DUKE UNIVERSITY

Nicholas Institute

FOR ENVIRONMENTAL POLICY SOLUTIONS

2018 Annual Report

Global Engagement, Locally Grounded

Energy Access | China Environment | Small-Scale Fisheries

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 six 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.*

Morning at the jetty in Mangalore, India, by Milind Arvind Ketkar. See small-scale fisheries story on page 17.

COVER IMAGE: Jugaad (जुगाड़) is a Hindi word that describes the ingenuity of people who solve problems with limited resources. Such ingenuity is on full display in this commercial area of Delhi, India. By T. Robert Fetter, senior policy associate at the Nicholas Institute who works with the Energy Access Project.

GLOBAL INQUIRY, IMPACT

At Duke University's Nicholas Institute for Environmental Policy Solutions, we work to inform decision makers about the risks and rewards associated with policies at the local, national, and global levels. In 2018, we have pursued leveraging our global platforms with gusto.

This deepening of our leadership on global issues in order to meet 21st century challenges is one way we are embodying Duke University's charge to enhance the "creation, delivery, and translation of knowledge for a rapidly changing world."

In our feature section, we describe projects that extend beyond our borders. One project takes an interdisciplinary approach to developing modern, sustainable access for the 1 billion who are still without electricity and to reach the 2.8 billion currently without access to clean cooking facilities. Another project explores how vital small-scale fisheries are to communities around the world, but how their value is severely underestimated. A third feature story discusses work in China that intends to discover how the Belt and Road Initiative can be executed with environmental safeguards and what policy design lessons we can draw from China's nascent national carbon market.

Though much of our emphasis over the past 12 months has been on addressing global issues, we are working more and more in state and local venues. In the Gulf of Mexico, we are arming decision makers with the tools to better assess progress to restore Gulf ecosystems in the wake of the 2010 Deepwater Horizon oil spill. Through a new initiative, the Internet of Water, we intend to improve how our nation's water data are collected, shared, and used in order to transform water management.

In this issue, we introduce the new talent we've brought on to support these efforts and share stories of how two courses we taught on opposite sides of the globe—in Durham, North Carolina, and Kunshan, China—left lasting impressions on enrollees.

The following pages illustrate our understanding of the importance of on-the-ground learning with and from those grappling with decisions that have long-lasting implications for our environmental and human well-being. Together, we are developing a deeper understanding of challenges and discovering the best ways to meet them.

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

GLOBAL ENGAGEMENT, LOCALLY GROUNDED

THREE STORIES THAT EXTEND BEYOND U.S. BORDERS.

TYLER WAKEFIELD, IMAGINENERGY PHOTO CONTEST


Meeting the
Energy Needs of
the World

Access to modern and reliable energy is something that most of the world takes for granted. But many around the world are living a different reality.

Across sub-Saharan Africa and India, children often complete homework by the flicker of candles and kerosene lamps as wisps of smoke trickle up around them from the stoking of the fire beneath their cooking stove.

Smoky homes and candle-lit homework sessions are the norm for billions without access to modern energy.

The Duke University Energy Access Project aims to help achieve the United Nation's (U.N.) seventh Sustainable Development Goal, which is to ensure universal access to affordable, reliable, and modern energy services by 2030. This new research and policy platform at Duke takes an interdisciplinary approach to developing market and policy solutions for the 1 billion who are still without electricity, another billion lacking reliable electricity, and the more than 3 billion people currently without access to clean cooking technologies.

"We are at a critical moment," said Jonathan Phillips, Energy Access Project director. "Innovative business models, financing arrangements, and policy reforms are coming together in a way that has the potential to

FARAZ USMANI, DUKE UNIVERSITY PH.D. CANDIDATE, IMAGINENERGY PHOTO CONTEST

A woman in Kandal Province, Cambodia, uses a cleaner burning, more efficient improved cook stove. Nearly three billion people still rely on traditional stoves and dirty fuels for their primary energy needs.

eliminate global energy poverty. The next three years are key to shifting the trajectory to give us a shot at achieving Sustainable Development Goal 7. Duke has much to contribute to this fight."

Establishing the Energy Access Project

The Energy Access Project was established in late 2017 with a $1.5 million gift from Jim Rogers, former CEO and chairman of the board for the electric utility company Duke Energy, and his wife, M.A. Rogers. The Bass Connections Challenge at Duke University added $750,000 in matching funds to support the project's goal of accelerating deployment of sustainable energy and empowering the world through expanded energy access. Key Duke collaborators in this effort include the Nicholas Institute for Environmental Policy Solutions, the Duke University Energy Initiative, the Sanford School of Public Policy, the Nicholas School of the Environment, and Bass Connections.

The idea for the Energy Access Project began long before 2017, with a two-year collaboration between Jim Rogers and Nicholas Institute director Tim Profeta. Rogers, a long-time advocate for universal electricity access and author of the book *Lighting the World: Transforming Our Energy Future by Bringing Electricity to Everyone*, served as a Rubenstein Fellow at Duke from 2014 to 2016 after retiring from his CEO post.

In 2015–2016, Rogers led a collaboration with Profeta and Tatjana Vujic, currently director of Biogas Strategy at Duke, which focused on off-grid electricity solutions. This Bass Connections project, a platform for giving students interdisciplinary experience addressing real-world problems, germinated the idea for the Energy Access Project. Vujic and the students created the initial version of the project proposal that Rogers and his wife would later fund.

LAURENCE GENON

A panel session at the Washington, D.C., launch event for the Energy Access Project.

Understanding the Issue of Modern Energy for All

The Energy Access Project launched in Washington, D.C., in February 2018, bringing together leaders from government, business, civil society, and academia to discuss the biggest barriers to energy access and how to overcome them.

One of the seven key themes was that more research is needed to strengthen our understanding of the way in which modern energy access relates to education, health, and food security outcomes. Collaborations between researchers and policy makers could facilitate effective planning for communities' energy futures and help to mobilize local entrepreneurs.

With an international research collaborative, the Sustainable Energy Transitions Initiative (SETI), the Energy Access Project staff and students helped to review nearly 80,000 academic articles to map the existing research connecting energy access, technologies, and interventions to different impacts and development outcomes.

"The review points to a troubling pattern," said Energy Access Project faculty director

Subhrendu Pattanayak, who also leads SETI. "There's a big gap between what is being evaluated by scholars and the types of programs, projects, and policies being implemented."

This gap—between what we know and what we do—could keep the world from achieving a critical number of these Sustainable Development Goals, Pattanayak said, noting that we must make scientific evidence more practice based by training the next cadre of scholars and practitioners and encouraging impact evaluations of real-life projects, programs, and policy or risk being left in the dark.

Staff are taking on work to help researchers and decision makers make research more accessible to target audiences. In doing so, the project will drive a global research agenda focused on filling key knowledge gaps, in the process deepening our understanding of how energy access relates to other development outcomes. The Energy Access Project is convening researchers to lead integration of diverse disciplines, such as data analytics, with real world energy access applications using tools like satellite imagery and artificial intelligence.

