DUKE UNIVERSITY

Nicholas Institute

FOR ENVIRONMENTAL POLICY SOLUTIONS

2019 Annual Report

Local to Global Impacts

Energy Efficiency | Oyster Reef Restoration | Coral Reef Protection

CONTENTS

*Established at Duke University in 2005, the **Nicholas Institute for Environmental Policy Solutions** helps decision makers create timely, effective, and economically practical solutions to the world's critical environmental challenges. Through its five programs, the Nicholas Institute mobilizes objective, rigorous research to confront the climate crisis, clarify the economics of limiting carbon pollution, harness emerging environmental markets, put the value of nature's benefits on the balance sheet, develop adaptive water management approaches, and identify other strategies to attain community resilience.*

MEETING ENVIRONMENTAL CHALLENGES NEAR AND FAR

The environmental and energy challenges that the world is facing do not recognize borders. As such, policy solutions are needed at all levels—local, national, and global—to meet these challenges head on.

At Duke University's Nicholas Institute for Environmental Policy Solutions, we bring our interdisciplinary approach to these issues to decision makers from Raleigh to Washington to capitals around the world. The past year has highlighted our leadership and the thoughtful, timely analysis that we provide to break down barriers to environmental progress.

In our feature section, we describe projects that are making an impact at three levels. The first project brought together a wide range of stakeholders in our backyard to map out an energy-efficient future for North Carolina. Another project is putting tools in the hands of decision makers to assess the effectiveness of habitat restoration in the Gulf of Mexico in the wake of the 2010 Deepwater Horizon oil spill. The final project analyzed international policy for opportunities to enhance protections for warm-water coral reefs and improve the resiliency of these biodiverse ecosystems to climate change.

This year has also seen the launch of a pair of ambitious new projects. Here in North Carolina, we are lending our climate and energy policy expertise to state agencies to help meet greenhouse gas reduction targets set by Gov. Roy Cooper in an October 2018 executive order. On a global scale, we've started a policy analysis that will inform a project with the goal of reducing the flow of plastic pollution into the ocean to near zero.

As we work with the decision makers of today, we are preparing the policy leaders of tomorrow. For a dozen Duke students this year, that meant traveling to Zambia with Bass Connections and the Energy Access Project in an effort to expand access to affordable, modern energy in rural parts of the country. Closer to campus, the Environmental Justice Lab is gathering students, research assistants, and faculty to bring a data-intensive approach to investigating environmental justice issues.

Meanwhile, we continue to find innovative ways to apply research from Duke's world-renowned scholars to real-world policy. There is, perhaps, no better example of this than our Catalyst Program. Seed funding awarded in the first two years of the program has blossomed into larger projects and deepened partnerships between Nicholas Institute senior staff and Duke faculty. The six grants awarded this year promise to do the same.

MEGAN MENDENHALL

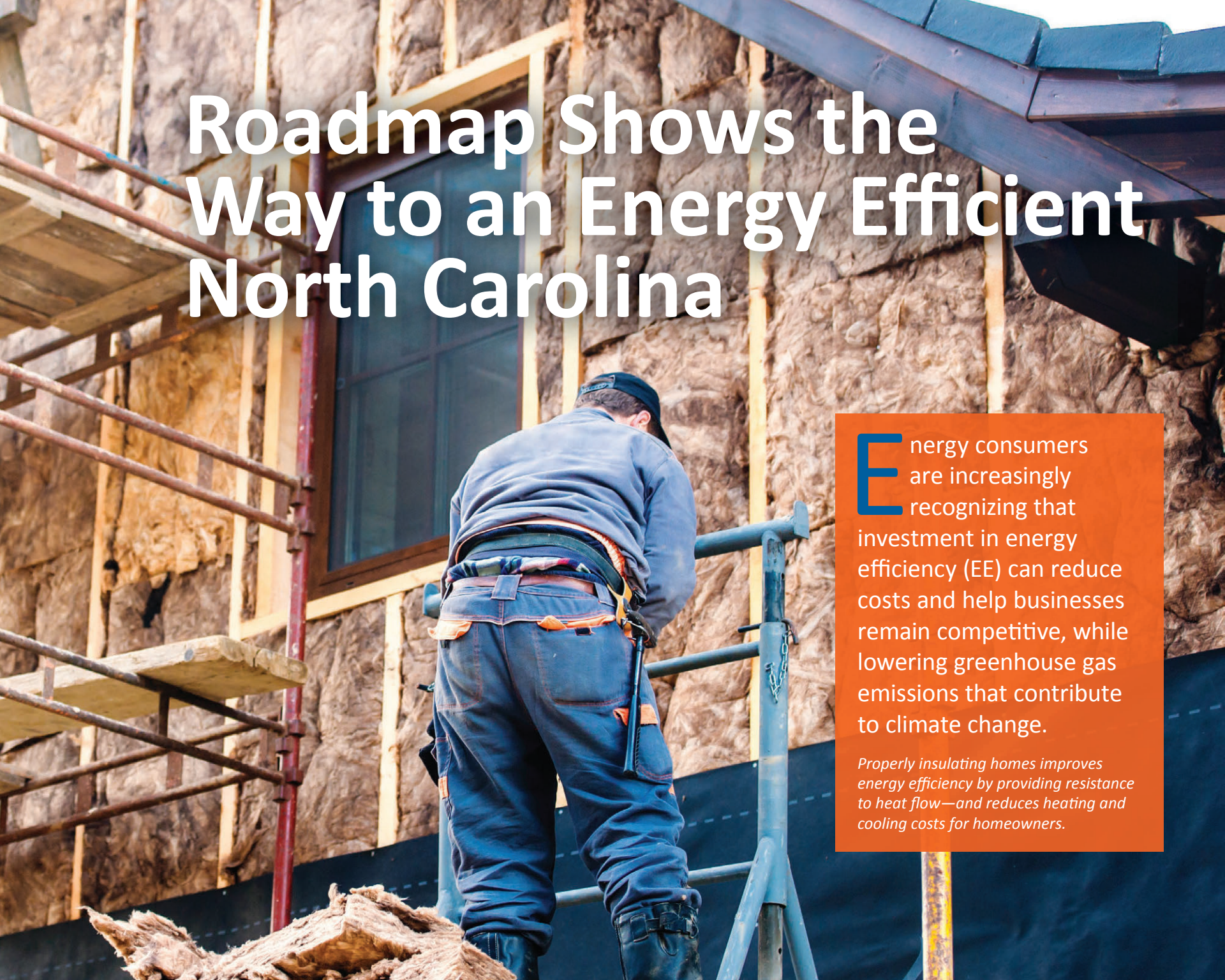
As always, we invite you to contact us to discuss potential partnerships on research, engagement, and educational endeavors.

—Tim Profeta
Director
Nicholas Institute for Environmental Policy Solutions

LOCAL TO GLOBAL IMPACTS

THREE STORIES OF POLICY PROGRESS AT THREE DIFFERENT LEVELS.

Roadmap Shows the Way to an Energy Efficient North Carolina



Energy consumers are increasingly recognizing that investment in energy efficiency (EE) can reduce costs and help businesses remain competitive, while lowering greenhouse gas emissions that contribute to climate change.

Properly insulating homes improves energy efficiency by providing resistance to heat flow—and reduces heating and cooling costs for homeowners.

A small group of leading energy efficiency experts has been building momentum in recent years to make North Carolina more energy efficient. This group—including academic experts, consumer advocates, environmental nonprofits, commercial entities, state agencies, and utilities—has been focusing on ways to educate consumers, pursue new opportunities, and make energy efficiency more accessible to all.

Wanting to expand on this work and help the group drive toward a common goal, Duke University's Nicholas Institute for Environmental Policy Solutions initiated a process in partnership with North Carolina's Department of Environmental Quality (DEQ) to develop the North Carolina Energy Efficiency Roadmap. The objective of this comprehensive Roadmap is to identify and achieve a shared set of EE policy objectives and develop a prioritized set of recommendations to inform the statewide Clean Energy Plan, part of Executive Order 80 (EO80) signed by Governor Roy Cooper in October 2018. (See page 28 for more information.)

EO80 lays out specific greenhouse gas emission reduction targets for North Carolina, as well as energy consumption reduction goals for state-owned buildings. The Roadmap of EE recommendations is included in the state's Clean Energy Plan as an integral pathway to achieving these goals.

Many Drivers, One Destination

The Roadmap process was guided by an EE Steering Committee, who met regularly from September 2018 through July 2019. The role of the committee was to provide guidance and input to the Nicholas Institute as the Roadmap progressed. During this time, a series of workshops and small working groups collected the expertise of more than 100 stakeholders from state, regional, and national

NORTH CAROLINA ENERGY EFFICIENCY ROADMAP

OBJECTIVE 1
Align interests to create an EE conducive climate.

OBJECTIVE 2
Increase access for hard to reach sectors.

OBJECTIVE 3
Develop a uniform standard for tracking and benchmarking EE costs and benefits.

ACTION NEEDED

- Executive or administrative
- Legislative or regulatory
- Non-policy or policy-lite
- Multiple actions

FOCUS AREA

- **A** Regulatory studies/changes
- **B** Enhanced data tracking
- **C** Increased efficacy of existing EE programs
- **D** Improved technical assistance for utilities and state agencies
- **E** Energy Efficiency Advisory Council (EEAC)
- **F** Statewide Clean Energy Fund
- **G** Opportunities for new program development
- **H** Building code improvements
- **I** Education and awareness
- **J** Workforce and economic development

KATE COBB

Participants in a May 2019 workshop prioritized the 32 final recommendations listed in the North Carolina Energy Efficiency Roadmap.

organizations in the development of impactful and feasible EE strategies that could help the state achieve its EE potential.

