



Letter from the Director

Earth Day 2020. A remarkable phenomenon began on April 22, 1970 where 20 million people around the country rallied and demonstrated their support to protect our environment. It was a magical day, set aside to foster awareness of humanities reach and the accompanying environmental degradation. Shortly afterward, the Environmental Protection Agency, the Mine Safety and Health Act, the Natural Resources Defense Council, the Ramsar Convention, Greenpeace, the Marine Mammal Protection Act, the Endangered Species Act, and the President's Council on Environmental Quality all began while at the same time US Whaling ended. From 1970 to 2018, the combined emissions of the six criteria pollutants set forth by the Clean Air Act dropped by 74%, while the U.S. economy grew by 275%. A Green Economy can work!

This year marks the 50th anniversary of Earth Day, a time for hope and optimism. Yet, as I write these words, greenhouse gas emissions are rising (atmospheric CO₂ at 412 ppm +), Australia is burning, the Right Whale is dying, and 95 US environmental rules are being rolled back. So, at this time of

celebration commemorating the 50th anniversary of a magical event we find ourselves surrounded by a planet and political system in flux. This is also a presidential election year in the United States. The kind of challenges we face rival any in our history and calls out for dedicated, inspirational leadership. We need leadership to forge a pathway towards a pro-conservation, pro-planet, and an environmentally sustainable economy. That leadership comes from two core vectors - top down (elected officials) and bottom up (grass roots) and we desperately need both. We need national leadership on environmental justice, a 100% clean energy economy, end plastic pollution, a new vision for agriculture and a message that resource extraction at the expense of biodiversity is unacceptable. On the top down aspect, we, as eco-conscious voters, get to express our support for the candidates that most align with our core environmental values. On the bottom up aspect, we can vote with our dollars, we can pick up a shovel, and we can take some simple steps that collectively make a big difference. Here are six that I am focusing on this year and in the meantime, I hope to see you at the voting booth and in the streets fomenting or promoting environmental change.



Jerry L. Burgess, Ph.D.
Director for the Environmental Science
and Policy & GIS Programs

2020 Earth Year Resolutions:

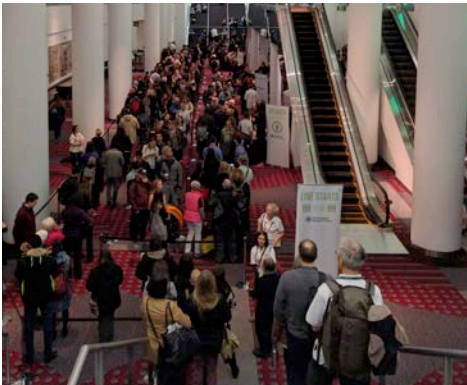
- Read More Books and Nuanced Articles – be smart, be informed
- Skip Single-Use Plastic – we are at a recycling crisis at the moment and there is no need for “wish-cycling”
- Register for an Earth Day Event – at JHU or in your local area
- Eat from the Bottom of the Food Web – saves water, saves energy and tastes great
- Stop Consumerism – don't buy it and shop at thrift stores
- Vote! – Do not waste this opportunity. Your children may not forgive you.

Reality Check

By Niharika Bandaru

“CO₂ is the exhaling breath of our civilization, literally... Changing that pattern requires a scope, a scale, a speed of change that is beyond what we have done in the past.” – Al Gore

“Change” is a word of an ambivalent nature. It can either evoke a feeling of hope and excitement for the thrilling possibilities ahead, or frighten and paralyze one with debilitating grief. When Donald Trump won the Presidential Election in November of 2016, at least half the populace was gripped with fear; a feeling that reverberated across the nation and overseas. There was, however, one particular group, which decided to harness the strength of that fear, to fight another type of change that has now become the rallying anxiety of millions worldwide – climate change.



On March 2, 2017, still fresh from the jolt of reality that hit following the election and the new government’s decision to withdraw from the Paris Accords, a group just shy of two thousand gathered in the Colorado Convention Center (a LEED Gold Certified building powered by an impressive 300kW rooftop solar power system) in Denver, Colorado. The air was rife with electricity and emotion, and when the Former Vice – President of the United States, Al Gore, walked on to the stage, that same crowd erupted into a standing ovation and a string of cheers that lasted a whole five minutes. For the next two days, he was going to be the liberator that would deliver a charged group of environmentalists of all ages (the youngest being a one year old) from the impending climate crisis. This was my first impression of The Climate Reality Project.



[The Climate Reality Project](#), that organizes these carbon-neutral leadership and communication trainings across the world multiple times a year, is a non-profit that was founded in 2005 by Al Gore. “Through grassroots leadership trainings, global media events, digital communications and issue campaigns, Climate Reality works to spread the truth and raise awareness about the climate crisis (Algore.com, n.d.)”; and they have kept their word. To date, they have trained over 20,000 Climate Reality leaders like myself, worldwide. Along with a handful of expert scientists, communicators, elected officials, and activists, Al Gore took to stage for three days in that March of 2017, to show his famous presentation from the award-winning ‘An Inconvenient Truth’ documentary; highlight global mitigation and adaptation efforts; teach community mobilization strategies; and engage with some of the most motivated mosaic of individuals I have ever come across. In more ways than one, the Climate Reality Leadership training changed my life.

