CFAES

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

Impact Statement

INVESTIGATORS

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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.**

THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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.

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