"The amount of listening, learning, and discussion that took place during this process has been really informative and beneficial to all participants," said Jennifer Weiss, a senior policy associate at the Nicholas Institute who led the Roadmap process. "The networking during these workshops allied people to others that they might not have been in contact with in their normal workday. The goal was not to gain consensus on all recommendations, but to have a broad set of stakeholder voices and ideas heard and discussed."

To ensure that recommendations delivered from this process were holistic and supportive of goals and objectives of the state, the Roadmap followed a "five pillar" approach. The five pillars—benefit analysis, regulatory reform, education and outreach, financing models, and grid integration—form the framework of the Roadmap, with equity as an overarching consideration for all pillars.

An initial workshop held at Duke in October 2018 brought together stakeholders from academic institutes, utilities, environmental agencies, industry, and government agencies, including DEQ. Workshop participants discussed challenges and barriers to energy efficiency in North Carolina, the true potential for energy efficiency in the state, and shared goals among all the sectors.

The group's first task was to establish three shared objectives that would, together with the five pillars of the Roadmap, become

the foundation for the evaluation of all recommendations. Workshop participants then discussed approaches, methods, tools, and other ideas to achieve these goals.

More than 100 potential solutions were discussed and then distilled down to 11 working group themes, ranging from Education and Workforce Training to Data Access, Analysis, and Tracking. These working groups met from November 2018 through March 2019 to research potential solutions, interview subject matter experts, and refine recommendations. The goal during these work sessions was to come up with specific recommendations for achieving the energy efficiency goals laid out in EO80.

Shared Energy Efficiency Roadmap Objectives

1. **Align interests to create an EE conducive climate**
2. **Increase access for hard to reach sectors**
3. **Develop a uniform standard for tracking/benchmarking EE costs and benefits**

On the Road to Energy Efficiency

In May 2019, the stakeholders reconvened for a second workshop to hear each working group's presentation on 32 final recommendations. During the second half of the workshop, participants were tasked with prioritizing these recommendations based on their impact and feasibility. From these exercises, the Steering Committee consolidated the list to 10 focus areas, which were then presented to DEQ to be included in the Clean Energy Plan:

1. Energy Efficiency Advisory Committee
2. Enhanced data tracking
3. Education and awareness
4. Workforce and economic development
5. Building code improvements
6. Statewide Clean Energy Fund
7. Regulatory changes/studies for evaluating EE programs
8. Improved EE program efficacy
9. Opportunities for new program development
10. Improved technical assistance for utilities and state agencies

> "The Energy Efficiency Roadmap is not a starting point, nor is it a destination." —**Jennifer Weiss**, senior policy associate, Nicholas Institute

While it is clear from EO80 and the Energy Efficiency Roadmap process that North Carolina has made strides to become a more energy-efficient state, there is a lot more work to be done. With the Roadmap showing the way forward, a key to rapid implementation is to establish an Energy Efficiency Advisory Committee to oversee progress on the plan's recommendations, further refining them and continuing to facilitate discussions between EE stakeholders and subject matter experts.

While not all of the final recommendations had agreement from all participants and many potential solutions did not make the completed Roadmap, the hope is that other groups across the state will continue to work on the various ideas generated by the Roadmap process. By continuing to work together on the EE focus areas and recommendations outlined in this Roadmap, North Carolina will be well on the way to meeting the clean energy goals outlined in EO80, as well as increasing grid resiliency and improving the health and economic well-being of all of the state's energy consumers.

"The Energy Efficiency Roadmap is not a starting point, nor is it a destination," Weiss said. "It is a framework for mapping out the potential pathways towards greater investment in energy efficiency in order to maximize its full potential as a least cost resource. It is important that North Carolina continues to innovate and encourage ideas from all stakeholders as we all work together to help the state achieve its economic and environmental goals."

—by Kate Cobb

Work on this project was funded by the Merck Family Fund and Energy Foundation.

GEMS:
Discovering the Right Metrics for Restoration

Volunteers in Florida set up oyster balls to provide surfaces for oysters to attach. The restored reef will become a living shoreline to prevent coastal erosion by stabilizing sediment and attenuating waves.

A casual observer might think of habitat restoration as a singularly environmental issue, but the truth is restoration involves—and benefits—many areas of human life. The return of a wild place to its natural state is one benefit, of course, but economic pluses like jobs, recreational areas, and better health are all a part of what communities can gain when society decides to restore a disrupted environment.

Money from the federal government is flowing into restoration of the Gulf of Mexico following major oil spills like Deepwater Horizon in 2010. Right now, however, there is no shared platform to guide the assessment and reporting of restoration progress and its effectiveness for the broad set of environmental, social, and economic goals shared by the many institutions working in the Gulf.

The GEMS program—Gulf of Mexico Ecosystem Service Logic Models & Socioeconomic Indicators—wants to change this. GEMS is looking to standardize the metrics used to consider the broader benefits of restoration, and "to get to the point where we can account for how restoration is benefiting people in both the selection of restoration projects as well as in tracking restoration projects to see what is achieved," said Lydia Olander, director of the Ecosystem Services Program at Duke University's Nicholas Institute for Environmental Policy Solutions.

The GEMS team is using ecosystem service logic models to find the best way to track restoration benefits going to fisheries, employment, recreation, tourism, and the ecosystems themselves. These models trace the effects of restoration strategies as they influence ecological and social systems to create outcomes that are important to people, a best practice recommended by the National Academies of Science.

The GEMS project, housed at the Nicholas Institute, is a test project for the Bridge Collaborative to see if Bridge guidance on logic models and evidence evaluation work as tools to advance cross-sector impact. The program is headed by Olander; Christine Shepard, director of science, Gulf of Mexico Program, The Nature Conservancy; Heather Tallis, global managing director and lead scientist for strategy innovation, The Nature Conservatory; and David Yoskowitz, associate director and endowed chair for socioeconomics, Harte Research Institute.

"Will the billions being spent to restore the Gulf of Mexico have a lasting impact for Gulf state economies and the ecosystem? Right now, there's no easy way to know because there is no clear way to assess these projects," said Tallis. "It is tough problems like this that the Bridge Collaborative aims to solve by connecting people and evidence that don't usually meet."

Oysters in the Gulf

GEMS spent year one of its operations building ecosystem service logic models for the oyster reef restoration techniques prevalent in the Gulf with expert input and a literature review. Ecosystem service logic models can be used to highlight gaps in the understanding of how oyster reef restoration affects the biophysical and social systems, guide monitoring efforts to address these uncertainties, and illuminate the most important pathways from oyster reef restoration to various outcomes.

The team focused on oyster recovery efforts at locations in five Gulf states: Galveston Bay, Texas; Chandeleur & Breton Sounds, Louisiana; Back Bay of Biloxi, Mississippi; Mobile Bay, Alabama; and Charlotte Harbor, Florida.

"We wanted a touchpoint in each state to ensure that our understanding of restoration in these systems was relevant at both the local level and regional scale in sites across the Gulf," Olander said. The sites are also interesting because "some of these sites are a part of national networks like the National Estuarine Reserves or the National Estuarine

The GEMS team held a workshop in Punta Gorda, Florida, in October 2018 to discuss oyster reef restoration in Charlotte Harbor.

Partnership Program, so they have a lot more science and data that might support the new metrics we were working to develop."

The team found that there are six oyster reef restoration techniques widely used across the Gulf, though which are used varies from place to place. The end result of restoration was not just an improvement to the environment in areas such as reduced shoreline erosion and increased fish populations, but economic and mental health bonuses: more jobs, impact to public infrastructure, and better quality of life.

Katie Warnell, a policy associate at the Nicholas Institute, has spent a good deal of time in the Gulf working on this project. She said the group's initial list of benefits to oyster restoration evolved over time, and some, such as flood protection and carbon sequestration, were removed because "stakeholders and experts told us that they are not strongly driven by oyster reef restoration or not highly important to Gulf coast communities." She was also surprised by how important recreational fishing was as a benefit across the Gulf coast.

"The five focal estuaries where we held workshops varied in population, local economy, and status of oyster reefs, but participants at each workshop identified recreational fishing as one of the most important outcomes of oyster reef restoration," Warnell said. "We also heard from some participants about the cultural and economic importance of high-quality recreational fishing, as it makes guiding fishing trips a sustainable way of life."

