES.**

RESPONSE

SENR faculty and students bring diverse scientific research and outreach skills to unpack the linkages between people and the production and consumption of energy.

Our faculty and students are **leading research** projects to understand:

- how landowners respond to opportunities to host new types of energy production
- how different forms of energy development and distribution impact local residents and communities
- variation in attitudes towards energy development, distribution and use
- drivers of consumer behaviors and energy usage patterns

Our courses use energy issues to explore the complicated linkages between policy and the social, economic and environmental outcomes of energy transitions. Students gain increased levels of energy literacy, knowledge of the social, environmental and economic aspects of energy, and learn how to apply this knowledge to real world problems and case-studies.

THESE RESULTS ARE BEING USED TO
ADVOCATE FOR POLICIES TO ENSURE THAT
THE BENEFITS OF 21ST CENTURY ENERGY
TRANSITIONS ARE WIDELY SHARED.

IMPACT

Supported by competitive external grants, in 2018 **our faculty implemented a growing and nationally-recognized body of applied research on social aspects of energy transitions.** We conducted surveys, interviews, and focus groups that document how different landowner groups perceive and are impacted by wind, shale, and coal production. These results are being used to advocate for policies to ensure that the benefits of 21st century energy transitions are widely shared. **We demonstrated** how industry networks and state policy approaches to regulating shale energy development shape the trajectory and impacts of new energy projects across 15 different states. **We surveyed** agricultural operators to better understand their decisions to allow new forms of energy development on their productive fields, which enables us to better predict when and where such projects may take place. **We partnered** with public utilities to gather data from consumers that is contributing to the design of more effective interventions to reduce and/or load-shift energy use in residential buildings. We worked with the Smart Columbus program to document how interpersonal discussions and issues of identity can help increase electric vehicle adoption in the region. We raised the **energy literacy** of hundreds of Ohio State University undergraduate and graduate students by engaging them in hands-on applications of academic theory and research to tackle real world energy issues.

Bringing Back the Fire: Pioneering New Approaches to Using Prescriptive Fires to Restore Ohio’s Native Landscapes