Energy Access Project staff Hannah Girardeau, Marc Jeuland, and Jonathan Phillips pose in front of the U.N. Sustainable Development Goals (SDGs) at the Sustainable Energy for All Forum in Lisbon, Portugal, where they presented work by Duke University scholars that highlights how changes in energy access and technology could affect SDG outcomes.

Overcoming Policy, Market Barriers to Access

"Despite the increased interest in the idea of universal energy access, our policy makers and analysts have not quite caught up with the quick-moving world of the business models and financing piece," said Profeta. "Because this is all so new, there's a chance for great creative thought on how to get at this problem. Duke has the expertise and experience to find those unique solutions."

Beyond its research focus, the Energy Access Project is working directly with policy makers on the design of key institutions and policies to support electrification as well as with companies and social enterprises to understand how innovative business models can help reach last-mile customers.

To help the U.S. Congress navigate emerging market financing reform options, Energy Access Project staff assembled an analysis of how a new, more fully equipped American development finance institution could help fill the global energy financing gap.

In their policy brief, released in June 2018 as the Better Utilization of Investments Leading to Development Act (BUILD Act) legislation continued to move closer to passage in Congress, Energy Access Project staff found that the

United States is not fully harnessing the power of private sector-led development, leaving U.S. foreign policy gains—and U.S. Treasury profits—on the table and businesses without the capital to build modern energy systems and other underpinnings of development.

"If just 7 percent of global power investments were focused on where 14 percent of the population lives, universal electrification could be achieved by 2030," Phillips said, noting the lack of early-stage concessional capital to get projects adequately developed, de-risked, and ready for debt investment. "More risk-appetite capital is needed to mobilize the larger pools of money available through private equity funds, development finance institutions, and other investors."

Entirely new energy delivery platforms have the potential to power remote villages many miles from the existing grid. The Energy Access Project is collaborating with CrossBoundary Energy and the Rockefeller Foundation on the newly created Mini-Grid Innovation Lab to help refine one of these promising models. The partnership is testing innovative new business models for deploying off-grid mini-grids in order to improve the economics of mini-grids and better understand how rural low-income customers can best be served.

"The ultimate goal of this effort is to equip governments, investors, and developers to dramatically accelerate rural electrification in an integrated manner, unlocking new economic opportunities for millions of households," Ashvin Dayal, Rockefeller Foundation associate vice president and managing director for Smart Power, said in an interview with *Solar Magazine* about the lab.

> "Earth's population is growing, its climate is changing, and economic inequality is expanding. With all these globally destabilizing forces, increased focus is needed on vectors of empowerment and opportunity and innovation. That's what energy access is really all about."
>
> —**Jonathan Phillips**, Energy Access Project director

BELLA TRAN, IMAGINENERGY PHOTO CONTEST

Students as Engines of Innovation

The Energy Access Project is interested in "supporting the bubbling ecosystem of ideas and collaboration that's happening at Duke and around the world," said Phillips, and mobilizing students is "central to this work."

The project supports relevant courses, internships, and campus events that build linkages between the Duke student and faculty community and the energy access practitioner and policymaking community.

T. Robert Fetter, a senior policy associate at the Nicholas Institute who works with the Energy Access Project, installs an air quality monitor on a household in Uttar Pradesh, India.

ImaginEnergy Photo Contest

The cover photo and three photos highlighted in our feature story on the Duke University Energy Access Project were submissions in the ImaginEnergy Photo Contest, organized by the Duke student group Global Energy Access Network (GLEAN). Several of the student photos featured in our story were among the top 20 finalists. As finalists, their images were professionally printed and exhibited at the Louise Jones Brown Gallery at Duke University.

Meet the Energy Access Project Directors

JONATHAN PHILLIPS

Jonathan Phillips leads the Energy Access Project's policy engagement and analytical work. He mobilizes students and faculty with expertise in fields such as data analytics, energy markets and development, business and finance, and other disciplines. He is also building partnerships with leaders from across business, government, and nonprofits to develop the policies and platforms to address emerging market energy challenges.

Phillips was named director of the project in October 2017.

Formerly the senior advisor to the president and CEO of the Overseas Private Investment Corporation, Phillips helped manage the organization's climate finance capabilities, including the corporation's $2.1 billion in on- and off-grid energy transactions under the U.S. Government-led Power Africa initiative. Phillips also helped lead Power Africa's private sector engagement with the U.S. Agency for International Development and served as senior advisor to Senator Edward Markey.

SUBHRENDU PATTANAYAK

Subhrendu Pattanayak, a professor in Duke's Sanford School of Public Policy, serves as faculty director of the Energy Access Project. Pattanayak leads the project's research network and works to build educational initiatives, including the creation of courses that deepen understanding of critical problems.

Pattanayak has joint appointments in the Nicholas School of the Environment, Department of Economics, and the Duke Global Health Institute. He studies the causes and consequences of human behaviors related to the natural environment to help design and evaluate policy interventions in low-income tropical countries. He has collaborated closely with multi-lateral agencies, NGOs, governments, and local academics in Brazil, Costa Rica, India, Indonesia, Mexico, Nepal, Sri Lanka, and the United States.

He also leads the Sustainable Energy Transitions Initiative (SETI), which aims to foster global interdisciplinary research on energy transitions and energy access with support from the Environment for Development Initiative and Sida.

ANDREW SEELAUS

Duke University student Andrew Seelaus captures how one village in Uganda uses solar to power refrigerators.

Shortly after its launch, the Energy Access Project sponsored and helped to judge the Energy in Emerging Markets Case Competition in partnership with M-KOPA Solar. The competition attracted 45 student teams from around the world to focus their business and problem-solving acumen on a real-world challenge facing one of the leading companies in the solar home system sector in Africa.

"The competition helped M-KOPA's leadership team think through credible options for addressing a difficult regulatory and business model issue while giving hundreds of students an opportunity to wrestle with questions of technology, policy, and community development in an important and rapidly developing sector," Phillips said.

The Energy Access Project is also supporting Duke science students' efforts to create an energy access data platform. Through the Duke Data+ Program, a team of undergraduates are working closely with Power for All, a leading energy access research and policy nonprofit, to develop machine learning and natural language processing tools to improve visualization of data and information on energy access in developing countries.

"This project is different than other projects I've worked on because we are working with an outside client to come up with a solution to a problem which does not already exist," said Brooke Erickson, a member of the three-person Duke student team. "I feel as though I am truly creating new knowledge and new algorithms instead of just understanding existing algorithms."

The effort ties into Power for All's Platform for Energy Access Knowledge (PEAK), which automatically curates, organizes, and streamlines large, growing bodies of information into sharable, data-driven stories for policy makers and researchers alike. The students consult with Power for All to creatively visualize PEAK's library—using artificial intelligence—to create more effective science communication.

The research is allowing the students to apply their skills in ways they never thought possible.

"Since I am not specifically studying energy or the environment, it has been extremely eye-opening to work with Power for All and the Energy Access Project," said Erickson, who is studying economics and computer science. "I have learned about the dire need to expand energy access globally and feel as though I am able to contribute to solving that problem despite my lack of background knowledge in the area. This experience has taught me that there are ways to use computer science and data analytics in every interdisciplinary field."

—by Erin McKenzie

Work on this project is funded by Jim and M.A. Rogers and the Bass Connections Challenge.