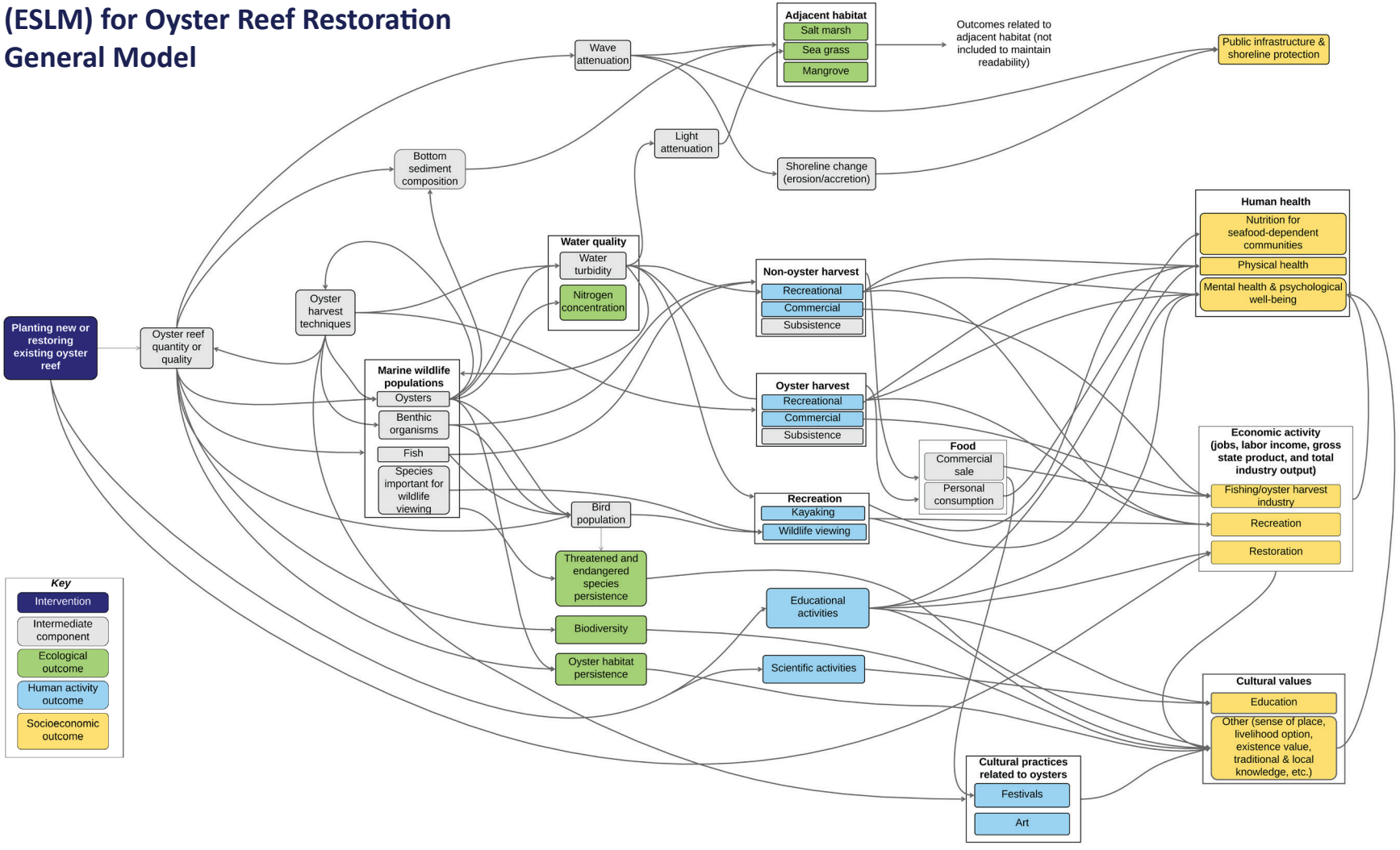
Of the many metrics developed, those related to economic impact, like jobs, were unexpectedly difficult to measure.

"We found that the existing data is insufficient to track jobs at a project scale, except for restoration jobs that are directly tied to restoration funding," said Olander. "Other types of jobs, like commercial and recreational fishing, require the use of economic modeling to estimate how restoration changes jobs at a regional scale and then backtrack these to estimate more local, county-scale restoration impacts."

Economic revitalization and community resilience are two of the five goals for the Gulf Coast Ecosystem Restoration Council, a part of the RESTORE Act, and an independent entity of the federal government. Established by President Barack Obama in 2012, one of the Council's primary responsibilities was to develop a comprehensive plan to restore the ecosystem and the economy of the Gulf Coast region.

Josh Goldstein, director of the Bridge Collaborative, said the GEMS work "is completely in line with the RESTORE Act itself.

Ecosystem Service Logic Model (ESLM) for Oyster Reef Restoration General Model



> “Will the billions being spent to restore the Gulf of Mexico have a lasting impact for Gulf state economies and the ecosystem? Right now, there’s no easy way to know because there is no clear way to assess these projects.”
>
> —**Heather Tallis**, global managing director and lead scientist for strategy innovation, The Nature Conservatory

The language in there really says this is what we're aiming for with restoration." The value in understanding what the benefits are from different types of restoration ahead of time is "invaluable," he added.

Year Two and Beyond

Moving on to year two, GEMS will tackle most restoration options funded by RESTORE and the Gulf states. The program will develop a suite of models and metrics for restoration of beaches, dunes, barrier islands, seagrass, tidal marshes, wetlands, and non-natural restoration action such as stormwater management, septic tank removal, recreation enhancements (e.g., boat ramps), and surge barriers.

GEMS will produce two users' guides, one aimed at funders and another for practitioners. The funders' guide will specify the kinds of outcomes that arise from different types of restorations to assist in the comparison of project proposals. It will also include the socioeconomic measures and metrics for the benefits these projects might generate, how they can be quantified, and whether these metrics could be required for reporting or suggested as optional measures. For the practitioners, the guide will help them build their ecosystem service logic models and metrics and assist them in setting their projects in terms of the funders' hoped-for outcomes.

The use of ecosystem service logic models by projects and funders is intended to increase transparency about the expected outcomes of projects including their socioeconomic benefits, which are currently not the focus for many projects. And the inclusion of a standard set of reporting metrics for restoration projects will allow for better cross comparison of projects and the ability to roll up results and report across large scales. Ideally, this will help target restoration funding toward projects that provide the most benefit to both nature and human society.

This project is a partnership among the research organizations, the Gulf funders, and restoration practitioners that will integrate these ecosystem services tools and metrics into their restoration process.

"Cross-collaboration with our partners on this project was essential for getting input from a wide variety of stakeholders as we developed socioeconomic metrics," said Olander. "Our partners at The Nature Conservancy, the Harte Research Institute, and our Advisory Council with state, federal, regional alliance, and funder representatives all have extensive networks of restoration practitioners and community stakeholders throughout the Gulf to ensure that we capture the full spectrum of benefits from restoration that matter to Gulf coast communities, and that the socioeconomic metrics we develop to capture those benefits are feasible for projects to measure."

—by Jason Gray

Work on this project is funded by the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine.

Policy Analysis Looks for Opportunities to Strengthen Coral Reef Protections

Warm-water coral reefs are the most biodiverse marine ecosystems on the planet, providing homes for thousands of species that can be found nowhere else. They also are considered to be some of the most vulnerable ecosystems to climate change.

Coral bleaching occurs when corals exposed to stresses such as rising temperatures or pollution lose their symbiotic algae, causing them to turn white.

Duke's John Virdin met with a U.N. advisory committee for the second time in Bangkok, Thailand, in October 2018 as part of the coral reef policy analysis. The committee provided guidance to the Nicholas Institute team at key points in the research process.

The impacts of other human activities have a cumulative effect on coral reefs and hamper their ability to respond to climate change. For this reason, the United Nations Environment Programme (UNEP) was tasked by U.N. member states with finding out whether current international policy is adequate to both address all of these various human activities and enhance the resilience of coral reefs. A research team from Duke University's Nicholas Institute for Environmental Policy Solutions took an exhaustive approach to reviewing international policy to try to get UNEP the answer and chart a possible course forward.

"There's no lack of commitment that countries have made," said John Virdin, director of the Ocean and Coastal Policy Program at the Nicholas Institute. "It's not as if this has been forgotten. Countries have made hundreds of commitments over the years related to coral reef conservation and management, but the amount of binding, enforceable commitments, the specificity of those commitments, was not very large."

A Rapidly Changing Environment

Often called "rainforests of the sea," warm-water coral reefs are estimated to provide habitat for more than a quarter of all marine life—despite covering only a small fraction of the ocean floor. Largely as a result of this high biodiversity, hundreds of millions of people rely on coral reefs for numerous benefits, including food and revenue from fisheries, storm protection, recreation, and even medicine.

These delicate ecosystems are quickly changing, however, as the world's oceans continue to get hotter with increasing greenhouse gas concentrations.

A 2018 report from the U.N. Intergovernmental Panel on Climate Change projected that coral reefs will decline by 70 to 90 percent with global warming of 1.5°C compared to pre-industrial levels. Human activities such as overfishing, nutrient pollution, and coastal development are further degrading reefs at the local level and making them less resilient to the effects of rising temperatures.

As if to underscore the magnitude of the issue, the U.N. Environment Assembly met for the second time ever in 2016 in the midst

of an unprecedented global coral bleaching event. During the session in Nairobi, Kenya, the Assembly passed a resolution to promote the sustainable management of coral reefs. The resolution directed UNEP to work with the International Coral Reef Initiative to analyze "global and regional policy instruments and governance mechanisms" related to the protection and management of reefs.

"The idea was that there is all this new science coming out showing just how vulnerable these reef ecosystems are," Virdin said. "Do we have the right international policies in place to address this?"

> "There's no lack of commitment that countries have made—it's not as if this has been forgotten."
>
> —**John Virdin**, director, Ocean and Coastal Policy Program, Nicholas Institute

Building a Policy Library

UNEP's Coral Reef Unit asked the Nicholas Institute to serve as a technical partner and conduct the policy analysis. The team from the Nicholas Institute was comprised of: Rachel Karasik, a policy associate; Amy Pickle, director of the State Policy Program; Steve Roady, a Nicholas Institute faculty fellow and professor at Duke Law School; Tibor Vegh, a policy associate; and Virdin. The group also enlisted the help of Charles Di Leva, former chief counsel of the Environmental and International Law Unit at the World Bank Group.