A motivated environmentalist that I was, I was just looking for a way to lend my voice to the global movement of climate action – but I knew not how. I held an undergraduate degree in Environmental Engineering, but was working in the automotive safety industry at the time; a far throw from my true passions. In the quest for answers and a community of like-minded individuals during a time of apparent chaos, the training was like a tonic. It was something tangible we could do, instead of grappling in the dark. The camaraderie with fellow trainees, along with the new knowledge, and a plethora of resources, gave me the confidence I needed to get going. Since then, I have started and coordinated a local climate awareness project called ‘[Windsor of Change](#)’, commenced my Master’s with the ESP program at JHU, and most recently, made a career switch and accepted a job as a Climate Change Analyst, where I am currently developing a Climate Change Adaptation Plan for a Canadian municipality. My own little footprint, if I may, in this movement for climate action.

We have realized over the past couple decades, that we live in a time where absolute scientific fact isn’t good enough. Science governs much of the phenomenon on the planet; yet it is not scientists that are the governors or politicians. Scientific communication has come into the foray as scientists are now having to train themselves in how to effectively simplify and accurately communicate complex science to the public. We have to be able to effectively deliver the message as well as mobilize action. As I learnt from my fellow Climate Reality Leaders, change can be an awkward and fearsome thing, but it is change that also creates opportunity to learn and grow. With the climate crisis, not only is it important to recognize what the issues are that are impeding action, but also that we empower ourselves with the right tools, and be persistent.



“After the final no there comes a yes / And on that yes the future world depends.” – Wallace Stevens

Niharika Bandaru is a 5th semester ESP AAP student. She currently resides and works in Ontario, Canada and is a 2017 Colorado Trainee of the Climate Reality Project.

All thoughts expressed in this piece are her own and are in no way a reflection of The Climate Reality Project.

Career Spotlight: Water Resources

By Kelly Romero-Heaney

As the Water Resources Manager for the City of Steamboat Springs, a remote ski town in Colorado, Kelly Romero-Heaney oversees her City's stream health and storm water pollution prevention programs and its water supply, conservation and source water protection planning. The integrated nature of her role has enabled innovative strategies to preserve the health of the Yampa River, one of the few free-flowing rivers in the American West.

When the Yampa River experienced consecutive dry years, it was placed on the EPA's Impaired Waterbody List for temperature, Kelly secured public and private funding, built a coalition and led the development of the Yampa River Health Assessment and Streamflow Management Plan. She quickly put this plan into action by restoring the riparian forest and augmenting flows to prepare the river for the emerging effects of climate change. [Listen to this American Rivers podcast to learn more.](#)

Although Kelly has put environmental science and policy into practice over her 18-year career, JHU's academically facilitated deep-dive into the subject matter offers a fresh perspective on addressing issues of water scarcity and ecological degradation in her native State of Colorado. The flexibility of the ESP Program has allowed her to remain present for her children and her work with time leftover to ski powder, run trails, and grow vegetables in her high altitude garden.



Internship Project in the Peruvian Amazon

By Allison Leight

One of the aspects of the Johns Hopkins AAP program I have been most grateful for the opportunities it provides for its students to travel. With field trips, travel courses, and the ability to customize your own independent studies, this program allows students to get hands on experience in the field across the globe. Through my capstone internship project, I had the opportunity to live and work in the Peruvian Amazon for three months this fall. I worked for Alliance for a Sustainable Amazon, a nongovernmental organization that operates a research station in the Madre de Dios department of eastern Peru in the western Amazon. This young NGO's station, Finca Las Piedras, is situated outside of Peru's protected areas, and is instead located among small farms and Brazil nut concessions. The organization's founders believe this provides them with the unique opportunity to spread conservation ideas to those in the surrounding area through cultivating relationships within the local community, providing education opportunities, and leading by example.

Alliance for a Sustainable Amazon's primary focuses are on biological research, tropical agriculture, and community outreach, and each day at the field station was new and exciting. I had the opportunity to assist with a

herpetology surveying project where we more than doubled the number of species that had previously been seen at the field station in a couple months' time. I also helped with reforestation and seed collection projects, working and interacting with visiting groups, helping some with ASA's *Lepidoptera* project, and participating in workshops on topics including birding, GIS, and off trail navigation. I was fortunate enough to see monkeys, agoutis, and so many species of frogs, lizards, snakes, birds, and insects.

For my independent research project, I designed and implemented an agroforestry plot to test the effects of biochar on the growth and yield of a locally important relative of cacao known as copoazu (*Theobroma grandiflorum*) intercropped with a popular nitrogen fixing tree, *Inga edulis*. If biochar improves copoazu growth and yield, this plot could serve as a model for local farmers as a way to slow the destructive agriculture practices of the area by making existing plots viable for longer. The Amazon faces many challenges, chiefly among them deforestation due to logging, agriculture, and mining. However, hope springs eternal at Finca Las Piedras, and the work they are doing here is incredibly important and beneficial.