Can China's Development Ambitions and Environmental Protection Priorities Yield a Global Dividend?

More than two years ago at the United Nations Conference of the Parties meeting in Paris, China vowed by 2030 to peak its carbon emissions, make a 60 to 65 percent improvement in the carbon intensity of its economy, and draw at least 20 percent of its energy from non-fossil sources. In 2017, it advanced efforts to make good on that Paris Agreement pledge by creating a national carbon market that when fully implemented could more than double the volume of worldwide carbon emissions covered by a tax or tradable permit policy. And this year it announced its greatest environmental reform in decades—an environmental "super ministry" that could strengthen compliance with its new emissions trading program.

But at the same time that China is working to tamp down on pollution at home, it has, in past decades, been seen to be exporting pollution through infrastructure investments in the developing world. Some fear its Belt and Road Initiative, though promised to be environmentally friendly, could be a powerful driver of coal-powered power generation and a threat to biodiversity and other ecological values.

Can China's international development efforts be environmentally sustainable and will its unique approach to emissions trading work?

Answering those questions is opening up new research areas and collaboration opportunities in China for Duke University's Nicholas Institute for Environmental Policy Solutions.

Learning from China's Carbon Market

On March 13, China announced that it would consolidate its environmental policymaking into one agency—a move that could affect China's global efforts to address climate change.

"The effectiveness of this new ministry will inform not only China's environmental future, but also its stability, its socioeconomic ambitions, and global efforts to address environmental challenges," said Jackson Ewing, a senior fellow at the Nicholas Institute and an associate professor in the Sanford School of Public Policy who is focused on China.

The new Ministry of Ecological Environment, by virtue of having legal authority to ensure consequences for noncompliance with environmental regulations, could put teeth into China's emissions trading system, which began the first of three implementation stages in December 2017 and which seeks to ultimately cover carbon emissions in eight sectors, starting with the power sector.

If China's new carbon market substantially curbs carbon emissions, the world could benefit. But even if the market stumbles, it could offer valuable lessons for other markets, existing and new. That's because it has adopted a policy mechanism unlike any other carbon market to date.

In new, peer-reviewed research, Nicholas Institute faculty fellow and Sanford School of Public Policy professor Billy Pizer and Xiliang Zhang of Tsinghua University examine just how China's emissions trading approach differs from the traditional cap-and-trade approaches implemented in places like California and the nine-state Regional Greenhouse Gas Initiative.

What makes China's carbon market different is its multi-sector tradable performance standard—a new approach that poses some unique challenges.

"With a tradable performance standard, like a cap-and-trade program, firms that can reduce emissions relatively cheaply will sell their emissions allowances to firms facing more expensive mitigation costs, and the performance standard will be met on

Meet the New Team

JACKSON EWING
Senior Fellow

Jackson Ewing was jointly appointed a senior fellow at Duke University's Nicholas Institute for Environmental Policy Solutions and an adjunct professor in the Sanford School of Public Policy in January 2018.

At Duke, Ewing is furthering environmental research and engagement—strategically planning and implementing collaborative research and outreach activities with Duke Kunshan University's Environmental Research Center and the Nicholas Institute. He is engaging U.S. policy makers, business leaders, and other key stakeholders to produce research materials and organize U.S.-based activities exploring environmental policy in China.

Ewing is also developing educational activities for the iMEP Program, a new international master's degree program designed to meet the growing global need for leaders who are versed in both Chinese and international environmental issues and policies. He partners with faculty at the Sanford School, the Nicholas School of the Environment, and Duke Kunshan University to advise students, teach courses, and grow the program on Duke's Durham campus.

average," Pizer said. "What's more, within a regulated sector, production can shift from dirtier to cleaner producers if that's a cost-effective mitigation strategy for the sector as a whole."

But there's a downside to the tradeable performance standard. Unlike cap-and-trade programs, which lead to increased product prices reflecting mitigation costs and the products' total carbon dioxide emissions, performance standards lead to increased product prices reflecting only mitigation costs. That difference makes for a comparative inefficiency that is amplified when the tradeable performance standard applies to multiple sectors.

"Under a single-sector tradable performance standard—let's say for electricity—the incentive to reduce electricity use is less than it would be under a cap-and-trade program," Pizer said. "Under a multi-sector tradeable performance standard, trade can occur between firms in different sectors to further reduce overall costs. But if you have standards in some sectors that are easier to meet than others, you ultimately discourage cost-effective choices among carbon-emitting products, creating additional inefficiency. This also occurs when there's subcategorization, for example, when different technologies in the same sector face different standards."

That last approach—the one China intends to take with its electric power sector—could lessen the incentive to ditch dirtier technologies, and it could even increase the emissions rate of the sector as a whole

if production shifts to higher-emitting subcategories.

China's choice to experiment with a tradable performance standard, Pizer said, offers a rich learning opportunity for policy makers.

Greening the Belt and Road Initiative

Over the past two decades, China's growth has been rapid. But under President Xi Jinping, there appears to be an effort to shape development to new ends: rebalancing the economy, reducing poverty, and improving the environment.

When China announced its Belt and Road Initiative (BRI) in 2013, it pledged that the initiative would be environmentally friendly. Although President Xi Jinping's new development paradigm attaches great importance to green development and climate change mitigation, the concern is that the initiative will simply exacerbate environmental ills in the countries that have become home to its extraordinary

number of infrastructure projects—locking in everything from unsustainable energy infrastructure to an increasing reliance on non-domestic farmland to meet China's growing demand for beef, pork, and fish.

Duke has developed the Green Belt and Road Initiative, a research collaboration platform for the university community working on BRI issues that will explore what will make China's environmental pledge a reality. Coordinated by the Nicholas Institute and Duke Kunshan University (DKU), the initiative has two aims: to provide recommendations for the design of infrastructure investments, thereby ensuring the best possible environmental and social outcomes, and to communicate best environmental practices to stakeholders and decision makers in China and BRI countries.

Both of those aims are reflected in a three-day conference planned at DKU in October 2018 that will focus on the environmental, economic, geostrategic, and legal dimensions

BOTH PHOTOS COURTESY OF THE ORGANIZING COMMITTEE OF THE 2018 CHINESE ENVIRONMENTAL SCHOLARS FORUM

Students and scholars—including our own Billy Pizer, Jackson Ewing, and Brian Murray—pose for a photo during the May 2018 Chinese Environmental Scholars Forum at Duke.

Meet the New Team

ELIZABETH LOSOS
Senior Fellow

Elizabeth Losos is a senior fellow at the Nicholas Institute exploring how to plan for and optimize the environmental impact of infrastructure expansion in Asia, Africa, and Europe that is stimulated by China's new Belt and Road Initiative.

Losos was formerly president and CEO of the Organization for Tropical Studies, a global consortium of universities and research institutes with the mission of promoting education, research, and the responsible use of natural resources in the tropics. She directed the organization's four research stations in Costa Rica and South Africa as well as undergraduate, graduate, and professional field-based educational programs in tropical biology, conservation, global health, and environmental policy.