To help guide the research process, UNEP formed an advisory committee of 23 experts from 14 member nations, most of which have coral reefs. The committee met for two days in June 2018 to review the research plan for the project. A follow-up workshop in October 2018 gave committee members an opportunity to review a first draft of the report with a summary of the results.

Before the Nicholas Institute researchers could dig into the study, they faced a challenge—identifying what exactly they were going to analyze.

"The easiest way to do the analysis would have been to just turn to a database and retrieve the relevant policy documents, code them, and analyze them," Vegh said. "We were missing the crucial first step—there was not such a database available."

Without an inventory of coral reef policies at their fingertips, the team would have to build one from scratch. The researchers cast

a wide net in their search, checking existing international policy databases, scientific literature, and "grey literature," such as government reports and white papers. Advisory committee members also consulted with their professional networks for leads.

"We looked at pretty much every written source we could think of," Vegh said.

The search turned up thousands of pages of documents containing hundreds of policies with varying degrees of specificity to corals. The team, in consultation with the advisory committee, had to make choices about what exactly to include in the analysis. One example of an obvious fit was a prohibition on boats dropping anchor near a coral reef off Hawaii. The 1996 London Protocol that banned dumping from marine vessels was more ambiguous because it does not explicitly mention corals, but it made the cut because of its clear implications for the ecosystem.

The team ultimately catalogued 232 policy instruments that directly or indirectly support either the conservation and sustainable management of coral reefs or address the manmade causes of change in these ecosystems. Those policy instruments contain nearly 600 discrete commitments related to coral reef ecosystem conservation and management that the international community has made.

DID YOU KNOW?

> 85 percent
of the world's warm-water coral reefs are under the jurisdiction of just
25 countries

Three countries alone—Australia, Indonesia, and the Philippines—are home to
> 40 percent
of the reefs

Report Recommendations

The report, *Analysis of Policies related to the Protection of Coral Reefs*, identified four possible pathways for international policy responses to promote the protection and sustainable management of coral reefs. As noted in the report, these pathways are not mutually exclusive.

1. **Maintain the status quo for international reef-related policy, with accelerated implementation.**
2. **Strengthen the existing international policy framework and governance mechanisms.**
3. **Introduce new international policy instruments and/or governance mechanisms.**
4. **Provide rapid support for policy implementation targeting a subset of countries.**

A Broad But Shallow Commitment

With their sample finally defined, the Nicholas Institute researchers used coding software to identify what each policy is meant to address. In addition, they categorized policies based on whether they represented legally binding commitments or softer, aspirational ones.

Once everything was coded, the researchers were able to summarize what the international community agreed to do to preserve coral reefs. The analysis showed that "the breadth of international coral reef-related instruments is vast," but "the depth is less so." Many commitments are vaguely focused on "marine and coastal ecosystems" rather than coral reefs in particular, and the majority set voluntary targets for individual countries. While the analysis focused on policy design rather than implementation, the team could conclude that simply following through on all these existing commitments—voluntary or not—would go a long way toward improving the condition of coral reefs. That was reflected in the report's four recommendations, which generally encouraged the use of incentives to get countries to do their part.

"[International policy] has been broadly designed to address threats to coral reefs and the key drivers of change," Virdin said. "It's maybe not as specific and as binding as it could be. But rather than focus on a new binding coral reef conservation treaty, why not focus on some sort of funding mechanism to help countries implement the commitments that they've already made?"

In March 2019, UNEP presented the report during the fourth session of the U.N. Environment Assembly in Nairobi. While UNEP endorsed the report's recommendations, the Assembly simply took note of them and encouraged countries to consider them.

Despite the lack of immediate action, the analysis provides a path forward for the protection of coral reefs.

"Countries individually can do a lot," Virdin said. "They don't have to act collectively because these are mostly ecosystems under national jurisdiction."

The research method developed for the report also has the potential to help the Nicholas Institute in its future work. Many of the same members of the coral reef team are already applying it to an upcoming study of public policy on preventing plastics from reaching marine environments. (See pages 30-31.)

"This could be the beginning of one type of research that we do really well, which is analyzing policy in a more comprehensive and top down way to see what's worked and what hasn't worked and offer solutions to policy makers," Vegh said. "This is a very good representation of what the Institute should do and does."

—by Jeremy Ashton

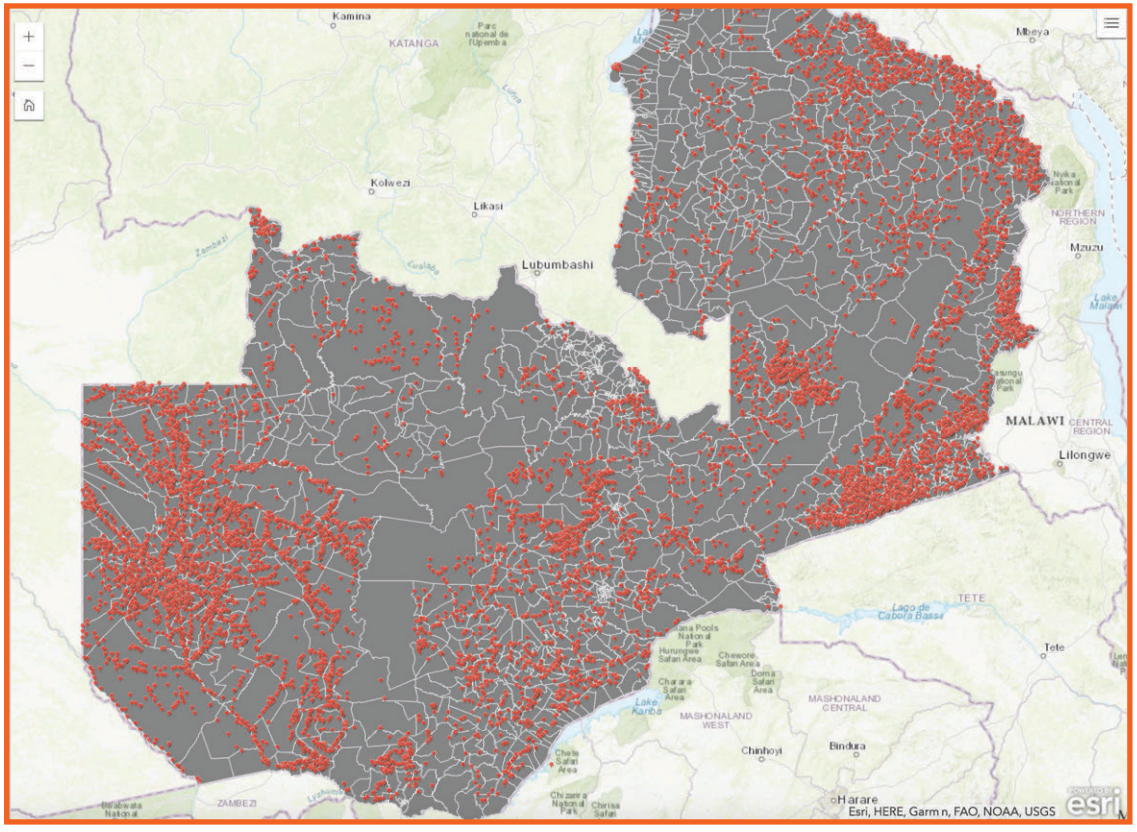
Work on this project was funded by the United Nations Environment Programme.

EDUCATION

Chase the darkness away!

Students Explore Energy Access in Zambia from the Ground Up

Access to affordable, modern energy is critical to economic development in rural sub-Saharan Africa. Increasingly, sources off the main electrical grid, such as solar home systems and microgrids, are providing the power that people in these areas need.



SUBHRENDU PATTANAYAK

During the 2018-2019 academic year, a dozen Duke students worked with faculty and staff from the Energy Access Project (EAP) to explore ways to expand access to off-grid energy in one particular African country, Zambia. Funded by and conducted through Bass Connections, the project sought to evaluate the business and policy landscape for energy access in Zambia. The project was led by two staff members from the Nicholas Institute for Environmental Policy Solutions—EAP Director Jonathan Phillips and senior policy associate Rob Fetter.

"When it comes to delivering improved development outcomes, energy is the lynchpin for everything from poverty eradication to health, education, and gender equity," Phillips said. "In Zambia, people want electricity. And many are willing to pay for it. So the challenge becomes identifying electrification pathways that allow for grid expansion while giving private companies the tools and enabling environment to step in and help meet the needs of off-grid households as quickly as possible."

The EAP staff chose Zambia for the project because conditions there showed potential for replicating results elsewhere. While each country has its own unique characteristics, Zambian household income levels, electrification rates, and ratio of urban-to-rural populations are similar to many other parts of Africa. Zambia is also beginning to

Geospatial Model:
http://bit.ly/ZambiaGeospatialModel
User's Manual:
http://bit.ly/ZambiaGeospatialModelManual

About the Energy Access Project

Established in 2017, the Energy Access Project at Duke University takes an interdisciplinary approach to developing sustainable, modern energy solutions in emerging economies around the world. The project is a partnership of Duke's Energy Initiative, the Nicholas School of the Environment, the Sanford School of Public Policy, Bass Connections, and the Nicholas Institute for Environmental Policy Solutions.

For more information, visit energyaccess.duke.edu.

About Bass Connections

Duke Bass Connections bridges the classroom and the world beyond the university, giving students from all of Duke's schools a chance to tackle complex societal problems alongside faculty. Bass Connections supports research teams that draw on perspectives and methods from multiple disciplines, as well as robust engagement with communities, stakeholders and decision makers.

T. ROBERT FETTER

draw commercial interest as an electricity market, making policy work there immediately relevant to companies and non-governmental organizations looking to invest time and resources.

