Appalachian STATE UNIVERSITY

APPALACHIAN STATE UNIVERSITY:

RESEARCH-TO-ACTION MULTIDISCIPLINARY PROJECTS (RAMP)

QUICK FACTS

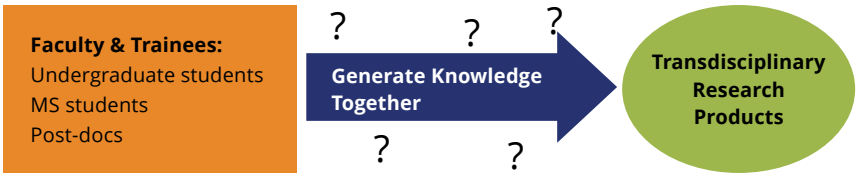
Year founded: **2021**
Project source: **Faculty**
Duration: **Semester-long**
Students per year: **10**
Interdisciplinary: **Yes**
Vertical integration: **No**

By: Kimberly Bourne, Postdoctoral Associate at the Research Institute for Environment, Energy and Economics (RIEEE) and Lead Co-Instructor of RAMP (Fall 2023); Christine Ogilvie Hendren, Vice Provost for Research and Innovation and Professor of Geological and Environmental Sciences; Grace Marasco-Plummer, Associate Director of RIEEE; Jay Rickabaugh, Associate Professor of Government and Justice Studies and Lead Co-Instructor of RAMP (Fall 2022 and 2023)

Appalachian State University RESEARCH INSTITUTE for environment, energy & economics

PROGRAM SUMMARY

As a society, we face many complex, large-scale problems such as climate change and food insecurity, and addressing them requires transdisciplinary research approaches. The Research-to-Action Multidisciplinary Projects (RAMP) model was co-created by the Research Institute for Environment, Energy and Economics and the Honors College at Appalachian State University (App State) as a course-based mechanism for blending the expertise and approaches of multidisciplinary faculty and students in semester-long experiences focused on convergence research. This model is envisioned as a platform for course-based research projects on a variety of problem-centered topics, and thus far has been piloted around two projects: 1) operationalizing the App State campus Climate Action Plan in conjunction with the Office of Sustainability, and 2) developing solutions to phosphorus sustainability.



RAMP experiences seek to address complex and specifically wicked problems at an applied scale using convergence approaches in the setting of the Appalachian High Country, where App State is located. Wicked problems are those that are difficult or seemingly impossible to solve because of the unknowable, contradictory and ever-shifting requirements of any potential solution, and the lack of any stopping rule that would signify a solution had been reached. Convergence research is applied to address these challenges by integrating knowledge, expertise and methods from various disciplines, with the goal of creating new approaches informed by this mixture of perspectives. Projects are developed by course faculty (four to six faculty from different disciplines) to explore locally relevant research questions related to the chosen wicked problem. Students are placed in interdisciplinary groups to complete these research projects under the mentorship of a participating faculty member. Local stakeholder engagement is highly encouraged for each project group.

This research-to-action course-based experience develops students' abilities to investigate physical and social-scientific events and circumstances with a focus on practical application. As a result, these courses emphasize out-of-classroom research but still utilize weekly meetings to build a base of knowledge and experiences and encourage cross-project convergence. The main focus is on developing practical research-to-action skills and convergence science literacy.

As one example, in the second iteration of this course, students explored phosphorus sustainability in connection with the National Science Foundation's Science and Technologies for Phosphorus Sustainability Center, in which Appalachian State serves as a core institutional partner. The element phosphorus (P) has been instrumental in both the most significant revolution to the conventional agricultural food system and one of the biggest environmental disasters of our lifetime. We are simultaneously facing a supply shortage and P-related water pollution, harming essential ecosystems.