Did you Know? To promote graduate students' engagement with the environmental impacts of China's Bridge and Road Initiative, Nicholas Institute senior fellow Elizabeth Losos and faculty fellow Billy Pizer share knowledge in a monthly seminar series housed within the Duke University Energy Initiative.

> Our workshop will bring these scholars together for the first time to develop a shared strategy for using geospatial data to proactively address the impact of infrastructure expansion on the environment.
>
> —**Elizabeth Losos**, Senior Fellow

of the Belt and Road Initiative. As part of that event, a project team led by Elizabeth Losos, a Nicholas Institute senior fellow, Nicholas Institute Ecosystem Services Program director Lydia Olander, and Binbin Li and Kathinka Furst of the DKU Environmental Research Center will assemble researchers and policy analysts who are mapping and tracking infrastructure expansion, environmental variables, and the legal and regulatory environment within BRI countries. The idea is to coordinate mapping and analytical approaches to assess the environmental impacts of linear infrastructure such as roads, rails, transmission lines, and pipelines as well as to identify geospatial strategies for minimizing and mitigating these impacts and to assess gaps in legal coverage to safeguard against them.

"Most of the work on BRI infrastructure impacts has occurred in silos," said Losos. "Conservationists, as an example, have focused on identifying areas of high biodiversity value that should be avoided; legal scholars, on laws and regulations that exist in BRI countries to safeguard against environmental threat; and economists, on the effect of expanded trade on livelihoods and migration. Our workshop will bring these scholars together for the first time to develop a shared strategy for using geospatial data to proactively address the impact of infrastructure expansion on the environment."

The Belt and Road Initiative is also the subject of a project funded by the Nicholas Institute's Catalyst Program, which supports the Nicholas Institute's engagement with Duke University faculty. Through the project, Losos, Olander, Nicholas Institute Ocean and Coastal Policy Program director John Virdin, and research associate Sara Mason, along with Binbin Li, Stuart Pimm, and Jennifer Swenson of Duke's Nicholas School of the Environment, are evaluating the impact of infrastructure investment on biodiversity in tropical Asia, one of the areas covered by the Belt and Road Initiative. The effort has resulted in biodiversity mapping across the BRI region, a webinar series on BRI-relevant topics, and a website devoted to Duke's BRI events, projects, and experts.

—by Melissa Edeburn

Work is supported by the National Sciences Foundation of China and the Georgetown University U.S.-China Initiative, the Nicholas Institute's Catalyst Program, the Duke Africa initiative, and an Education and Research Innovations in China (ERIC) Grant through the Duke University Office of Duke Kunshan University Programs and Duke-Kunshan University.

LEON WONG

The Role of Small-Scale Fisheries in Feeding the World

Small-scale fisheries in coastal and inland communities across the world are a major component of the world's food system. These traditional fishing communities found predominately in Asia and, to a lesser extent, Africa, are estimated to provide almost half of global capture fisheries production. Despite their contribution to feeding a growing population in both the developed and developing world, the fisheries are often ignored in states' policy making, in part because their value has been poorly measured.

"Ending hunger will likely require more sustainable management of the way we produce food from our oceans, and particularly greater security for small-scale producers," said the John Virdin, director of the Ocean and Coastal Policy Program at Duke University's Nicholas Institute for Environmental Policy Solutions. "Better illustrating the size of the contributions that small-scale fisheries make to food security and providing evidence that can be used by local communities to make a case for public support and investment in the sector could be important to advancing policy dialogues on how to end hunger and malnutrition."

The Nicholas Institute and the Marine Lab at the Nicholas School of the Environment are working with the United Nations Food and Agriculture Organization (FAO) and WorldFish on a new global study—*Illuminating Hidden Harvests: The Contribution of Small-Scale Fisheries to Sustainable Development*—that aims to make these fisheries' contribution better known.

Understanding Small-Scale Fisheries' Contributions

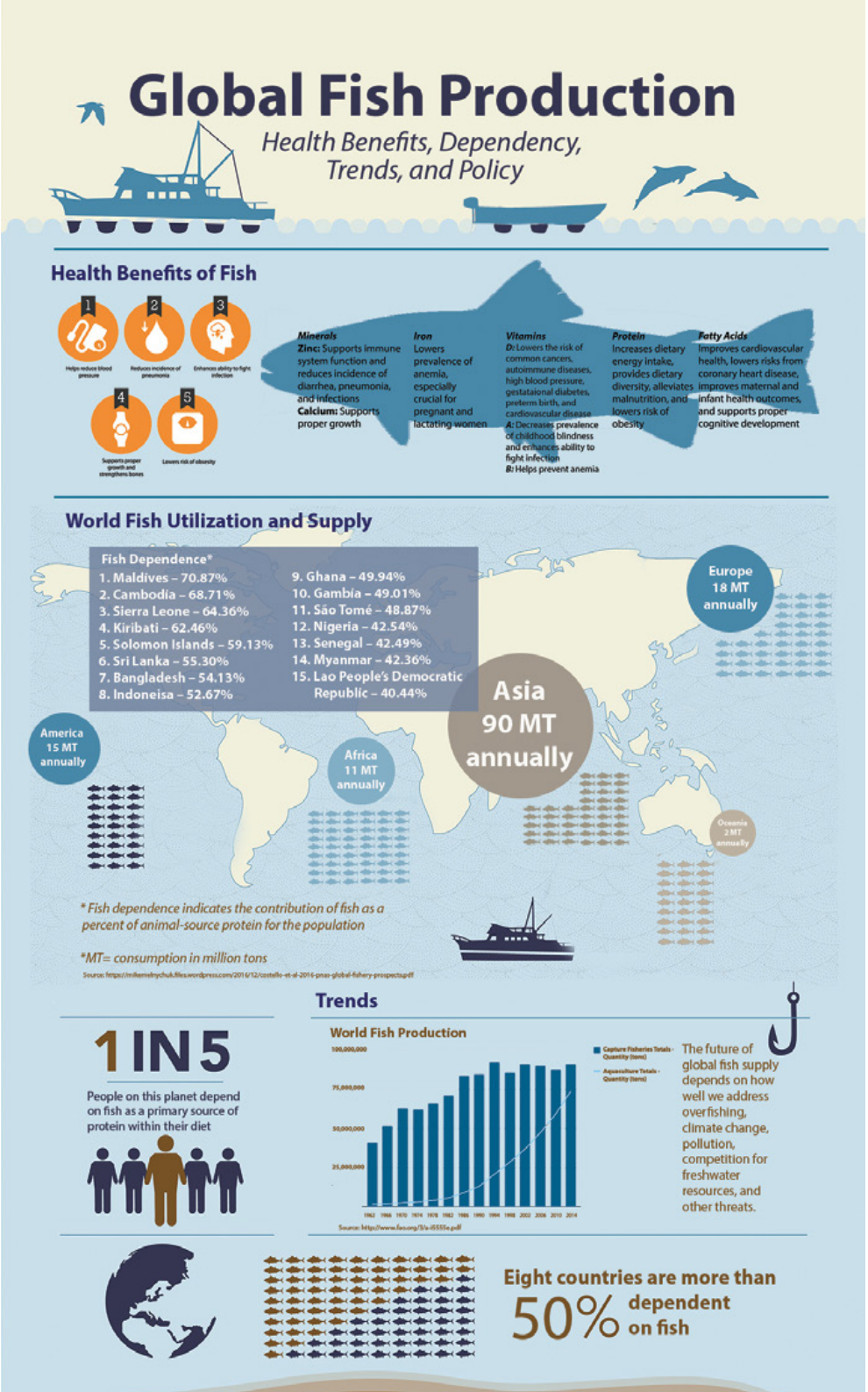
Fish and fish products account for almost 20 percent of global animal-based protein consumption, but they are also critical sources of micronutrients necessary for human health. Hundreds of millions of people rely on fish for nutrients such as iron, zinc, vitamins A and B12, and essential fatty acids. As fish populations decline, many food-insecure populations, particularly those served by small-scale fisheries, are at risk of malnutrition.