The project took an interdisciplinary approach to understanding the energy access challenge in Zambia, which was reflected in the makeup of the student team. The seven undergraduates and five master's students brought a variety of perspectives from different majors, including public policy, environmental management, engineering, and economics.

"There were a lot of people coming from a lot of different backgrounds in this class, so we wanted to maximize the skills that we already had in the room and come up with something substantial," said Ian Ferguson, who graduated in the spring with a master's degree in environmental management from the Nicholas School of the Environment. For most of the fall semester, the students developed the scope of the project, discussing how best to concentrate their work. The conversations were informed by studying academic literature on energy access and hearing guest lectures from experts.

The project team also visited Zambia twice—first in August 2018 for a scoping trip and later in March 2019 to report on their results. Over the two visits, the students met with more than 40 representatives of private companies, NGOs, government agencies, the

national utility, and donor partners working on power sector development. In addition, they interviewed households in four Zambian communities to better understand consumer energy needs.

That firsthand experience proved to be invaluable.

“I learned a lot from [the academic literature], but when you actually go on the ground and start asking people questions, you realize that it’s a pretty different landscape,” said Kemunto Okindo, an undergraduate majoring in civil engineering.

By the start of the spring semester, the team had split into three groups, each responsible for delivering its own set of products.

The first group mapped and analyzed the existing policy framework related to off-grid energy. The students identified key stakeholders, available methods of financing and assistance, and the most relevant market barriers. Their analysis dug deeper on two issues that could have major implications for expanding off-grid energy in Zambia: results-based financing incentives and the regulatory environment, including recently established trial standards for minigrids.

AASHNA AGGARWAL

In conversations with developers, investors, and donors, one of the most frequent requests was more detailed data on customer demand for energy. The second group of students aimed to fill some of that knowledge gap. They interviewed households and small businesses and collected socioeconomic data to get a sense of Zambians willingness to pay for various energy services, such as cellular phone charging or lighting.

The willingness to pay data was incorporated into the third group’s product—an interactive map to guide off-grid developers and electricity system planners in selecting potential markets for expansion. Using publicly available data, the geospatial application provides detailed information on public infrastructure, population density and other demographic features, proximity to settlements, cellular phone coverage, and other important factors. The application enables users to prioritize specific criteria so they can narrow down where to invest.

For the students, the hope is that their project will lay a foundation for improving Zambians’ access to energy and their everyday lives, from health care to education to economic opportunities and more.

“Energy access really can be the catalyst for a lot of these issues,” said Miranda Wolford, an undergraduate student majoring in political science. “There are just a lot of opportunities for private companies to sustainably and ethically get involved in this space.”

—by Jeremy Ashton

Work on this project is funded by the Bass Connections Challenge.

The Environmental Justice Lab

Environmental policy does not just affect nature and climate; it affects human beings around the globe. So, there is a great need for consideration of environmental justice—where all are equally protected from health and environmental hazards regardless of race, gender, income, or national origin.

Kay Jowers, senior policy associate at Duke University's Nicholas Institute for Environmental Policy Solutions, and Christopher Timmins, professor of economics in the Trinity College of Arts & Sciences, created the Environmental Justice Lab in 2017 in response to a lack of "data-intensive policy-relevant investigations." Seed money from Trinity College to start labs in the Duke Economics Department got the project underway. While not a traditional lab one would find in the natural sciences, this lab is a gathering of like-minded individuals, professors, students, and research assistants "to tackle a series of related questions," as Timmins put it.

The Lab's current suite of projects includes a study of concentrated animal feeding operations impacts in North Carolina; the effect of housing discrimination on the sorts of neighborhoods that renters are steered to and away from; and the impact of natural disasters on disadvantaged groups, specifically Hurricane Sandy's wake in New York City.

How society adapts to climate change is a prime concern of environmental justice. What adaptation looks like in the short run is those who can afford to move out of places at risk are being replaced by people who are willing to take on additional risk in order to save money for other necessities (i.e., a question of income inequality).

"If we don't prevent new people from moving into these areas, we are likely to see a big increase in disproportionate exposure to climate risks over time before these areas become uninhabitable," said Timmins.

They are seeing the beginning of this process now with the aftermath of Hurricane Sandy.

"With Hurricane Sandy, we are interested in how neighborhoods that were flooded, or which became threatened by flooding after the updates to the flood maps, changed sociodemographically," said Timmins. "This relies on very detailed data about individual household location and relocation decisions that we acquired this past year."

The Lab's work has already yielded published results in a few short years. More working papers and articles detailing the results of the recent studies are on the way, which the members of the Lab hope will have an impact soon.

In addition to providing applied experiences for PhD and master's students, the Lab has supported approximately 15 undergraduates in its three years of operation. Anne Driscoll, now a PhD student at Stanford University, worked in the Lab on a few projects, including record linkage of housing data, the impact of hog farms on housing prices, and descriptive work on environmental justice.

"[Jowers and Timmins] set an amazing example—that I didn't appreciate as unique at the time—of how to use academic power to advocate for people, and how research can and should go hand in hand with what communities actually need," Driscoll said. "Their work goes beyond being abstract 'interesting' research; it's immediately impactful research. They've set an incredibly high standard for the kind of work I'd like to spend my life doing."

—By Jason Gray

Work on this project is funded by Duke Trinity College of Arts & Sciences.

Q&A *with* ADAM FISCHER

Adam Fischer graduated from Duke University in May 2019 with dual master's degrees from the Nicholas School of the Environment and the Sanford School of Public Policy—and a five-month head start on his post-Duke career. During the spring semester, Fischer began working for the U.S. House Energy and Commerce Committee, where he interned the previous summer. He earned class credit for the job through an independent study advised by Tim Profeta, director of the Nicholas Institute for Environmental Policy Solutions. Fischer took a few minutes to discuss this unique experience and his time at Duke.

▸ Your concentration in the Nicholas School's graduate program was in energy and the environment. What interested you in working in this particular area?

Fischer: Back in high school, I first realized that climate change was something I was particularly interested in. When I went to Tufts University, I doubled down on that and devoted my time to studying energy and climate policy, at least to the extent that I could as an undergrad.

As soon as I graduated, I moved to D.C. for an internship at the White House doing energy and climate policy work, which felt like one of those surreal once-in-a-lifetime experiences and just reaffirmed my interest in that field. From there, I went on to work in consulting for the Department of Energy as a contractor, just continuing to gain more exposure to these issues and broadening my depth of knowledge in energy and climate policy.

It's just such a dynamic field, and I've always been fascinated by and drawn to the idea of addressing these challenges that are so complex. The more I learned over the years, the more I wanted dig deeper.

▸ How did this opportunity with the Nicholas Institute come about?

Fischer: My first year at Duke, I wasn't planning to necessarily do the dual degree. I was at the Nicholas School and, as part of that, I had the opportunity to do a research assistantship. Fortunately, I ended up at the Nicholas Institute, which, quite frankly, was the only assistantship I wanted.

It was precisely the type of work I wanted to be doing—that kind of analytical focus on energy and climate issues but also with this applied view toward how to translate what's happening in a research organization to the real world.

I tend to think of myself as a pragmatic person, and I think that the Nicholas Institute takes a very pragmatic approach to the work it does. I was able to work with the Climate and Energy Team there for my first year, met some really interesting people, and was part of some very timely work. And I was able to maintain those relationships that I made moving forward.

▸ What did you learn through this experience beyond what you could get in a typical graduate program, and how do you think it has helped prepare you for your career?

Fischer: It's easy to get caught up in thinking about the curriculum and the classes and what seems like the more obvious parts of grad school. Now having finished up at Duke, I look back, and that was obviously an important part of my time there. But it's the relationships I built and the extracurricular experiences I had that were really formative, especially my time at the Nicholas Institute.

There are a lot of individual pieces of the puzzle from my time at Duke that made it such a memorable experience, but the Nicholas Institute definitely played a central role. And working with Tim was and has been very rewarding because of where he came from professionally and what he brings to the Nicholas Institute from that time. It's invaluable for me, personally and professionally.

▸ What advice would you have for other Duke students who are looking to follow a similar career path and work on climate change policy at the federal level?

Fischer: Grad school is this kind of unique moment in life when you're constantly surrounded by intellectual curiosity and opportunities that just don't present themselves in the real world. Take advantage of those and meet as many people working on the issues that you're interested in as possible, especially from different programs and places across campus. You never know how their backgrounds and insights might inform your own interests—not to mention who they might know and what professional opportunities might be on their radar.

Duke is a well-connected place on its own, but that network continues on post-Duke. For students who are interested in energy and climate issues, in particular, there are tons of people who are doing really impressive work on and off campus. So try to build that network and build that family as much as you can during your time at Duke, because you never know what doors it might open down the road.

—by Jeremy Ashton

NEW INITIATIVES

North Carolina Commits to Addressing Climate Change, Transitioning to Clean Energy Economy

In October 2018, North Carolina Governor Roy Cooper signed Executive Order 80 (EO80), setting his state on a course to address climate change through an approach aimed at expanding clean energy businesses and creating jobs.

The order commits North Carolina to achieve, by 2025:

- Reductions in greenhouse gases (GHG) to 40% below 2005 levels;
- Growth in the number of registered zero-emission vehicles (ZEV) to at least 80,000; and
- Reductions in energy consumption in state-owned buildings by at least 40% from fiscal year 2002–2003 levels.