“The Toughest Job You’ll Ever Love.”

By Kim Wilson

For most of my time growing up, I knew I would apply for the Peace Corps. My father often regaled my brother and I with story after story about his time serving in Malaysia, and I thought this was a completely normal experience to have before settling down into your nine-to-five. Growing up in the DC area around other Peace Corps parents affirmed this. It was not until I was older that I realized how unique it is for anyone to devote so much time away from their country of birth in service of one they have never known. To this end, for three years, I was a protected areas management volunteer in northeastern Madagascar.

Before getting into my specific experience, it is important to dispel a common misconception. While it is true that volunteers have access to resources, to expect that a Peace Corps Volunteer (PCV) changes their host community by “modernizing” them or providing handouts is to incorrectly frame the intentions of Peace Corps. The true value of the Peace Corps is to instill in the PCV a different take on service than what is espoused in the media towards developing countries, while at the same time augmenting the narrative other countries have regarding Americans. So yes, PCVs have access to several grant opportunities through USAID and other agencies to build wells, start a tree nursery, or fund an anti-malaria campaign, which are all potentially positive projects. Successful PCVs utilize these resources by developing relationships with their community and listening, rather than implementing top-down solutions the PCV believes are necessary. In this way a PCV is a consultant, and not an expert, who is helping their community meet their own goals.

These are all ideas taught in training but putting them into practice truly tests your flexibility. As an environment PCV my projects were especially fluid. I was trained and had expected to work with a small nature reserve to develop their ecotourism, but soon learned my community would benefit more from tree nursery training, and so that is where my work turned. We were later able to turn this into a reforestation effort and received funding to plant trees in

the reserve. Tangentially they requested other capacity-building trainings about which I had no expertise, and so I worked with nonprofits in the area to teach them how to farm crops that provided a higher yield or fetched a higher price at the market. Outlining it here it seems tidy and logical, but in truth these insights were not always easy to glean, and other projects ended up being non-starters even with community support. As a PCV one of the best lessons you can learn is how to start over when you are discouraged and unmotivated. Eventually if you keep trying new approaches with your community in mind, you will likely stumble upon something that works.

My third year I stayed on to be a PCV Leader and to teach at the local university. Working with the department head, we developed a service-learning course to replace the capstone requirement for fourth-year students. In this seminar Malagasy students were partnered with causes they cared about and tasked with designing a project they would volunteer at throughout the semester, culminating in a final presentation on their efforts. Projects ranged from a mentoring program at an orphanage to environmental conflict resolution in a nearby village where a park began enforcing its boundary. Even though I was an environment

volunteer who wanted to work in conservation, by letting go of expectations for what I wanted my service to look like, I found something even better by providing others an opportunity to shine. These sorts of adjustments are common experiences for many volunteers, and it is an important lesson to not be so rigid in your expectations and to remember who you intend to help. In the end, the best impact you can make is one that continues to exist after you leave and that can only be done by empowering others.

I titled this article with the Peace Corps’ tagline from a 1970’s advertising campaign because I truly believe it to be an accurate characterization. In a nutshell, being a PCV is challenging, enriching, and if you are doing it correctly, humbling. As I alluded to, it is a unique path to take and it is not for everyone, so if you have any curiosity into whether you would be a good fit, you most likely would be (no matter what stage you are at in the workforce).
– Kim Wilson, kwils100@jhu.edu



An “Environmental Geology” Career

By David Berry (Hopkins Guest Lecturer)

The Merriam Webster Dictionary defines **Geology** as *a science that deals with the history of the earth and its life especially as recorded in rocks*. The same dictionary defines the **Environment** as *the complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival*. So what would a career in Environmental Geology look like? I would say it’s one that develops an understanding of complex physical, chemical, and biological interactions by examining the preserved record of these interactions to solve threats to human health and the natural world in which we live.

Quite a few years ago, while pursuing my undergraduate degree in Geology, a time came when I realized two things: first, I needed money, and second, it was time to gain some real work experience. And since care for the Earth was a big part of my motivation for studying Geology, I got a list of local environmental consulting firms, submitted several resumes, successfully navigated my first professional interview, and so began my Environmental Geology career.

In the early 1990s, a lot of geology graduates were finding work in the environmental field, and I too was very interested in contributing to a cleaner environment as a profession. My first role in environmental consulting – at a smallish but growing firm – was as an industrial hygienist monitoring the abatement of hazardous building materials, mostly asbestos and lead paint. That position was a Godsend for a 21-year old college student as it offered me evening and weekend work that didn’t conflict with my classes and paid substantially more than my previous part-time jobs. After graduating college, I readily transitioned to a regular full-time employee and eventually made my way into my firm’s Environmental Services Department where I started working on subsurface investigation and remediation projects. It was then that I really felt I’d found my



preferred career path. Working on site investigations and soil and groundwater remediation projects, I began to identify myself as an “Environmental Geologist”, not necessarily fitting the conventional image of the geologist with a Brunton compass and rock hammer in his or her hands, and maybe not the stereotypical environmental scientist studying bugs and bunnies, but rather someone that uses geology to understand and solve environmental problems. Throughout the numerous and varied projects that environmental consultants are tasked with supporting – especially those that involve some sort of subsurface contamination, I saw how important an understanding of geologic principles was to solving environmental challenges.