NIPPON FOUNDATION NEREUS PROGRAM

Small-scale fisheries are facing a number of challenges, including external threats such as invasive species, infrastructure development, pollution, overfishing, climate change, and ocean grabbing that deprives small-scale fishers of resources and undermines their historical access to areas of the sea.

These threats to small-scale fisheries—coupled with their lack of political voice in many cases—could affect global food supplies. For these reasons, the partners on the new global study are particularly focused on the role of small-scale fisheries in helping to meet the first two of the 17 United Nations Sustainable Development Goals (SDGs): to end poverty and hunger.

This collaboration began in early 2017, when Xavier Basurto of Duke's Marine Lab and Virdin organized a meeting of some 40 thought leaders on small-scale fisheries at Duke to discuss strengthening governance of small-scale fisheries. In attendance were four staff members from FAO.



MICAELA UNDA

"The meeting helped us connect to FAO and its efforts to explore the value of small-scale fisheries beyond just economics," said Virdin. "We wanted to look at the social, economic, and environmental consequences of these fisheries and how they could contribute to the SDGs."

That work began with the Workshop on Improving Our Knowledge of Small-scale Fisheries: Data Needs and Methodologies, held at the FAO headquarters in Rome, Italy, in June 2017. The experts that gathered reiterated the message that policy makers often overlook the social, cultural, nutritional, and economic contributions of small-scale fishing communities.

Basurto, Virdin, David Mills of WorldFish, and Nicole Franz and Lena Westlund of the FAO, authored a meeting proceedings that provided background for a comprehensive new study to illuminate the hidden contributions of small-scale fisheries to sustainable development.

They are now working with experts globally to create that major report, due out in 2020. It aims to revisit and build on the 2012 study *The Hidden Harvests: The Global Contribution of Capture Fisheries* by the FAO, the World Bank, and WorldFish—a first attempt to synthesize information on the diverse and under-reported livelihood and economic contributions of capture fisheries globally.

"Duke University is well placed to complement FAO's policy-oriented work through solid scientific foundations, in collaboration with WorldFish," said Nicole Franz, the small-scale fisheries lead at

> "Better illustrating the size of the contributions that small-scale fisheries make to food security and providing evidence that can be used by local communities to make a case for public support and investment in the sector could be important to advancing policy dialogues on how to end hunger and malnutrition.
>
> —**John Virdin**, director, Ocean and Coastal Policy Program, Nicholas Institute

NIPPON FOUNDATION NEREUS PROGRAM

Duke's John Virdin and Xavier Basurto and other small-scale fisheries experts gather in Seattle, Washington, to discuss a 2020 study that's expected to be the most extensive compilation available on the diverse contributions of small-scale fisheries.

FAO. "By developing a snapshot synthesis of small-scale fisheries' contributions to sustainable development and related drivers of change by 2020, this new study aims to support evidence-based policy making. It is also expected to become an important advocacy tool for the empowerment of small-scale fisheries actors themselves to support sustainable small-scale fisheries development and governance."

A Global Picture of Fisheries Could Support Sustainability Efforts

In May 2018, some 20 leading small-scale fisheries experts met in Seattle, Washington, to review the design of the 2020 synthesis report.

"Following the workshop, the team has been finalizing protocols and instructions for consultants and institutions to complete 50 or so high-priority country case studies that will form the core of project data," said David Mills, who leads the WorldFish research cluster on Resilient Coastal Fisheries.

The effort will take advantage of improved availability of relevant national and global datasets on fisheries, demographics, employment, fish consumption, and nutrition to inform case studies and help paint a global picture of the state of small-scale fisheries and drivers of their change, Mills said. In addition to updating many indicators from the first FAO study in 2012, the new study seeks to synthesize social and nutrition benefits and to differentiate the flow of benefits from individual fishery sectors. The work will also

SHUTTERSTOCK.COM

produce methods to assess and monitor the sustainability of small-scale fisheries.

The final report won't be made public until the U.N. Committee on Fisheries meeting in July 2020, but the work is already getting attention.

Basurto presented the objectives of the upcoming report at a side event to the Committee on Fisheries (COFI)—a meeting of the world's top fisheries officials—in July 2018. Released at COFI, *The State of the World Fisheries and Aquaculture* (SOFIA)—the bi-annual flagship publication of the FAO Fisheries and Aquaculture Department—included mention of the forthcoming report, calling it "the most extensive compilation to date of information available on the diverse contributions of small-scale fisheries to communities and countries around the world."

"By expanding understanding of the contributions small-scale fisheries make beyond the economic issues, we hope to grow the type of data traditionally collected by countries and reported in SOFIA," said Basurto. "By doing so, we hope to provide a better picture of the complexities and challenges that make small-scale fisheries such a multi-faceted endeavor and to facilitate a level of comprehension and the imagination that leads to better management and governance schemes for these fisheries by managers, stakeholders, and governments around the world."

—by Erin McKenzie

Work on this project is supported by the Oak Foundation, the Food and Agriculture Organization of the United Nations, and the CGIAR Research Program on Fish in Agri-food Systems.

EDUCATION

MATTHEW NASH

Ethics Students Find Power Plant Proposal Sheds Light on Gray Areas of Decision Making

A proposal by the electric operator Duke Energy to site a combined heat and power facility on the Duke University campus became a teachable moment for 10 Duke students in a course on the ethical dimensions of environmental policy.