Much of the EO80 effort so far has focused on the drafting of key action plans by several state agencies to realize the targets set out in the order. Several senior staff members at Duke University's Nicholas Institute for Environmental Policy Solutions are serving in advisory roles for specific agency plans, including the Department of Environmental Quality's (DEQ) Clean Energy Plan, the Department of Transportation's (DOT) ZEV Plan, and the Climate Risk Assessment and Resiliency Plan.

"Climate change is a challenge like none other, with far reaching and global impacts," said Nicholas Institute Director Tim Profeta. "Any policy solution must take effect at an equivalent scale. But to begin the collective action necessary to reach our global ambition, state leaders like Governor Cooper must move independently and prove the benefit to their jurisdictions. That is why efforts like EO80 are so important to solving our global challenge."

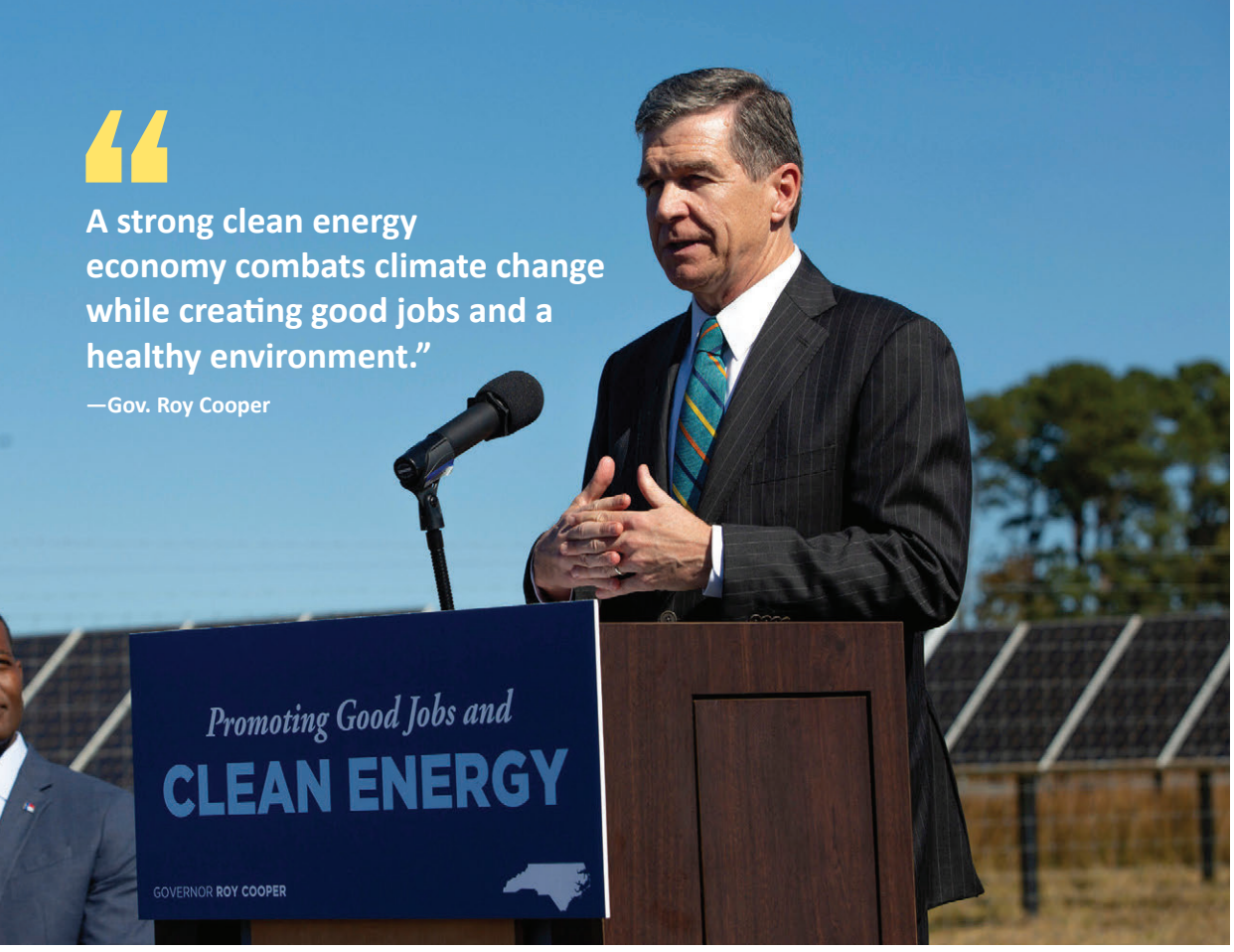
Profeta, Climate and Energy Program Director Kate Konschnik, and senior policy associate Jennifer Weiss have all shared their clean energy policy expertise in meetings and workshops on the Clean Energy, ZEV, and Climate Resiliency plans. In addition, Weiss has led an important parallel energy efficiency roadmap process, bringing together stakeholders from all sectors to discuss energy efficiency's role in achieving EO80's goals.

This roadmap will provide recommendations to increase energy efficiency in North Carolina and will be submitted to DEQ for inclusion in the Clean Energy Plan. (See page 5 for more information.)

"The magnitude of what the governor is trying to do with Executive Order 80 is aspirational and attainable; a lot of people have gotten behind this," Weiss said.

In another initiative, Ecosystems Services Program Director Lydia Olander and policy associate Katie Warnell are leading a subcommittee working with the NC Natural and Working Lands Stakeholder Group on targeting opportunities for floodplains and wetlands across the state. Olander and Warnell are also supporting a subcommittee on coastal habitats that will use modeling to assess where habitats are contributing most to blue carbon and coastal resilience.

NORTH CAROLINA OFFICE OF THE GOVERNOR



North Carolina Greenhouse Gas Inventory

In February 2019, the NC Department of Environmental Quality released the state Greenhouse Gas Inventory, an important foundation for achieving the goals of EO80. This inventory delivers a clear picture of where the state is and how far it needs to go.

23.7%
Statewide GHG reductions in 2017

→

31%
Current projected statewide GHG reductions by 2025

***NOTE: All reductions are compared to 2005 levels.**

One of the underlying intents of EO80 is to involve as many stakeholders in the state as possible. State agencies such as DEQ, DOT, and the Department of Commerce are all leading the effort. These agencies are working together with major NC universities including Duke, as well as utilities, businesses, technology developers, local governments, environmental groups, and other interested clean energy stakeholders and residents across the state.

The hope is that by bringing together all the right people, across different sectors, North Carolina can not only reach the goals by 2025 but exceed them.

"Institutions of higher education are one of the state's strongest assets, and they have been instrumental in the implementation of Governor Cooper's Executive Order 80," said Jeremy Tarr, policy advisor to Governor Cooper and a former Nicholas Institute professional. "Research, analysis, and convenings by North Carolina's public and private colleges and universities, including the Nicholas Institute at Duke University, have helped refine policy options and trade-offs for state decision makers on topics such as clean energy, zero-emission vehicles, climate mitigation, equity, ecosystem services, and resilience. To achieve the transformations needed to meet the challenge of climate change, we will need the innovative thinking and multi-disciplinary expertise that thrive at our universities."

—by Kate Cobb

Keeping Plastics Out of the Ocean

Each year, up to 13 million metric tons of plastic make their way into the ocean—the equivalent of a garbage truck emptying into the sea every minute—according to The Pew Charitable Trusts. Pew has begun a project to keep plastic from polluting the sea and shore and reduce the threat to marine life and is working with Duke University's Nicholas Institute for Environmental Policy Solutions.

Pew's "Preventing Ocean Plastics" project plans to build on recent increased global awareness and discourse around the leakage of plastics in the ocean. To help the international community mobilize to address this problem, Pew is developing a global roadmap to achieve near-zero ocean plastic leakage by 2040. Expected to be completed in time for the U.N. Oceans Conference in June 2020, the plan will identify economically viable steps to reduce the flow of plastics entering the world's oceans and potential public policies to help countries get there.

The roadmap will be developed based on two inputs: an economic analysis and a policy analysis. Pew has commissioned a Nicholas Institute team to conduct the policy analysis. Headed by Oceans and Coastal Policy Program Director John Virdin and State Policy Program Director Amy Pickle, the team includes policy associates Tibor Vegh and Rachel Karasik, faculty fellow Steve Roady, and several students from the Nicholas School of the Environment: Janet Bering, Juan Caldas, and Zoie Diana.

The objective of the policy analysis is to synthesize the landscape of public policy instruments at the international, national, and local levels that are intended to reduce

ocean plastic pollution across different geographic contexts, and then provide insights into the effectiveness of these instruments. The Nicholas Institute group will make a nonexhaustive inquiry into these public policy documents around the globe, based on publicly available data.

Reducing plastic leakage into the ocean is a multifaceted issue that needs action by more than just world governments, but looking at what governments around the globe are doing is an important piece of the work required, Virdin said. One of the desired outcomes of this project is a reasonably robust inventory of governmental responses, and a tool to start to systematically track those responses.

"I hope we get as good a sense as possible of how governments are responding to this problem, and any information available on what is and isn't working," Virdin said. The result of this analysis may include a menu of policy instruments that governments could use for a given context. Together with the economic analysis, this menu could be shared with countries and used as a basis for developing national action plans.

Without urgent action, "scientists predict that the weight of ocean plastics will exceed the combined weight of all of the fish in the seas by 2050," according to Pew. But this is not just a threat to ocean species—while plastic can take hundreds of years to break down completely, in the meantime, some of it degrades to minute particles, fueling concerns that these will end up being consumed by humans in seafood.