So What Does an Environmental Geologist Actually Do?

In my career, I’ve spent many years characterizing the magnitude and extent of various contaminants released into the environment...and then implementing remedial actions to mitigate the risks posed by releases of those contaminants. The two

most important questions to answer are what are the characteristics of the contaminant and how will it behave in a specific environmental setting. It’s in answering these questions that the Environmental Geologist can really shine. For it’s here that we get to combine our understanding of contaminant behavior with our understanding of earth systems. Understanding contaminant behavior typically derives from researching published sources for that specific contaminant. For example, is it a solid or liquid at standard temperature and pressure? Is it stable or volatile? If a liquid, is its specific gravity lower than that of water (a “floaters”) or higher (a “sinker”)? Understanding the environment into which the contaminant has been released can also involve some desktop research, but it also usually requires collection of site-specific data from field investigations. For me, this is the most exciting and satisfying part. We Environmental Geologists get to design an investigation scope of work (how and where to collect samples), implement the investigation (collecting field data and

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An “Environmental Geology” Career

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analyzing samples), and then develop conclusions and recommendations based on the data we generate. To understand the fate and transport of our contaminant(s), we need to evaluate the lithologic characteristics of our site (e.g. sand, silt, clay, saprolite, rock), the hydrogeologic characteristics (saturated or unsaturated soils), and the contaminant concentrations at our site. Interpreting the findings from the investigation helps us develop a Conceptual Site Model answering the questions: how did this problem start, what is the current condition, and what will the future condition be.

Data collection activities for a site investigation typically require the use of field observation, specific field instrumentation, and laboratory analyses. Some of the common technologies applied to field data collection include:

- *Water level meter* – uses conductivity for precise elevation measurement of the groundwater potentiometric surface for a monitoring well or piezometer;
- *Oil/water interface probe* – using light deflection and conductivity these probes detect and measure the elevation and thickness of separate phase liquids on groundwater - both light and dense non-aqueous phase liquids (LNAPLs – think oil floating on water, and DNAPLs like dry-cleaning solvents and coal tar);
- *Photoionization detector (PID)* – the PID is a staple of any environmental geologist’s toolbox as it measures total volatile organic compounds (VOCs) – usually in a soil sample – that are common with releases of petroleum fuels and solvents;
- *X-ray fluorescence meter (XRF)* – the XRF is a powerful tool that provides real-time concentrations of certain metals in soil. For example, the XRF is well-suited to delineating residual lead and arsenic in soil associated with pesticide application at an historic apple orchard. XRF technology is also commonly used by industrial hygienists for lead paint analysis in buildings.

An investigation at an historic industrial facility may involve use of several of these instruments to evaluate metals, VOCs, and semi-VOC compounds in subsurface media at the site.

Some investigations warrant the use of in-situ data collection technologies which can generate three-dimensional models of contaminant distribution and lithologic characteristics of the subsurface without the need for sample collection. Examples of tools designed for use with Geoprobe Systems® direct-push drilling equipment include:

- *Membrane Interface Probe (MIP)* – the MIP is a logging tool that measures volatile hydrocarbon and solvent contamination along with soil electrical conductance and permeability. An inert carrier gas is continually pumped behind a heated membrane in the probe as it’s advanced, delivering the carrier gas and collected VOCs to a

series of detectors at the surface. The detectors each respond to different analyte properties which allows the MIP operator to discern the contaminant type and map out the contaminant plume from source to extent. Obtaining an understanding of soil conductance and permeability along with the contaminant information provides insights into whether contamination has impacted subsurface migration pathways or trapped in less permeable strata. All of this information is useful when designing remedial actions.

- *Optical Screening Tools* – these tools use visible, ultraviolet, and/or laser light to excite fluorescent polycyclic aromatic hydrocarbon (PAH) compounds associated with NAPLs to map the distribution in the subsurface.
- *Hydraulic Profiling Tool (HPT)* - The HPT is a logging tool that measures the pressure required to inject a flow of water into the soil as the probe is advanced into the subsurface. This injection pressure log is an excellent indicator of formation permeability. In addition to measurement of injection pressure, the HPT can also measure hydrostatic pressure under a static condition. Along with the flow rate, these data can be used to calculate an estimate of hydraulic conductivity (K) in the saturated formation, yielding information on potential contaminant migration.

On top of the many available technologies to characterize a site, there are an ever-increasing number of technologies available for remediation of contamination, with state-of-the-art products that use chemical and biological processes to breakdown and/or convert contaminants to inert materials in a very cost-effective manner.

Why Is Environmental Geology Important?

With constant advancements in materials technologies and fuel technologies, and with continual research on the effects of human and ecological exposure to the associated natural and man-made chemicals, there will always be a need for environmental geologists to investigate and remediate chemical releases to protect human health and the environment.