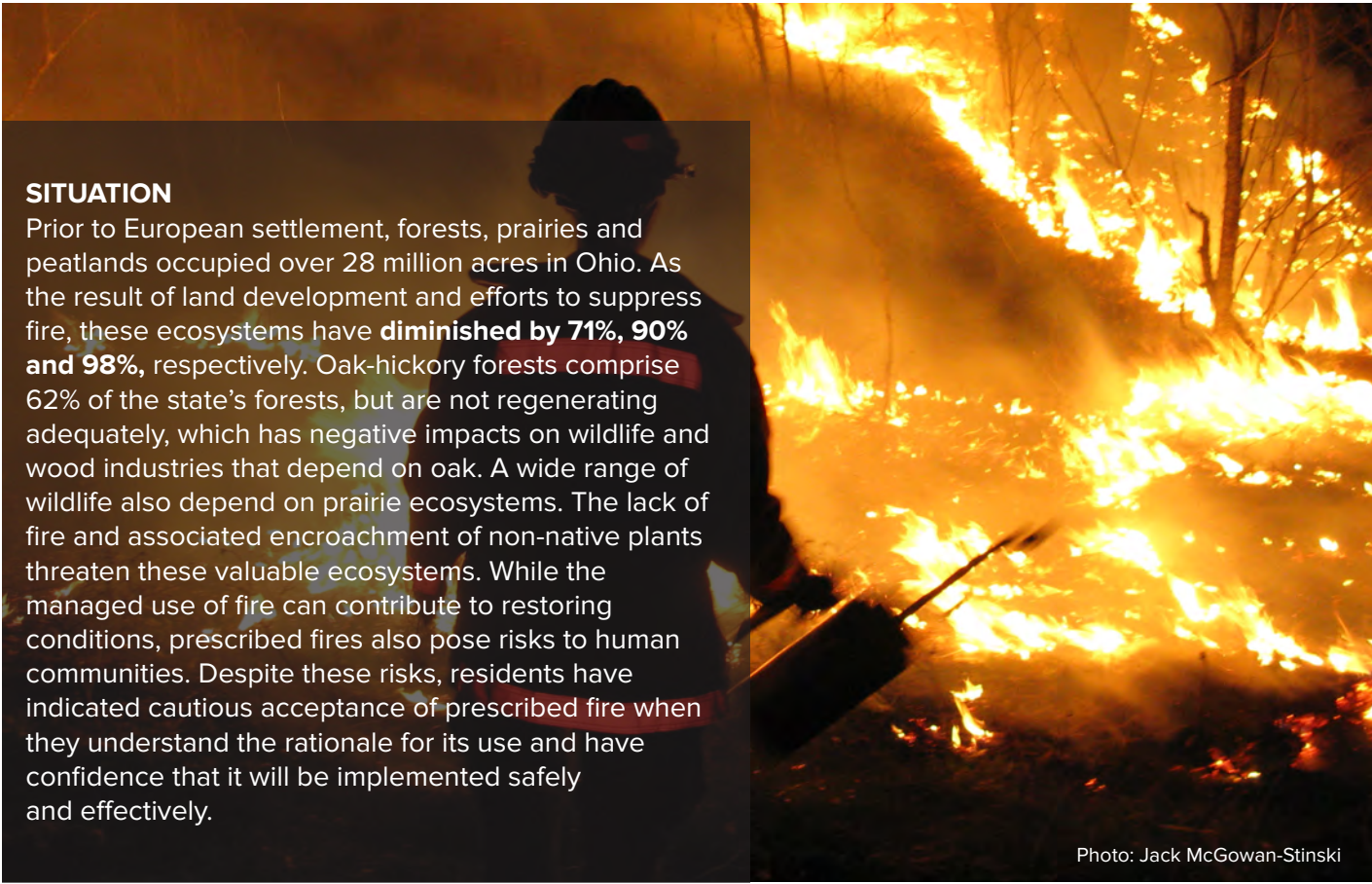
Impact Statement 2018

INVESTIGATORS

Matt Davies, Matt Hamilton, Steve Matthews, Eric Toman, Roger Williams, Robyn Wilson

SUMMARY

Ohio’s native oak-hickory forests, prairies and peatland depend on fire to maintain their health and presence on the landscape. The absence of fire has led to the near disappearance of many of these ecosystems. School of Environment and Natural Resources (SENR) faculty are working to better understand **how fire can be used as part of broader ecosystem management and restoration programs**. While fire enhances biodiversity and reduces invasive species, use of fire will require addressing public perceptions about the risks and benefits of fire.



SITUATION

Prior to European settlement, forests, prairies and peatlands occupied over 28 million acres in Ohio. As the result of land development and efforts to suppress fire, these ecosystems have **diminished by 71%, 90% and 98%**, respectively. Oak-hickory forests comprise 62% of the state’s forests, but are not regenerating adequately, which has negative impacts on wildlife and wood industries that depend on oak. A wide range of wildlife also depend on prairie ecosystems. The lack of fire and associated encroachment of non-native plants threaten these valuable ecosystems. While the managed use of fire can contribute to restoring conditions, prescribed fires also pose risks to human communities. Despite these risks, residents have indicated cautious acceptance of prescribed fire when they understand the rationale for its use and have confidence that it will be implemented safely and effectively.

Photo: Jack McGowan-Stinski

RESPONSE

SENR faculty are **leaders in research and innovation** to determine how fire can be used to protect and re-store Ohio’s native ecosystems.

Our work focuses on several questions:

- How variation in fire regimes influences the structure and function of prairie and oak forest ecosystems
- How drought affects the severity of peatland fires and how this drives changes in patterns of vegetation regeneration and carbon dynamics
- The role of fire in shaping the balance between invasive and native tree species

As an interdisciplinary unit, SENR combines expertise in forest ecology with research and teaching on the human dimensions of natural resource management. We study the public acceptance of prescribed fires, and work to develop effective public communication and engagement programs and strategies for encouraging fire preparedness on private property. We also explore the factors that shape resource management agency **decision-making** in fire-prone landscapes.

WE WORK TO DEVELOP **EFFECTIVE PUBLIC COMMUNICATION AND ENGAGEMENT PROGRAMS AND STRATEGIES** FOR ENCOURAGING FIRE PREPAREDNESS.

IMPACT

Our work has **provided state resource managers with vital information** to guide their use of prescribed fire to restore oak-hickory, prairie and peatland ecosystems. We have also included expanded information about the **use of fire in our courses**, where the next generation of resource managers received information and certification that meet Federal ICS-100, S-110, S-130 and S-190 requirements for wildland firefighter (red card) certification. **Students who completed our program have taken seasonal and permanent positions** in fire crews and are regularly employed by organizations that use prescribed fire as part of their ecosystem management. Through workshops, demonstrations, and face-to-face meetings, **SENR faculty have also provided critical leadership and guidance** to the Lake States Fire Science Consortium (LSFSC) which coordinates regional fire planning efforts in the region. Our collaborations with the College of Engineering have also produced a prototype of a mission planning platform that uses drones for monitoring and predicting fire behavior in real-time.

CONTACT US

We would be delighted to hear from you and answer any questions you may have.



NOTES

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- **The SENR Wildlife Fund (#316176)** enhances the quality of undergraduate and graduate wildlife education and supports innovative research and outreach efforts to enhance conservation and management.
- **The SENR Experiential Learning Fund (#316175)** provides hands-on and field-based learning that is critical to the success of the environmental professionals that SENR seeks to educate.

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