"We owe it to ourselves, and all the life in the ocean, to get this right," said Tom Dillon, Pew's vice president and head of environment, in a September 2018 interview on Pew's website.

—by Jason Gray

Work on this project is funded by The Pew Charitable Trusts.

@STUART-PRITCHARDS

Six Duke Projects Awarded Funding

Duke University's Nicholas Institute for Environmental Policy Solutions awarded seed funding to six projects for Fiscal Year 2019-20 through the Catalyst Program.

Now in its third year, the Catalyst Program continues to expand partnerships between Duke faculty and Nicholas Institute senior staff on research and workshops. Projects funded through the program develop new or emergent ideas related to environmental policy challenges at the federal, state, and local levels, and they enhance policy-relevant knowledge for the researchers involved.

"The Catalyst Program is surpassing our expectations in its ability to accelerate our work with colleagues on campus and find new topics on which we can bring campus to applied audiences, and bring applied audiences back to campus," said Nicholas Institute Director Tim Profeta. "Many of the projects over the past two years have increased in scale and ambition from the initial seed of a catalyst grant, and we hope this year's grants will meet with similar success."

Projects funded through the Catalyst Program are:

Green, Healthy, and Affordable Housing for Resilient Communities

This pre-catalyst planning grant will be used to build a team that will design a project to explore and propose policy solutions to two converging crises: affordable housing and climate change. The larger project will focus on creation of specific policy proposals and transactional models for green, healthy, and affordable housing for homeowners and renters in low-income/materially poor communities.

Collaborators: Kate Konschnik, Nicholas Institute for Environmental Policy Solutions; Ryke Longest, Environmental Law and Policy Clinic; Andrew Foster, Duke School of Law; Paige Gentry, Klein Hornig LLP.

ClimateCAP – The Nexus of Climate, Capital and Business in China

In March 2018, Fuqua EDGE organized and hosted a successful event called ClimateCAP: The Global MBA Summit on Climate, Capital & Business—in partnership with 15 other top-tier business schools from the U.S. and Europe—to educate graduate business students about the business implications of climate change. This pre-catalyst grant will be used to explore the potential to hold the 2021 ClimateCAP Summit at Duke Kunshan University (DKU) in partnership with the DKU Environmental Research Center. This effort supports a wider project to enhance Chinese private sector actions to address climate change.

Collaborators: Jackson Ewing, Nicholas Institute for Environmental Policy Solutions and the Sanford School of Public Policy;

Kathinka Furst, Duke Kunshan University Environmental Research Center; Dan Vermeer, Fuqua Center for Energy, Development, and the Global Environment.

Catalyzing New Collaborations on Social & Environmental Determinants of Health in Durham, NC

This project will bring together the expertise at the School of Medicine with the environmental policy expertise at the Nicholas Institute to develop policy-relevant, applied-research projects that evaluate approaches to address longitudinal changes in health outcomes due to dynamic environmental processes within neighborhoods. It will also seek to combine this work with a developing collaboration on housing security to assess children's health and educational outcomes.

Collaborators: Nrupen Bhavsar, Department of Medicine, General Internal Medicine; Kay Jowers, Nicholas Institute for Environmental Policy Solutions; Laura Richman, Department of Population Health Sciences; Christopher Timmins, Economics Department.

HighSeas @ Duke

The open ocean is facing rapid industrialization through traditional uses, such as fishing and shipping, and areas of growth including deep-sea mining, offshore aquaculture, offshore energy development, and communications infrastructure that together drive the emerging "Blue Economy." The management and governance of resources in marine areas beyond national jurisdiction is an urgent focus of the international community. This project will develop the strategic foundation for Duke University researchers to become the premiere academic resource for high seas ocean governance.

Collaborators: Pat Halpin, Nicholas School of the Environment; John Virdin, Nicholas Institute for Environmental Policy Solutions; Steve Roady, Duke School of Law and Nicholas Institute for Environmental Policy Solutions.

Artisanal Gold Mining Intervention Assessment

Artisanal and small-scale gold mining (ASGM) is an informal, non-mechanized economic sector in typically rural areas of more than 70 countries around the world. ASGM is the largest global source of mercury to the environment, and the practice is a leading cause of deforestation and biodiversity loss in countries where it takes place. This project will aggregate knowledge of the underlying dynamics of ASGM and identify and compare interventions that can address various impacts of gold mining to inform current funding priorities and next steps in scientific research and policy integration.

Collaborators: Bill Pan, Duke Global Health Institute and Nicholas School of the Environment; Alex Pfaff, Sanford School of Public Policy, Nicholas School of the Environment, and Economics Department; Lydia Olander and Elizabeth Losos, Nicholas Institute for Environmental Policy Solutions.

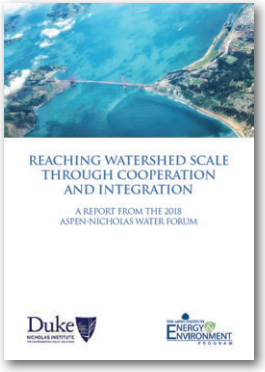
Marine Medicine: Multidisciplinary Research at the Nexus of the Environment and Human Health

Plastics make up more than 10 percent of human waste. Much of these plastics end up in the ocean, where they can be ingested by fish, birds, and other marine species. With the staggering volume of plastic debris produced annually and clear environmental and potential human health impacts, there is an urgent need to develop novel strategies to combat plastics bioaccumulation. Funding from this pre-catalyst grant will provide students with summer internships through the Duke Scholars in Marine Medicine Program to work on a research project investigating how new pollutants and new technology to remediate these pollutants interface with public policy decisions.

Collaborators: Jason Somarelli, Department of Medicine and Duke Comparative Oncology Group; Steve Roady, Duke Law School and Nicholas Institute for Environmental Policy Solutions; Meagan Dunphy-Daly and Richard Di Giulio, Nicholas School of the Environment; Daniel Rittschof, Andrew Read, and Thomas Schultz, Nicholas School of the Environment and Duke Marine Laboratory; William Eward, Department of Orthopaedics and Duke Comparative Oncology Group.

SELECTED PUBLICATIONS

Reaching Watershed Scale Through Cooperation and Integration



"Reaching Watershed Scale Through Cooperation and Integration" summarizes the Aspen-Nicholas Water Forum discussions of May-June 2018. The forum explored how integration could address the mismatch between what has traditionally been local solutions for local water issues and emerging water challenges that impact large geographic regions, multiple sectors, and different community functions. Integration is intended to synergistically combine efforts and resources to create benefits that could not have been individually achieved. The forum explored the opportunities and challenges to integration within and between water sectors, identifying common elements for success.

Cross-Discipline Evidence Principles for Sustainability Policy

Social and environmental systems are linked and, as this relationship becomes ever more apparent, governments, communities and organizations are increasingly faced with, and focused on, problems that are complex, wicked and transgress traditional disciplinary boundaries. This article in the journal *Nature Sustainability* suggests that evidence-based approaches to solve these complex multi-disciplinary challenges must draw on knowledge from the environment, development, and health domains. To address barriers to the consideration of evidence across domains, this paper develops an approach to evidence assessment that is broader and less hierarchical than the standards often applied within disciplines.

Reducing Environmental Risks from Belt and Road Initiative Investments in Transportation Infrastructure

The Belt and Road Initiative, due to its diverse and extensive infrastructure investments, poses a wide range of environmental risks. Some projects have easily identifiable and measurable impacts, such as energy projects' greenhouse gas emissions. Others, such as transportation infrastructure, due to their vast geographic reach, generate more complex and potentially more extensive environmental risks. The proposed Belt and Road Initiative rail and road investments have stimulated concerns because of the history of significant negative environmental impacts from large-scale transportation projects across the globe. This Working Paper for the World Bank studies environmental risks—direct and indirect—from Belt and Road Initiative transportation projects and the mitigation strategies and policies to address them. The paper concludes with a recommendation on how to take advantage of the scale of the Belt and Road Initiative to address these concerns in a way not typically available to stand-alone projects. In short, this scale motivates and permits early integrated development and conservation planning.

West Africa's Coastal Bottom Trawl Fishery: Initial Examination of a Trade in Fishing Services

Many states attempt to increase the economic benefits generated from their fish resources through foreign fishing arrangements that can be characterized as trades in fishing services. This paper published in *Marine Policy* provides a first assessment of the net economic benefits in a static analysis from one of the oldest such arrangements in West Africa: the coastal bottom trawl fishery. Focusing on the coastal states of Guinea-Bissau, Guinea, Sierra Leone and Liberia, the total resource rent (RR) generated by foreign fishing in 2015 was estimated and then decomposed for the two participants in the trade: the coastal states (RRCS) and the foreign companies (RRFC). The implications from this review

are that significant trades are occurring and even increasing without the minimum data required for West African coastal states to adequately evaluate the terms of trade, nor their sustainability.

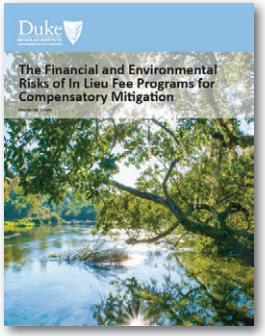
Building Ecosystem Services Conceptual Models

Funders and developers of infrastructure projects and businesses and managers overseeing critical natural resources are becoming increasingly aware of and interested in ecosystem services. Quick, simple, transparent, and low-cost ways for incorporating these services into decisions are just now under development. One tool that can support widespread implementation is ecosystem services conceptual models. This Nicholas Institute Report facilitates development and use of such models in federal decision making by presenting a "how-to" guide and illustrative examples. It is part of the Conceptual Model Series produced by the National Ecosystem Services Partnership, which included three "Ecosystem Services Conceptual Model Application" reports: "NOAA and NERRS Salt Marsh Habitat Restoration," "Testing General Model Adaptability," and "Bureau of Land Management Solar Energy Development."

