Enhancing the Student Experience through the Raritan

Overview

The Raritan River has a rich history, which includes strong ties to Rutgers University. However, for Rutgers students the Raritan River is a problem, a physical barrier separating campuses experienced primarily through the windows of a bus. However, a number of entities from across the university are collaborating to transform the Raritan Basin into an academic solution, an interactive field laboratory that enhances the student experience by linking science, engineering, and humanities programs through interdisciplinary classes, projects and activities that take place not only on the banks of but actually on and in the Old Raritan and its tributaries. The initiatives involved in Raritan-related efforts include the Johnson Family Chair in Water Resources and Watershed Ecology, the Sustainable Raritan River Initiative (SRRI), and the new multidisciplinary, university-wide collaborative called the Rutgers Raritan River Consortium (R3C).

Through these groups, students have the opportunity to:

- Access the Raritan River on our new 20 passenger vessel
- Collect and analyze data to improve understanding of the Raritan
- Participate in ongoing research within the Raritan River
- Participate in studios focused on Raritan issues/concerns
- Participate in seminars and conferences addressing Raritan region topics
- Utilize the Raritan as a resource to enhance science, planning and policy curriculum
- Interact with and learn from professionals, stakeholders and decision-makers in the field.

Access to the River

Field experiences provide students with a sense of their local environment and how it fits into the larger world. It also allows students to see firsthand and apply the concepts that are addressed in their courses. These hands-on experiences have been shown to increase student research skills, self-efficacy, and desire to remain in science. Moreover, additional studies indicate that first- and second-hand student data collection spur discussion of “data ownership” (i.e. provenance); how data provide evidence for claims/interpretations/conclusions; data trends; and discussing/explaining data.

In Fall 2016, Rutgers launched a new 20 passenger landing craft that can navigate the lower Raritan River and estuary. The R/V *Rutgers*, operated by the Department of Marine and Coastal Sciences, provides those on board with the opportunity to

experience the Raritan ecosystem firsthand and participate in authentic research and data collection. The vessel is available to organizations inside and outside of Rutgers University and comes equipped with instrumentation to measure water quality and quantity, such as CTDs, an ADCP, and a fluorometer. Since October, groups from Rutgers' School of Environmental and Biological Sciences, School of Arts and Sciences, School of Engineering, Mason Gross School of the Arts, Edward J. Bloustein School of Planning and Public Policy, and Newark campus's Meadowlands Environmental Research Institute, among others, have used the boat. Of the 385 people in total who have been on board, 180 were undergraduates that were onboard with their classes in oceanography, environmental sciences, environmental economics, civil and environmental engineering, and landscape architecture.

Access to Data

Along with learning about the history, economics, flow dynamics, and science of the river, while onboard the R/V *Rutgers,* students routinely collected data on temperature, salinity, pH, dissolved oxygen, backscatter, and fluorescence within the water column. The cruise data is complemented by a real time water quality monitoring station deployed mid-river off the Rutgers boathouse. This data, along with other related data, has been integrated and made available through an open access data portal. The data portal allows all Rutgers students virtual access to the Raritan. With the information in the data portal, students can analyze the dynamic physical and biological processes acting to shape the ecosystem. They will also be able to develop and test models about the past and future behavior of the basin and the effect of human activity.

Research Opportunities

Aboard the R/V *Rutgers*, students have also had the opportunity to gain valuable research experience and contribute to ongoing research. To date, approximately 50 students have participated in research and training projects aboard the *Rutgers*. For example, a graduate student from the Department of Environmental Sciences, with support from undergraduate interns, sampled in Raritan Bay to look at how methylmercury is taken up by the natural phytoplankton, a process that influences concentrations of this toxic mercury species in marine food webs and seafood. Another example of student research involved a group of twelve students from the National Science Foundation's Research Experiences for Undergraduates (REU) who participated in sampling and analysis of the Raritan River. And in a further example, graduate and undergraduate students worked with Dr. Max Häggblom to obtain sediment samples from the Raritan. The students used these samples to set up microcosms and determine the biodegradability and environmental fate of pharmaceuticals and personal care products and their metabolites.

Dr. Häggblom's research was partially supported by funding from the Rutgers Raritan River Consortium's (R3C) mini-grant program. This new program is designed to encourage student opportunities to be involved in multidisciplinary research, learn new industry standard protocols, and analyze data. A further purpose of the mini-grants is to

encourage Rutgers faculty, staff and students to partner with stakeholders from across the Raritan region to advance cooperative watershed planning for a healthier Raritan. Dr. Häggblom's research involves partnerships with a number of water treatment purveyors on the Raritan, which provided students with access to professionals in the field. The R3C awarded a total of five mini-grants in 2017 and also funded two student internships.

Career and Training Opportunities

In addition to formal classroom and research experiences, students also have access to training opportunities on the Raritan led by professionals from both inside and outside of Rutgers. Two examples of this are training events involving partnership with the New Jersey Department of Environmental Protection (NJDEP) and the Marine Technology Society. These opportunities allow students to learn the most up to date techniques and network with professionals.