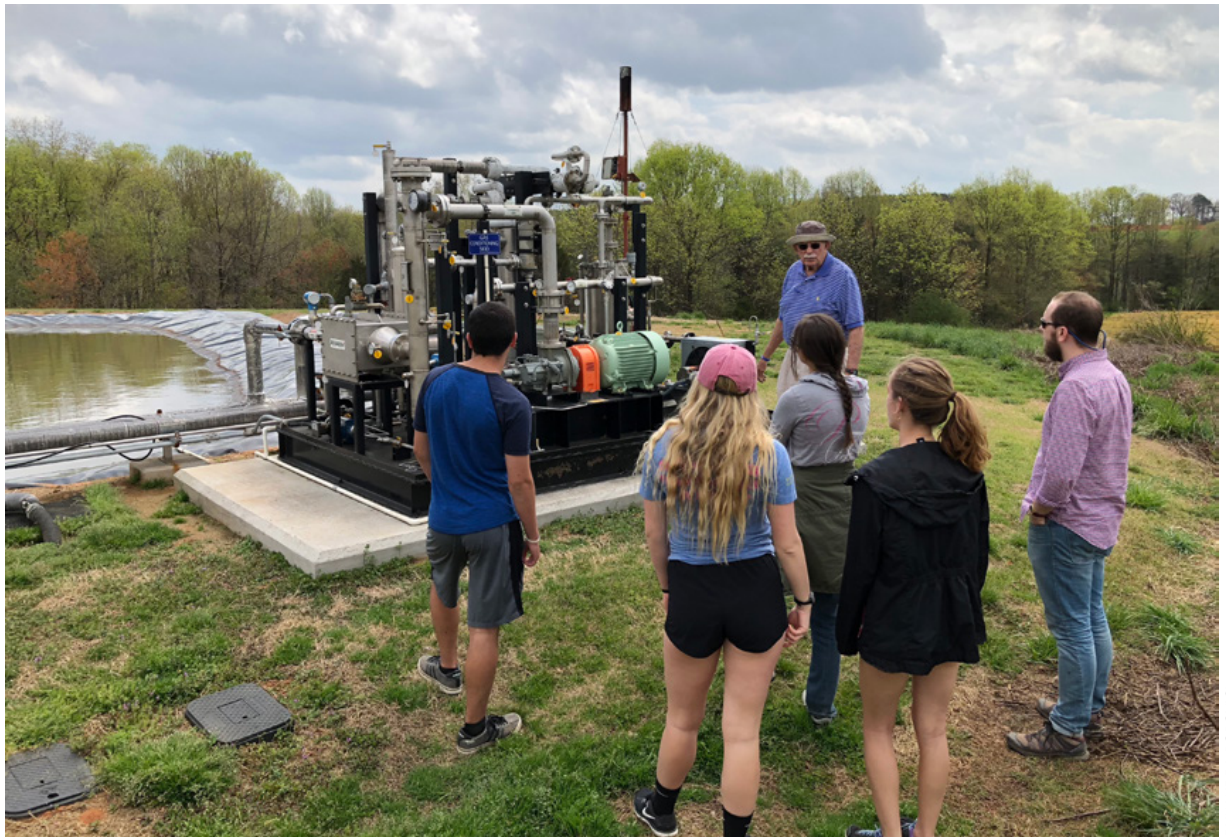
The Nicholas Institute for Environmental Policy Solutions' Kay Jowers led the course with David Toole who holds joint appointments in the Kenan Institute for Ethics, the Duke Global Health Institute, and the Duke Divinity School. They saw a ready-made case study of the influence on policy of assumptions about how things should or ought to be in the university's process for considering the proposal.

"We weren't looking to have the students weigh in on a decision on the proposed plant so much as help them engage with a real-time decision-making process in order to assess the underlying commitments and assumptions of its participants," said Jowers.

That effort involved social science, philosophy, and even theology, along with data collection. In particular, it included a trip to a hog farm so the students could learn how it makes biogas, one potential fuel source for Duke Energy's proposed 21-megawatt plant.

To learn how biogas production might affect nearby residents and how stakeholders perceived many other aspects of the proposed plant, the ethics students conducted interviews with four small focus groups.

> **We weren't looking to have the students weigh in on a decision on the proposed plant so much as help them engage with a real-time decision-making process in order to assess the underlying commitments and assumptions of its participants.**
>
> —**Kay Jowers**, senior policy associate, Nicholas Institute



RUXANDRA POPOVICI

"I was shocked to learn how drastically differently each group viewed stakeholder engagement in the decision-making process," said Elizabeth Allen, a rising junior studying environmental science and policy who facilitated the interview with local community members and sat in on her classmates' interview of university administrators.

Allen said she began the course with a "theoretical understanding of environmental justice and stakeholder engagement" and left it awakened to the reality that "there are no ideal solutions. At the end of the day, decisions must be made—and these decisions will never make everyone happy," a reference to varying perceptions about the benefits and costs of the project, now delayed indefinitely as the university focuses its attention on expanding opportunities to use environmentally friendly fuels to advance its goal of carbon neutrality by 2024.

In a final report compiled by the students that will be submitted to focus group participants, the students detail those perceptions. But the main audience for the just-out report is Duke administrators.

"The report recommends communication improvement strategies for engaging stakeholders," Jowers said. "It supports open engagement with community stakeholders, accountability to the environment and the community, and transparency and inclusiveness."

Allen said getting her head around a real-world issue with environmental justice components was what she was after and what the ethics and environmental policy course provided.

"It helped me think about the gray areas of decision making, tradeoffs, and stakeholder engagement," Allen said. "I came out with a more nuanced understanding of how real-world decisions are made, which will help me when I am working to advocate for or change decisions being made."

—by Melissa Edeburn

Work was supported by The Issachar Fund.

Course Gives Students Chance to Participate in Conservation Planning

Duke Kunshan University (DKU) administrators received some help from their own students as they planned the second phase of the Kunshan, China, campus expansion this spring.

Three students used skills learned in a course on conservation planning and monitoring led by Duke University's Nicholas Institute for Environmental Policy Solutions senior fellow Elizabeth Losos to develop biodiversity recommendations for the expansion, slated for completion in 2021.

"DKU is located in a biologically significant region. Rapid urbanization in the area has great potential both to affect positively and negatively the conservation of biodiversity and other ecosystem services on campus," said Losos. "With the university just beginning phase two of its physical expansion, we saw an opportunity to allow our students to use conservation planning tools to possibly help influence a real-world project and allow DKU an opportunity to show leadership in China by developing innovative approaches to address conservation through campus development."

The students spent the semester learning how to develop a conservation plan and visiting neighboring sites for ideas that would help address environmental concerns that construction could pose on campus.

They finished out their course with multiple presentations to the DKU Executive Vice Chancellor Denis Simon, the operations team, local Kunshan government representatives, and the newly hired landscape architectural firms.

"Our goal with the Conservation Action Plan for DKU is to incorporate biodiversity conservation elements into the campus expansion and garden designs to promote native species, improve human well-being, and advance DKU's position as an environmental leader," said Julie Mao, who is finishing out her second year of the international Master's in Environmental Policy program (iMEP).

The students' presentations and final report to administrators recommended restoration and enhancement of the natural ecosystems of Kunshan by (1) planting native vegetation to restore the natural ecosystem and nurture native, endemic, and threatened flora and fauna; (2) building forest and wetland corridors to increase habitat connectivity in an urban area; (3) incorporating green roofs on buildings to provide a space for native plants and butterfly populations to thrive; and (4) transitioning to a naturalistic landscaping approach to promote a healthy ecosystem for native species.

"The students are smart and practical," said Ning Bai, associate director in the DKU Office of Construction Management and Planning. Bai is supervising the expansion project and attended one of the student's presentations. "Their recommendations are based on Liz and the students' thoughtful thinking," he said. "The designers like these recommendations."

Bai said he would like to incorporate the student's ideas into the expansion's design and construction, noting that the transition to naturalistic landscaping and native plant adoption recommendations will likely find their way into the final design.

"This is exactly the kind of course we want to offer both graduate and undergraduate students here at DKU," Simon said. "The ability to solve real problems, to translate theory into practice, and to contribute to one's community are all meaningful hallmarks of a DKU education."