Profits and Productivity: Stimulating Electricity Demand in Low-Income Settings

As electricity companies in low- and middle-income countries move deeper into rural regions, the cost of new connections generally increases while the electricity demanded by these new customers remains lower than urban and peri-urban customers. This is a challenging dynamic for utilities looking to sustain their financial health as well as for governments tasked with engineering viable strategies for achieving universal electrification. Off-grid platforms like solar home systems and minigrids have entered this market, developing innovative approaches to serving these populations that promise to scale up to help meet the needs of the one billion people around the world still lacking electricity access. The creative partnerships and complementary services these off-grid providers are pursuing provide important lessons for larger utilities. Yet the primary driver for new electricity connections—the grid—will continue to play an important role in closing the access gap, especially in places where serving commercial, industrial, and other productive loads is a priority. Countries with national utility companies facing massive debt, stagnant revenue, and overcapacity must develop strategies for maintaining fiscal health, ideally in a manner that facilitates rural income growth and development.

The Financial and Environmental Risks of In Lieu Fee Programs for Compensatory Mitigation



This Nicholas Institute Report is a review of a sample of In Lieu Fee (ILF) Programs through an analysis of general incentives created by the ILF Program model, and through drawing on a small sample of ILF Programs as case studies. This review focuses on the incentives created by ILF Programs as a mechanism of compensatory mitigation; while other forms of compensatory mitigation—permittee-responsible mitigation and mitigation banking—are not without their problems, there are intrinsic financial and environmental risks that are unique to ILF Programs. The insights gained from this limited review also demonstrate the need for a systematic review of ILF Programs across the U.S., particularly (a) consistency of CWA ILF Programs since the implementation of the 2008 Mitigation Rule, and (b) emerging ESA ILF Programs and their divergence from best practice principles present in the 2008 Mitigation Rule.

LAURENCE GENON

A Tribute to Jim Rogers

In December 2018, the Nicholas Institute for Environmental Policy Solutions lost one of its most influential figures in Jim Rogers. The retired chairman and CEO of Duke Energy, Rogers helped shape the Nicholas Institute from its beginning as a member of the Board of Advisors. Reprinted here is a tribute that **Director Tim Profeta** wrote immediately after Rogers' passing.

The Nicholas Institute for Environmental Policy Solutions, and the larger Duke University community, are heartbroken at the loss of our good friend, Jim Rogers. His passing leaves a void in the Institute's leadership, on our campus, and across the world of energy and the environment. It is not a void that can ever truly be filled.

I came to know Jim when I was a Hill staffer, running the Senate Subcommittee on Clean Air, Wetlands, and Climate Change. Jim arrived at my office as the CEO of Cinergy, the utility that burned more coal by percentage than any other. I expected a confrontational meeting. Instead, I was surprised by a deep and thoughtful exchange about the need for a reasonable planning horizon for Cinergy to be able to convert its fleet away from greenhouse gas emitting technologies.

"There's no question that Jim's leadership and support helped make Duke University a leader in energy policy and education. He was committed to building a smarter and more inclusive energy future, and we are very grateful for his association with the university."

—**Vincent E. Price**, president, Duke University

But even more interesting to me was the man with whom I had this exchange—a humble but charismatic leader who broke down barriers of culture and personality with nearly everyone he met, connected as a human, and found common ground. Jim was more than the prudent executive with whom you could engage about the future of energy in America—he was the CEO with whom you wanted to get a beer (or a vodka with a twist of lemon, as Jim preferred).

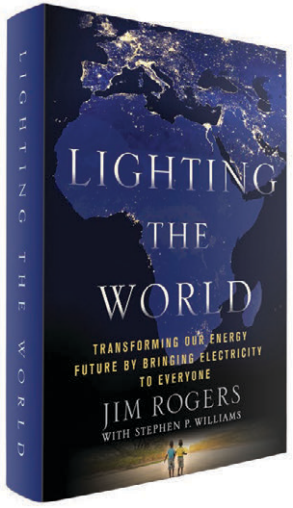
When I came to Duke to start the Nicholas Institute, I was asked to build a board of advisors. It was beyond certain that I would ask Jim to help. He was savvy, experienced, and strategic, and he possessed a deep knowledge of the political world in which the Institute needed to work. And he was generous with his time and knowledge—precisely the type of mentor one would desire if asked to build an Institute from scratch.

And for 13 years, Jim helped the University find the partnerships and the topics through which we might make meaningful progress toward solving environmental challenges. And all the while, he encouraged us with a smile, a laugh, and a subtle needle.

After Jim stepped down as CEO of Duke Energy, our partnership deepened. Jim called, asking to think together on what would be next for him, and that conversation led to his taking the first Rubenstein Fellowship at Duke University. And did he ever dedicate himself to that fellowship! He wanted to set the bar for the nascent program, and be the best fellow the University would ever have. He held lightning-round office hours, holding back-to-back meetings with students all day.

“For 13 years, Jim helped the University find the partnerships and the topics through which we might make meaningful progress toward solving environmental challenges. And all the while, he encouraged us with a smile, a laugh, and a subtle needle.”

—**Tim Profeta**, director, Nicholas Institute



The most illuminating experience from that fellowship was the course that Jim and I taught on rural electrification in Africa and India. We created it as a venue for him to explore the ideas he was outlining for a forthcoming book on the challenge of bringing electricity to the billion-plus people who lack it. The course attracted graduate students from five schools across Duke, and they did not disappoint, wielding tools from a range of disciplines as they tore at his hypotheses from every angle. Jim had been developing his arguments for years, yet he demonstrated no defensiveness or hubris. Rather he reveled in the intellectual pushback. Meanwhile, he offered every student in the course a lunch or dinner to explore whatever he or she wanted—and every student took him up on it.

Jim expressed deep gratitude to the students for the experience. *When Lighting the World: Transforming Our Energy Future by Bringing Electricity to Everyone* (St. Martin’s Press, 2015) was published, he was quick to acknowledge that Duke students’ critical thinking had helped shape the book’s growth.

Jim enjoyed teaching. He delighted in building things. He took great satisfaction in working to solve problems, especially daunting ones like worldwide electrification. But above all else, Jim loved his family. Our hearts go out to M.A., his children, and his grandchildren. Jim often said that he lived by “the grandfather’s rule”—he wanted to work in a way that would make his grandchildren proud. He certainly succeeded.

Jim was a great mind, a great leader, and a great operator in the best sense of the word. And to so many, he was also a great friend. His disarming manner, boundless energy, amiable Kentucky accent, graciousness, and quick wit made every exchange with Jim a delight. What I would do to have a chance to enjoy even one more conversation with him! Rest in peace, Jim, and thank you.

INSTITUTE SENIOR LEADERSHIP

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Nicholas Institute

Emerson Beyer
Associate Director
Corporate and
Foundation Relations

Martin Doyle
Director
Water Policy Program

Kate Konschnik
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Sheri Matthews
Associate Director
Finance and
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Lydia Olander
Director
Ecosystem Services
Program

Jonathan Phillips
Director
Energy Access Project

Amy Pickle
Director
State Policy Program

John Virdin
Director
Ocean and Coastal
Policy Program

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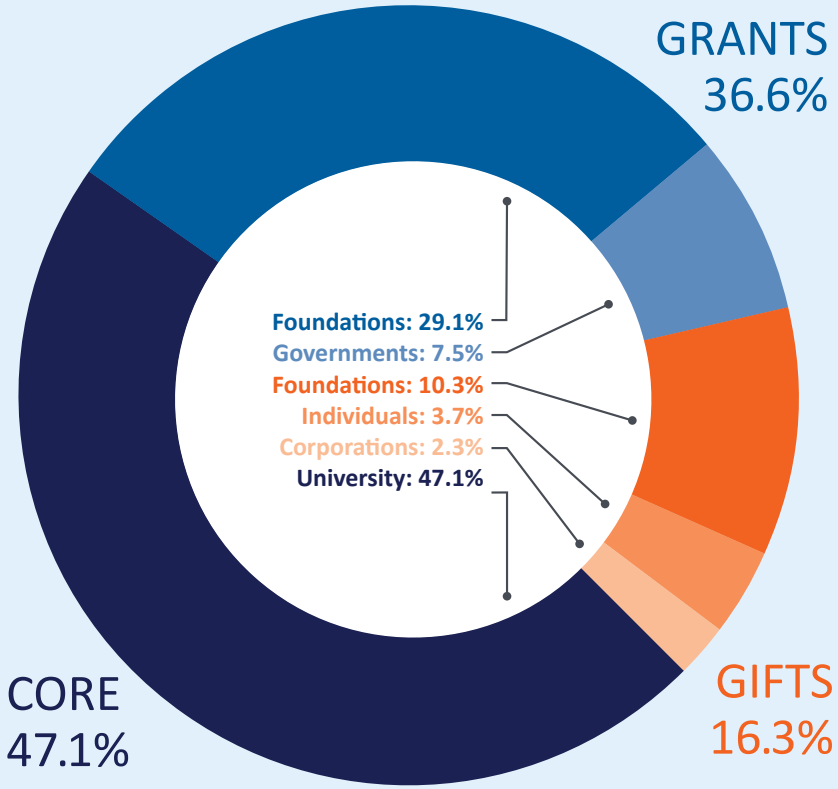

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