When I first started working as a consultant, environment issues rarely garnered front page news. Things are obviously different today; environmental reports often headline the evening news with stories of climate change, global deforestation, contaminated water supplies, new emerging contaminants, habitat loss, islands of floating plastic the size of Texas, and so on. Environmental geologists are playing an increasingly important role in understanding the threats to the environment, using data to understand the processes at work in our changing world, and helping to develop the solutions to promote sound environmental stewardship so future generations can enjoy the beauty of the natural world around us.

Drones on Campus

by *Dietrich Gaitz and John Ahluwalia*

As one might expect, I was excited to see a 'Drones in Geospatial Decision Making' course offered at Johns Hopkins University. GIS for Geospatial Decision Making was an experience that broadened the scope of my studies, not just within Geographic Information Systems, but in the fields of environmental decision making, fieldwork planning and analysis, and drone technology and aircraft mission protocol. The course structure and flow differ from others offered in the GIS department and necessitates many skillsets that would prove to be invaluable to anyone who would consider a career involving data collection using an unmanned aircraft. The course is a special kind that provides the student far more than an understanding of a certain subject matter but integrates hands-on application and real-world experience and certification that will follow them well after the course officially ends.

Throughout the course, which was held on the main campus at Homewood, we had great discussions on the multitude of potential applications drones can be or are currently being used for scientific, engineering and planning purposes. The diverse student backgrounds added value to the course, enabling us all to learn from one another from our personal experiences. This class was taught by Prof. Jim Blanchard who is endowed with the experience and technological know-how to offer students with a comprehensive survey of GIS Drone technology. Thanks to our education and training at Johns Hopkins we are certified to fly commercially with the confidence and skills needed to plan and execute scientific missions using modern drone technology successfully. The additional time on campus with our peers resulted in a terrific community learning experience.



Saying Goodbye to Fox Island in the Face of Climate Change

By Norah Carlos



After forty years of hosting tens of thousands of students and teachers on environmental education programs, the Fox Island Environmental Education center has closed its doors. There will be no more Fox Island sunsets, no more casting a line for a rockfish out your window, no more paddles through the guts the marsh, and no more students to walk through its doors. It's a sad reality many of us have known for a while. Fox Island will not be here forever. It cannot outlive or outpace climate change.

For CBF educators like me, and the generations of educators before me, Fox has been the most spectacular place to fall in love with the Bay. The combination of habitat, isolation, and wonder made it the perfect spot for environmental education field experiences. When students and teachers came out to Fox, they were fully immersed in the Bay. Standard activities included testing water quality, walking and paddling through the salt marsh, propping or beach-combing for treasures, and of course, keeping a log book of all the diverse species encountered during the trip. Traditional watermen activities were also essential components of every trip. Setting crab pots, dredging for oysters, and scraping the underwater grass beds were always on the itinerary and where the impact of people came into the conversation. What happens upstream impacts the people, fisheries, and water quality downstream.

The closeness of Fox Island to the Bay is what makes it so special, but also makes it incredibly vulnerable. Once thick and full, the marshes are eroding away. A survey from 1773 shows Fox Island was once 426 acres. Today in 2020, it's barely hanging on to 34 acres. Over the past fifty years, the land surrounding Fox Island has been disappearing at an alarming rate. A combination of sea level rise, erosion, and subsidence

has reduced the area surrounding Fox by more than 70%. With protective marshes crumbling into the Bay, vital defenses from storm surges, high winds, and strong waves are no longer there. Fox Island is at the mercy of the next storm, making it no longer viable for student field trips.

For teachers who have brought their classes out to the education center, Fox Island has been a field experience to bring curriculum and content to life, allowing students to live and breathe a stewardship ethic and fully immerse themselves in the ecosystem. Being on Fox for three days allowed students to embrace a new perspective, see the Bay up close, and make these looming and daunting environmental issues personal. For generations of students, Fox Island has been a transformative experience that brings the Bay to life, steering them towards careers in science, conservation, education, and advocacy. There is so much life in the Bay, so much worth saving. All we have to do is get out there, experience it for ourselves, and take action. Easier said than done, but if we do not take the time to appreciate these precious resources, how are we going to love and protect them?

Fox Island is not the first island to wash away into the Bay, and it will not be the last. Climate change is not just an abstract idea, happening far away in Australia, the Amazon, or the Arctic. It's happening in our own backyards- in Virginia, in Maryland, in the Bay. Coastal communities are vulnerable and in need of support. This is Fox Island's final lesson, its last teachable moment. Don't let other places fall to the same fate as Fox Island.

Norah Carlos is the Education Engagement Manager at the Chesapeake Bay Foundation. She lead teacher professional development courses out to Fox Island for the past five years and managed CBF's neighboring Smith Island Environmental Education Center for two years. She lives in works in Annapolis, MD.