The NJDEP is charged with monitoring and assessing water quality standards throughout all state waters from inland freshwater ponds and streams to the coastal ocean. In a project partially funded by the R3C mini-grant program, Dr. Bob Schuster (NJDEP) and Dr. Josh Kohut (Rutgers) are working to fill a gap in water quality monitoring along the tidal Raritan River between the Rutgers New Brunswick Campus and the Raritan Bay by training students aboard the R/V *Rutgers* with NJDEP staff. The training included information on the proper way to monitor the tidal Raritan to ensure quality data can be ingested into the NJDEP data archive and the opportunity to ask NJDEP professionals specific questions about their experiences working with a governmental agency. This training engaged eleven undergraduate students and nine graduate students studying public policy and planning, environmental science, biological oceanography, physical oceanography, civil engineering, ecology and evolution, bioenvironmental engineering, and geology.

Like the NJDEP training, the 2017 Marine Technology Society's Glider Camp, led by Rutgers Center for Ocean Observing Leadership, provided undergraduate students with the opportunity to interact with and learn from scientists while on the Raritan. This week long, hands on experience introduced the students to underwater robots and allowed them to apply what they had learned through an underwater glider deployment in Raritan Bay. Ten students from Rutgers, the University of Delaware, Bristol Community College, and the Naval Academy participated.

Practicums, Studios and Internships

The Raritan River and its many regional science, planning and policy issues provide a rich resource for Rutgers practicums and studios where students take on the role of consultant for clients in the Raritan basin. In the fall of 2016, the Millstone Valley Preservation Coalition engaged juniors in Holly Nelson's Landscape Architecture course to re-envision the Griggstown and Blackwells Mills Causeways as part of the Millstone Valley National Scenic Byway Causeway Project. The project involves a partnership with PSE&G, Franklin and Montgomery Townships, the D&R Canal State Park, and the NJDOT.

Students were tasked with addressing utility line and traffic safety concerns, improving public access, improving aesthetics, and addressing habitat concerns.

This past spring, graduate planning students from Dr. Stuart Shapiro's Environmental Policy Practicum accepted the Sustainable Raritan River Initiative's (SRRI) challenge to explore New Jersey policies that impact water quality. Their work resulted in a report entitled, *Every Drop Counts: Locally Driven Policies to Help Improve Water Quality in the Raritan River Basin* that will be promoted by the SRRI in the coming year. Students also presented their findings in a Lightning Talk and poster session at the 9th Annual Sustainable Raritan River Conference and Awards Ceremony.

Also during the spring semester, students in Dr. Rick Lathrop's Advanced Environmental Geomatics class investigated the relationship between land use and water quality/quantity in the Raritan River basin using a geospatially distributed watershed runoff model. Final projects included the development of online map stories examining the natural and cultural history of the lower Raritan. The story maps have been posted to the SRRI website as a resource for anyone taking a tour on the lower Raritan and can be found on the RU on the Raritan blog page. Students also participated in the poster session at the annual conference.

And in the coming Fall semester, Rutgers Facilities and Master Planning will be the client for a graduate planning studio that will focus on the RU2030 Master Plan element for a pedestrian/bikeway bridge across the Raritan River that will connect the College Avenue Campus with Livingston/Busch campuses as well as explore a boardwalk to reconnect the D&R Canal towpath from Landing Lane Bridge to Boyd Park. The guest-lecture style studio will connect students with experts in a broad range of environmental planning fields as students grapple with regulatory, environmental advocacy, habitat, health impact, water supply, public access, and multi-modal transportation issues.

Internships centered on the Raritan take a number of forms. Dr. Dan Van Abs' Raritan Scholars course pairs (unpaid) undergraduate students with non-profit organizations around the Raritan basin to assist them in their work on Raritan issues and to help students gain work experience, professional connections, and to better understand the value of watershed management. One of this past semester's scholars worked with Dr. Rick Lathrop to compile a GIS-based inventory of green infrastructure and habitat restoration projects in the Raritan basin to inform the NJDEP's forthcoming 2017 Integrated Water Quality Assessment Report that will have a focus section on the Raritan Water Region.

Student interns are also a critical component of the R3C mini-grant funded projects mentioned under *Research Opportunities* above. For example, Dr. George Guo secured funding through the R3C for a student intern to conduct an inventory of grey infrastructure in the Raritan Basin that will inform future assessment work in the region. In another example, (paid) student interns and a post-doc performed a significant amount of the data compilation and analysis that went into the recently released status

and trends report for the Raritan – *State of the Raritan, Vol. 1* – that was showcased at the June Conference.

Raritan Conference and Consortium Meetings

Conferences, seminars and meetings focused on the Raritan provide Rutgers students with a number of exciting opportunities to learn about research in complementary fields, to network with professionals in the field, and to solicit interest and feedback when they showcase their own work. Through the support of SRRI sponsors, Rutgers students attended the 9th Annual Sustainable Raritan River Conference and Awards Ceremony free of charge. Over 170 people attended the conference including representatives from environmental non-profits, businesses, local, state and federal governments, academics, and interested citizen scientists and advocates. In addition, this year's conference included a Lightning Talk session where seven of the eleven talks showcased work by Rutgers faculty and staff involving students. The conference closed with a poster session where seventeen of the 25 posters involved students and covered a broad range of science, planning and policy efforts focused on the Raritan.

A further opportunity for students that is based on the Raritan is through the Rutgers Raritan River Consortium (R3C). The R3C holds periodic meetings around campus to share ideas, plan programming, and encourage cross-disciplinary partnerships around Raritan issues. R3C events include a social aspect (food) to encourage networking, and students are invited to participate.

Summary

Through the concerted efforts of the R3C organizations, the student experience on the banks of the Old Raritan is becoming more rich and varied. We are excited to continue to improve the student experience as our programs grow and we continue to build this multidisciplinary collaboration focused on science, planning and policy for the Raritan.