For the students, the experience of using industry tools and seeing their recommendations gain momentum will have lasting effects. "This course is the most practical course I've taken," said Cui (Janet) Liu, who is obtaining her master's degree in environmental policy at DKU. "This course taught me how to identify conservation targets and all kinds of threats and structure effective strategies in a systematic manner. Since I'd like to advance a career in the field of conservation after graduation, I believe I can frequently benefit from what I've learned from this course and our professors."

—By Erin McKenzie

CUI LIU

CHUCHU ZHANG

Elizabeth Losos and her students following a presentation to DKU administrators on biodiversity recommendations for the campus expansion.

Workshops Help Decision Makers Navigate Complex Electricity Sector Landscape

As the U.S. electricity sector continues to undergo market shifts, grid operators in competitive wholesale electricity markets are responding to those changes in a variety of ways. Their decisions have far-reaching impacts for states, utilities, merchant generators, new energy technologies, and consumers.

FRANZ LITZ

Many of these interests have found help navigating the uncharted territory with Duke University's Nicholas Institute for Environmental Policy Solutions.

For several years, Nicholas Institute staff have produced analyses of the sector's evolving dynamics and convened decision makers and stakeholders to discuss options for accomplishing a range of goals within the PJM region, which includes the District of Columbia and all or part of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.

In particular, the workshops that the Nicholas Institute has co-hosted with the Great Plains Institute (GPI) since 2015 have become increasingly important learning opportunities—ones that strike a "good balance" between presentation of "high-level information" and "closed-door regulator-only discussion," according to one participant at the latest workshop, in Washington, D.C.

That workshop brought together some 150 air and energy regulators—including then Federal Energy Regulatory Commission (FERC) Commissioner Robert Powelson—utilities, other power providers, and investors to consider the increasingly complex task of responding to the changing power generation

JEN WEISS

mix. Participants heard directly from the PJM about its proposed market rule changes as well as from state officials and power generators, who shared perspectives on those proposals and other energy generation trends.

"Our May 2018 event was fortuitous in its timing in that it provided a forum to discuss the contentious capacity repricing proposals that PJM had just submitted to FERC," said Nicholas Institute Climate and Energy Program director Kate Konschnik. "At their most basic level, the workshops are designed to help people with differing objectives understand one another's positions and, we hope, identify strategies to manage the fundamental shifts afoot on the grid."

Each workshop and research project is designed to cater to the evolving information and analytical needs of stakeholders and decision makers.

"We learn what's on our participants' minds and that helps us shape our agendas for upcoming events as well as think about where we want to put our research efforts in the short and long term," said Nicholas Institute senior policy associate Jennifer Weiss.

Last year, she noted, there was interest in a carbon pricing framework that could apply to the entire market or a sub-region of PJM states. In response, the Nicholas Institute and GPI hosted a 2017 workshop that highlighted some of the thinking about the framework.

"The overarching topic that we're trying to help participants get their heads around is how to harmonize RTO markets and state policies," said Weiss. "That task is complicated by the varying goals of states, a rapidly changing grid, new consumer demands, and a host of other factors. Our workshops keep participants abreast of the latest regulatory developments and analysis so they can better understand their options for achieving their aims."

—by Melissa Edeburn

Work on this project is supported by the Energy Foundation.

Meet the New Team

KATE KONSCHNIK
Director, Climate and Energy Program

Kate Konschnik joined the Nicholas Institute in December 2017. She is also a senior lecturing fellow at the Duke University School of Law.

At Duke, she's assumed responsibility for engaging with state and federal stakeholders in the climate and energy policy community on climate change, the Clean Air Act, and energy law and policy—topics she covered at the Harvard Environmental Law Program's Environmental Policy Initiative, which she founded.

Konschnik also co-leads Power Shift, a meeting series that brings together electricity practitioners and energy law professors to design the legal infrastructure for tomorrow's grid.

Prior to her tenure at Harvard, Konschnik was chief environmental counsel to Senator Sheldon Whitehouse, and an environmental enforcement trial attorney at the U.S. Department of Justice.

NEW INITIATIVES

Research Will Help Assess Progress on Gulf Ecosystem Restoration

In the wake of the 2010 Deepwater Horizon oil spill, billions of dollars in civil penalties from settlements with Transocean and BP will be used to fund projects to restore Gulf of Mexico ecosystems.

SARA MASON

Will the billions being spent on the effort have a lasting positive impact for Gulf state economies and ecosystems? Right now, there's no easy way to know because there is no clear way to assess that impact.

With support from the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine, a team of researchers led by Lydia Olander of Duke University's Nicholas Institute for Environmental Policy Solutions aims to devise an assessment approach through the new project Gulf of Mexico Ecosystem Service Logic Models & Socio-Economic Indicators, or GEMS.

"There is no shared platform to guide assessment and reporting of restoration progress that consistently tracks the benefits of restoration projects to fisheries, tourism, employment, recreation, and ecosystems," said Olander, who is partnering on the project with researchers from The Nature Conservancy, the Harte Research Institute for Gulf of Mexico Studies, and the Bridge Collaborative.

The team is working to develop an approach that allows decision makers, funders, and practitioners across the Gulf to compare outcomes and measure success across projects and estuaries on the basis of the goals identified for Gulf restoration as they grapple with how to distribute restoration resources.

"This effort will provide a way to ensure investment is focused on restoration projects capable of delivering the greatest impact," Olander said.

The research team envisions development of ecosystem services frameworks for restoration strategies to compare project designs and a set of common socio-economic indicators that will unify comprehensive reporting on the progress and effectiveness of Gulf of Mexico ecosystem restoration projects on a local and regional scale. This approach could be used to coordinate and compare multiple restoration approaches and to improve states' ability to communicate the economic and social benefits of their work.

This project is a case study of the Bridge Collaborative, a global coalition of scientists, practitioners, and organizations rapidly moving beyond business as usual to create a more equitable and sustainable world. Results will be used to test the Bridge Collaborative's guidance on logic models and evidence evaluation as tools to advance cross-sector impact.

—by Erin McKenzie

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

Forum Helps Decision Makers Develop Opinions with Facts

PHOTOS BY CARR ELLIOTT

Civil discourse. Imagination. Empathy. Understanding. These are not things that you necessarily think of when people from different political parties and ideologies come together for a discussion. But the Sanford School of Public Policy at Duke University is changing that one forum at a time.

The North Carolina Leadership Forum (NCLF)—a program of the Sanford School that's now concluding its second year—brings civic, business, and political leaders together to learn, collaboratively, about a challenge facing North Carolina and, to the extent possible, find common ground.

The 2017-2018 forum focused on how the state can best meet its future energy needs, partnering with the Nicholas Institute for Environmental Policy Solutions and the Duke University Energy Initiative to present the programming.

"The forum brought people together that may not have previously had the opportunity to discuss the issue collaboratively," said Jennifer Weiss, senior policy associate in the Climate and Energy Program at the Nicholas Institute. "We were not there to pitch a solution. The forum gave participants the ability to let their guard down, listen to others, and understand the facts so they could discuss the issues and agree on the solutions together."