Nature Bound: The ESP Blue Jay Book Review

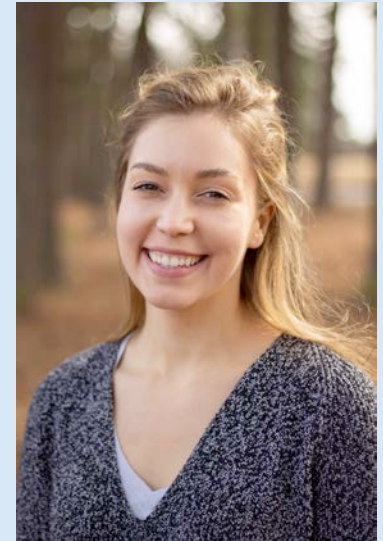
By Morgan Conover

The Overstory By Richard Powers
502 pages. W.W. Norton & Company.

In a society concerned almost exclusively with human affairs, trees are regarded only to the extent they are useful to humans. So when a novel comes along in which trees are given due attention, it's refreshing. *The Overstory* by Richard Powers, which won the 2019 Pulitzer Prize for Fiction, weaves an intricate story of nine people moved to protect trees. They become outcasts as their drive to protect dwindling forests tends towards eco-terrorism. While their lives begin and end in dramatically different ways, they are tied together by a common mission: to preserve and protect the living things still standing.

The Overstory is both a paean to the natural world and a moral call-to-action. It marvels at the interconnected social network of forests, questions what difference individual actions make, asks what it would take to live within our means, questions human primacy and transience, and investigates the role of activism and whether violence can ever be excused even if enacted in the name of a noble cause. The book also speculates on a bleak but likely future: "Look at the life around you; now delete half of what you see."

Powers has crafted a novel as towering as a redwood and as enduring as a bristlecone pine. The best stories are the ones that reveal difficult truths about our society. As one of those stories, *The Overstory* asks better of us.



Hopkins Seminar Series

By Scott Atkinson

Our 2nd live broadcast in the Business of Saving our Planet series called "Technology, Innovation & Intelligence in Conservation" occurred on January 7th. Our panelists included Aulani Wilhelm (SVP, Center for Oceans at Conservation International) who led the designation of Papahānaumokuākea Marine National Monument, one of the largest protected areas on Earth. Andrea Crosta (Co-Founder of Earth League International) who is the main protagonist in Nat Geo's 'Sea of Shadows' and Netflix's 'Ivory Games'. Will Marshall (CEO of Planet Labs) whose company films the Earth from space every day and makes global change visible, accessible, and actionable. We were honored to have Hopkins well represented by our very own Dr. Rae Wynn-Grant, who among other topics, discussed technology's role in wildlife ecology and conservation!

This panel was moderated by current student, Scott Atkinson, who corralled an

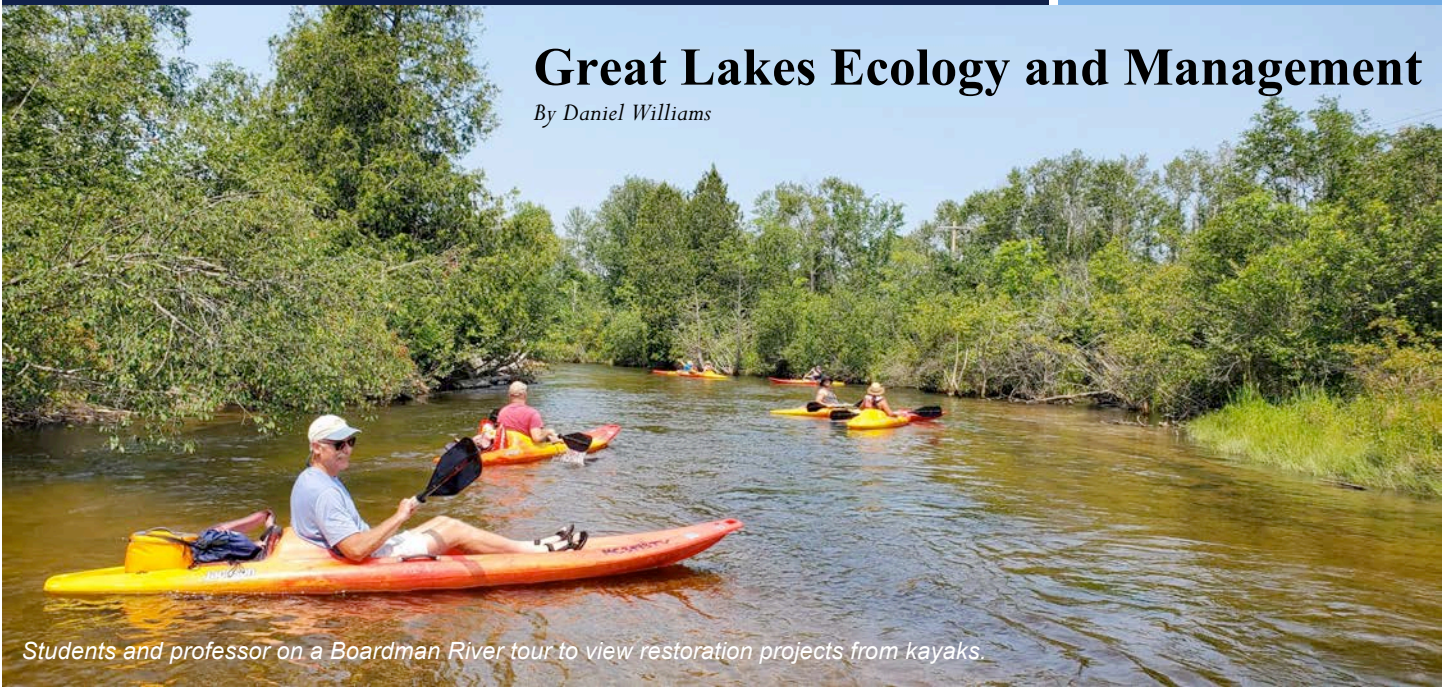
impressive group of leaders in the room for the broadcast. The live audience included JHU students, alumni and CEO/Executive level leaders from organizations such as Google, WildAid, the Marine Mammal Center, Island Conservation, Wildlife Conservation Network, Softbank's Vision Fund, Mission Blue, RedPoint Ventures and several other impact investment firms and non-profits.