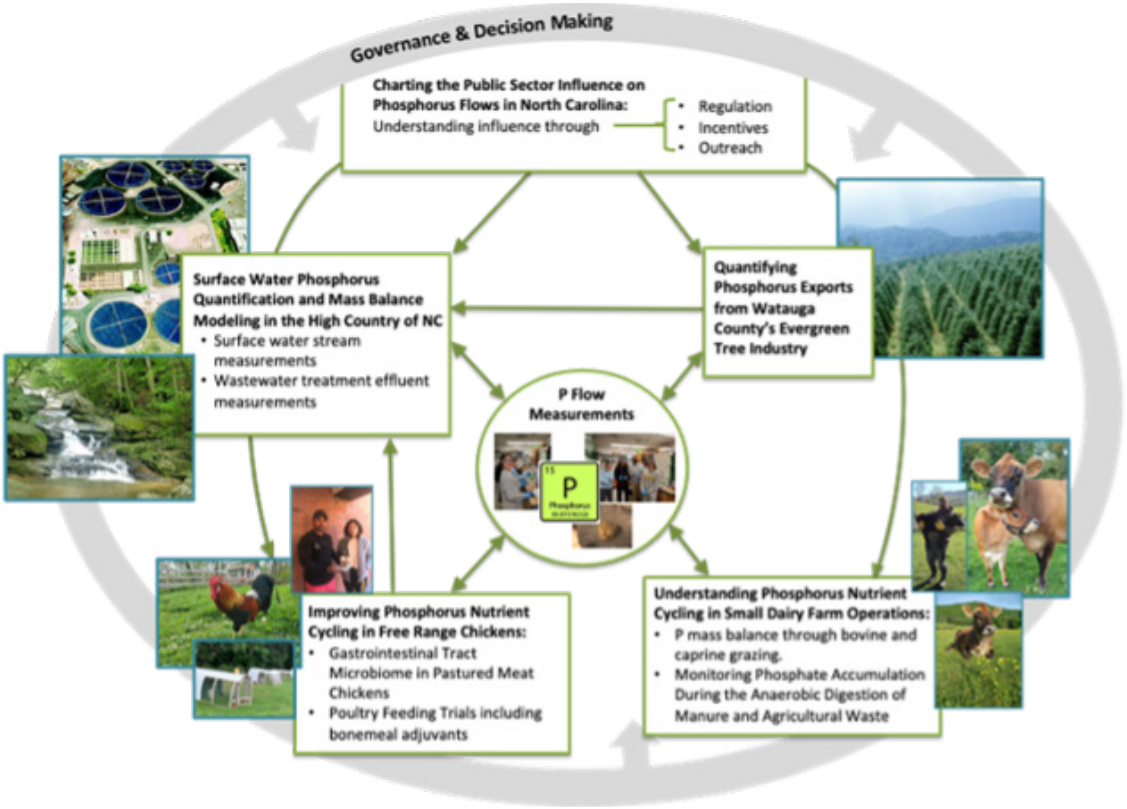


Diagram of an interlinked set of research projects designed to build an understanding of phosphorus flows in the Appalachian highlands along with the decisions and practices that govern them

Faculty from government and justice studies, chemistry and fermentation sciences, and sustainable development and biology departments led projects exploring local P cycling in agriculture and wastewater treatment as well as the government structures present to regulate this cycling. Students engaged in hands-on research activities such as:

- Developing a P supplement made from bovine femurs sourced from a local butcher for livestock chickens and evaluating its sustainability and effectiveness.
- Tracking orthophosphate flows from wastewater treatment plants, livestock production and non-point sources to determine the impact of local industries on P cycling using public databases.
- Evaluating the frequency and type of relevant North Carolina government agency press releases to assess whether P is a subject of outreach to media, and thus, the public at large.

RESOURCES AND ADMINISTRATIVE MODEL

This course is supported by the App State Honors College and the Research Institute for Environment, Energy and Economics (RIEEE). While it is listed as an Honors College course, half of the available seats are open to non-Honors students. The Honors College provides funding to compensate faculty, as this course does not count toward faculty teaching requirements. We have developed tiered faculty roles in which instructors of record take on the course planning, syllabus creation and organizational tasks; core faculty help develop lecture content and closely mentor project teams; and guest lecturers occasionally develop lecture content based on their expertise and provide some guidance to project groups.

The Honors College also provides instructional funding support for two adjunct stipends per course, supplementing research funding for faculty and student projects. Additional administrative support is provided by RIEEE, as Institute leadership helps to determine the chosen wicked problem and appoint instructors of record.

BEST PRACTICES AND LESSONS LEARNED

Based on feedback elicited from course instructors, we have defined three learning outcomes central to any RAMP course: 1) outline a research question and the project methods to answer the question in a rigorous manner, including study design, data collection and data analysis; 2) develop an understanding of wicked problems and establish a framework to assess the viability of different solutions; and 3) carry out convergent research practices to create holistic solutions to wicked problems that cross disciplinary boundaries. Each iteration should also have a learning outcome goal specific to the subject matter to ensure understanding of the complexities of the specific wicked problem and why it is defined as such.

To achieve these learning outcomes, students must first establish foundational knowledge tailored to the wicked problem at hand through engaged, interdisciplinary lectures and background literature review. This foundation helps students formulate research questions related to the larger project. As they carry out the research necessary to answer these questions, students must have the opportunity to reflect on their progress and methods

together throughout the semester. During classroom time, students should be encouraged to continually reflect upon the group's larger body of work and connection to societal impacts. By working across disciplines and projects, students will be able to successfully engage in convergent research in a meaningful way.

Strong administrative and organizational support from the instructor of record and RIEEE have been pivotal elements to course implementation. Instructors who have led these classes have also noted the value of the multidisciplinary approach, underscoring that it has enabled each instructor to share their disciplinary expertise with students in a meaningful way. The students in turn were motivated and engaged with the team and their individual research projects, further contributing to the success of the course.

CHALLENGES AND PRIORITIES FOR THE FUTURE

Faculty have identified several important course improvements, including 1) more effective use of classroom time through providing narrower prompts for guest lectures and more time for students to engage across projects; 2) more frequent course assignments to create a structure for concurrent research progress and evaluation; and 3) the provision of a predefined set of potential research areas as part of a larger project.

Currently, only one section of the course is offered. The long-term goal is to develop a cohesive program and structure to allow for multiple sections based on different issues. Each section will share course objectives around developing the skills to lead and engage with convergent research as well as follow a similar group research project structure with weekly seminars.

The number of sections available will be restricted by the number of faculty willing to take on an additional course and the availability of research funding. The current iteration of the course is bolstered by the research funding provided to App State by the Science and Technologies for Phosphorus Sustainability Center. In future iterations, the instructor of record will have to carefully manage the balance between allowing faculty enough flexibility in defining projects to further their own funded research, while also creating a cohesive set of projects that allows for impactful convergence. An alternative is to find additional funding sources to provide research grants to faculty who agree to lead projects. With each consecutive year the RAMP course has been offered, the course has filled up more quickly with less recruitment effort; however, an increase in program visibility and intentional recruitment across the university is essential to its sustainability in terms of both faculty and student engagement.

Appalachian State University is located in Boone, North Carolina, in the southern Appalachian High Country. It is a public, regional comprehensive university and a Primarily Undergraduate Institution with about 20,000 students, over 150 majors and more than 80 graduate programs (largely master's degrees and certificates). About 35% of students are first-generation.