With this panel discussion, we discussed critical issues in wildlife biology, the use of technology to help fight illegal wildlife trade, explored how technologies are impacting conservation and used to drive climate policy changes in the EU, highlighted new tools for large scale science communication, and explored how technology can democratize scientific access and empower wildlife biologists, business people and policy makers.



Great Lakes Ecology and Management

By Daniel Williams



Students and professor on a Boardman River tour to view restoration projects from kayaks.

Seeing any one of the Great Lakes for the first time is nothing short of exhilarating. When one hears the word “lake,” there is a set of expectations that follows but those assumptions are shattered when witnessing a Great Lake. It is more likely one would believe they are standing on a coastline, immersed in the sound of thundering waves powerful enough to bring down ocean going vessels than to think they were gazing out on freshwater. The sheer vastness of a Great Lake and the glorious wonderment it incites cannot be properly described in writing. It needs to be felt. This summer, students of the Great Lakes Ecology and Management course had the most meaningful and unforgettable experience doing just that.

Upon arrival at Cranbrook Institute of Science in Bloomfield, Michigan, students stepped foot into a mystery filled and ivy laden museum. Opening the doors to the room designated for our classroom lectures, we were greeted by walls of books and full-sized casts of both a tyrannosaurus rex and triceratops skull. The tone was set. It was immediately apparent that this wouldn't be an ordinary educational experience.

Jon Allan, a brilliant, good-natured man and recently retired Director of the Michigan Office of the Great Lakes, began with a powerful introduction to the Great Lakes. He expressed the sheer weight of the task in managing 20% of the world's surface freshwater as a system, at scale, and in real-time. In the least, this was an intimidating proposition. Yet our class, bright-eyed, up for a challenge and led by the inspirational, award-winning professor, Paul Kazyak, pushed forward. We were unwavering in our enthusiasm for the opportunity to learn from such distinguished experts.

In the days that followed, every hour was packed with incredible educational experiences. From expert guest lecturers to first-hand experiences seine and gill netting, to a kayak adventure and tours of shipwrecks, students were

engaged in all things Great Lakes for the full duration of the trip. Even aside from our scheduled activities, stops at parks to grill and swim, evenings spent trying the local restaurants while listening to live music, and even a highly coincidental visit to the Great Lakes International Joint Commission meeting in Traverse City, allowed students to relax, open up, and come away with meaningful and life-long friendships. Though there were many impressive and relevant activities, one event, in particular, stood out.

Crossing the Mackinac Bridge and officially arriving in the Upper Peninsula at Bay Mills, we received a truly unique perspective on Great Lakes management. Bucko Teeple, an Ojibwe elder at the Bay Mills Indian Community spoke with us on the native American perspective of subsistence fishing and natural resource conservation. At first, it was apparent that Bucko was somewhat skeptical of our intentions and as we were told stories and shown pictures of the tribe's vandalized and burning fishing boats, his response to outsiders was well justified. Yet, through our sincere conversations it seemed we gained a mutual understanding and were able to dig deeper into issues of tribal fishing rights and their relationship with state and federal governments. Perhaps the reason our time with Bucko was so endearing was that he allowed himself to be vulnerable and trust our motives. His openness allowed for candid discussions about racism and how it affects local opinion of the tribe's fishing practices. We spoke of how misunderstandings of cultural differences can lead to the exclusion of Native Americans in some important governmental decisions that impact the tribe.

Then, the simple, yet truly worthwhile exercise of blueberry picking exposed students to the connection the Ojibwe people feel to both the land and their ancestors. This relationship and link to the natural world greatly informs their management of the land. Taking the perspective that humans and the world are in a symbiotic relationship, rather than one where humans have the power to

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Sunset at Bryant Park, at West Arm Grand Traverse Bay of Lake Michigan.



At the USGS Hammond Bay Biological Station, students and teachers were able to hold sea lamprey, one of the most historically impactful invasive species.

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exploit nature for whatever it has to offer, was not lost on students. Perhaps, taking this viewpoint within government agencies could greatly improve management practices and redefine how we, as stewards of the land, interact with our natural world. The time spent on the reservation and the lessons we learned made for a truly exceptional event.

This course, being the first of its kind, sought to foster a passion for the Great Lakes, relay how important these bodies of freshwater are to the region and to the world, and raise the next generation of managers to continue the mission. From the decimation of lake sturgeon through overfishing, bycatch and altered spawning habitat, to the 1969 Cuyahoga River fire, to the

introduction of nearly 180 aquatic invasive species transported in ballast waters of foreign ships, management of this system has encountered tremendous challenges. Many of these issues have seen vast improvements and some are still very alive and relevant. Yet, with challenges come opportunity. Future managers will have the privilege to confront ongoing issues and forthcoming threats, to redefine the region's resiliency to negative human impacts, and to truly make a difference. The awe-inspiring waters of the Great Lakes are a unique and astounding part of our natural world. They are imperative to our children's future. They are alive. In an ever-changing world, it is up to us to safeguard their life-giving waters and maintain their prestige for many generations to come. Students of this course are now prepared to do so.

News of Note

Stay tuned for:

- Spring episode of: “Business of Saving the Planet” that will focus on the fashion Industry.
- Hopkins will be celebrating the 50th Anniversary of Earth Day so stay tuned.
- Graduation and Reception on May 20, 2020.
- Our Summer Newsletter that will feature our January course on Tropical Ecology in Cameroon (see photo).



Faculty News:

- Prof. Bennett is serving on the EPA Scientific Advisory Committee on Chemicals (SACC) which has been spent most of the past year (and will for the current year as well) providing expert peer review to EPA on the first 10 chemicals being risk evaluated as part of revised Toxic Substances Control Act (TSCA).
- Prof. Burgess presented two papers on metamorphism and geochemistry of rocks in Norway and Maryland at the annual meeting of the Geological Society of America.
- Prof. Houlihan, a tropical ecologist, recently published a paper entitled: “Pollination ecology of the ghost orchid (*Dendrophylax lindenii*): A first description with new hypotheses for Darwin’s orchids.
- Prof. Manville and co-authors will be publishing a paper on the “Effects of Ambient Non-Ionizing Electromagnetic Fields on Flora and Fauna.”
- Prof. da Rosa presented her research on cultural worldview and gender disparities in undergraduate climate science misconceptions at the North American Association of Environmental Education conference last fall.
- Prof. Ristino will have a podcast coming out on the future of food and farming hosted by Rob Verchick, law professor at Loyola in conjunction with the Center for Progressive Reform.
- Prof. Runyon published a book last fall that she co-edited entitled ‘Dryland Ecohydrology’. The book covers a wide range of contributions that seek to describe the various interactions between the biological and physical dynamics in dryland ecosystems, ranging from basic processes in the soil-vegetation-climate system, to landscape-scale hydrologic and geomorphic processes, ecohydrologic controls on soil nutrient dynamics, and multiscale analyses of disturbances and patterns.

Exploring Regional Geology in the Field and in the Lab

by Claire Flynn

We started the semester off with a bang – literally. Hammering off rock samples in the field, four days into class, was step one of our semester-long-exploration of the geology in the Baltimore Piedmont region. Most of us had never taken a geology course, or at least not recently, so pulling over to the side of Route 1 with a couple of sledgehammers was not commonplace. This experiential learning, starting class in the field, was the cornerstone of our geology project. Using the most interesting sample we collected that first field trip, a Perry-Hall Gneiss, as well as samples collected in semesters before, we moved towards unraveling the geologic history of the area using technology. To use the various technologies, we had to prepare our rock sample for analysis. This meant a class period on the JHU Baltimore campus in the rock lab, cutting with a rock saw and diamond blade (see image), pounding the rock into a fine powder, and sending it off to a lab where it would be sliced even thinner into microscope slides. Tactile learning, especially when you're watching a blade you can run your finger over cut literal rock, is quite the way to be thrown into the field of geology.

As the semester went on and we (somewhat) increased our knowledge of basic geological concepts, we also increased the depth of our analysis of our original samples. The giant chunks of rocks which we had carefully sliced into thin sections were sent off to labs – such as the X-Ray Fluorescence lab at Franklin and Marshall. We learned about and viewed each of the machines that would be analyzing our sample. We could view the thin slices through a polarizing microscope. Electron microprobe analysis (EMP) detected major and minor element concentrations and also determined the specific composition of the mineral samples. To learn more about this process, we visited Dr. Philip Piccoli at the University of Maryland EMP lab. We also observed Inductively Coupled Plasma Mass Spectroscopy to determine the trace elements in rock samples. Using all of this technology to determine the mineral composition of the samples in the Baltimore Piedmont region gave a micro-level view of the geologic history in the area. We then further explored the geologic history at a macro-level by returning to the field and visiting Shenandoah National Park's Skyline Drive. Our immersive and experiential project was a unique look at the exploration that geology guides. Being front and center to analyzing a little piece of the region's geology can really put time, and the side of Route 1, in perspective.



Environmental Sciences and Policy
MASTER OF SCIENCE

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