"I would dearly love to do this again, or perhaps continue the effort in a different forum. I never thought I would say this, but talking about the issue of respectful communication and a willingness to be wrong now floats my boat!"

—Unnamed NCLF participant

By the Numbers

According to the post-program survey of North Carolina Leadership Forum participants:

95% **better understand the values, opinions or priorities about NC's energy future held by people with different perspectives than their own.**

75% **viewed some issues about North Carolina's energy future differently than they did before participating.**

The group of more than 30 met 5 times over the course of 9 months to discuss the future of electricity and transportation in North Carolina to more fully understand the challenge of energy poverty, and to deliberate next steps in energy production.

"Across the political spectrum there are similarities and differences in opinion about what we should value most, what challenges we face, and what policies we should adopt to meet them," said Fritz Mayer, director of the NCLF and a professor in the Sanford School. "We never expected forum participants to agree on everything. But they walked away with a much more informed view about the energy needs of North Carolina and a much better understanding of why others might hold views different than their own."

Why? Participants took the time to listen and understand why their opinions differed from their peers.

"I understand the motivation of people with different views is not what I had decided it was," one unnamed participant shared in the final report, due out later this summer. "Their motivation comes from a place of wanting to do what's best for NC, though we disagree on how to get there."

Although participants didn't change their political philosophies as a result of the forum, a survey indicated that 85 percent, during the course of the program, made an effort to encourage or facilitate conversations among people of different parties or ideologies in their community or elsewhere.

"Although the intent of the forum was not to come up with a specific action plan, it did establish relationships that could help NC leaders tackle some of the state's energy challenges while more fully understanding the diverse perspectives across stakeholder groups," said Brian Murray, director of the Duke University Energy Initiative, a partner in forum programming.

—by Christopher Gloetzel

This program was hosted by Duke University's Center for Political Leadership, Innovation and Service (POLIS). Work was supported by the John William Pope Foundation, the Z. Smith Reynolds Foundation, and The Duke Endowment.

Foundations Support Internet of Water Launch

The Internet of Water, a new project to improve our nation's water data infrastructure, has been awarded start-up support by six foundations.

The S.D. Bechtel, Jr. Foundation, the Kingfisher Foundation, The Cynthia & George Mitchell Foundation, the Pisces Foundation, the Walton Family Foundation, and the Water Funder Initiative collectively awarded Duke University's Nicholas Institute for Environmental Policy Solutions $1 million in grant funding.

"Our water world is data rich, but information poor," said Martin Doyle, director of the Nicholas Institute's Water Policy Program. "This funding will create game-changing opportunities to support real-time decision making on a broad scale."

The funding supports the development of a national digital water data and information framework for sharing, integrating, and disseminating public, governmental data to characterize and forecast the quantity, quality, and uses of water across the United States.

The Internet of Water is an outgrowth of the 2015 Aspen-Nicholas Water Forum, which focused on water and big data, and was then followed by the Aspen Institute Dialogue Series on Sharing and Integrating Water Data for Sustainability—a convening of experts from different water sectors.

These efforts, led in part by the Aspen Institute, Doyle, and his Nicholas Institute colleague Lauren Patterson, provided key findings and recommendations regarding the challenges of and opportunities for developing the Internet of Water.

The subsequent report, *The Internet of Water: Sharing and Integrating Water Data for Sustainability*, found public agencies often collect data relevant to water management, but those data are often not openly shared across platforms, limiting their wide use.

"When water data are hard to discover or share across platforms, they are not put to additional uses to gain valuable insights that could revolutionize how we manage our water resources," said Patterson, policy associate in the Nicholas Institute's Water Policy Program.

—by Erin McKenzie

Creating an Internet of Water

There are many local, state, regional, and national level organizations that are working to improve their data infrastructure. The Internet of Water will initially focus on three broad tasks:

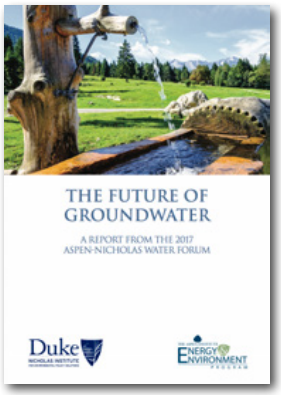
- **Discover the value of water data and commute that value**
- **Open public data by supporting agency efforts**
- **Connect data hubs together to increase data discoverability and usability**

SELECTED PUBLICATIONS

Interaction of Regional Electricity Markets, State Policies

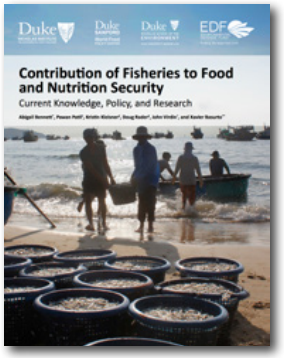
This primer by the Nicholas Institute for Environmental Policy Solutions is aimed at policy makers and stakeholders who seek an understanding of regional electricity markets and the effect of state policies on those markets as well as an understanding of recent market design proposals that are intended to address the regional transmission organization (RTO)-state policies interaction. It explains the workings of RTOs and how they differ between states with traditional regulation of electricity generation and states with restructured electricity markets. It also presents illustrative examples of how state policies interact with regional markets and describes discussions about how to better align RTO markets and state policy goals in three eastern RTOs.

The Future of Groundwater



The 2017 Aspen-Nicholas Water Forum focused on exploring the present condition of groundwater, the evolution of that condition, and opportunities for transitioning to more sustainable uses of groundwater resources. This report summarizes the discussion, finding that groundwater needs to be sustainably developed, meaning groundwater use must be balanced among economic development, environmental health, and quality-of-life needs.

Contribution of Fisheries to Food and Nutrition Security

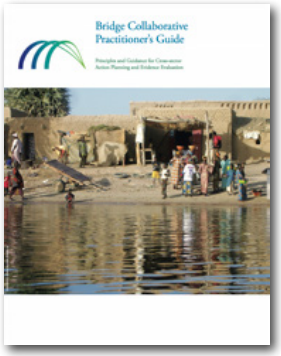


This report by the Nicholas Institute for Environmental Policy Solutions, the World Food Policy Center, the Nicholas School of the Environment, and the Environmental Defense Fund synthesizes current understanding of capture fisheries' contributions to food and nutrition security and explores drivers of those contributions in the context of U.N. Sustainable Development Goals. It suggests that a growing body of data and research focused specifically at the intersection of fisheries, nutrition, and food security can inform policies supportive of those contributions by improving understanding of fisheries' production and distributional dimensions and of consumption patterns and nutritional aspects of fish in the context of healthy diets and sustainable food systems.

Building the Bridge between Ecosystem Services Research, Practice

There is growing demand for research on the impacts of decisions on ecosystem services and human benefits—and a substantial gap between this research and the information required to support decisions. This article in the journal *Ecosystem Services* provides illustrative examples of the gaps between research and practice and describes how researchers can make their work relevant to decision makers by using benefit-relevant indicators and by choosing models appropriate for particular decision contexts. The examples are primarily drawn from the United States, and they include cases that illustrate varying degrees of success in closing these gaps.

Guide for Cross-Sector Action Planning



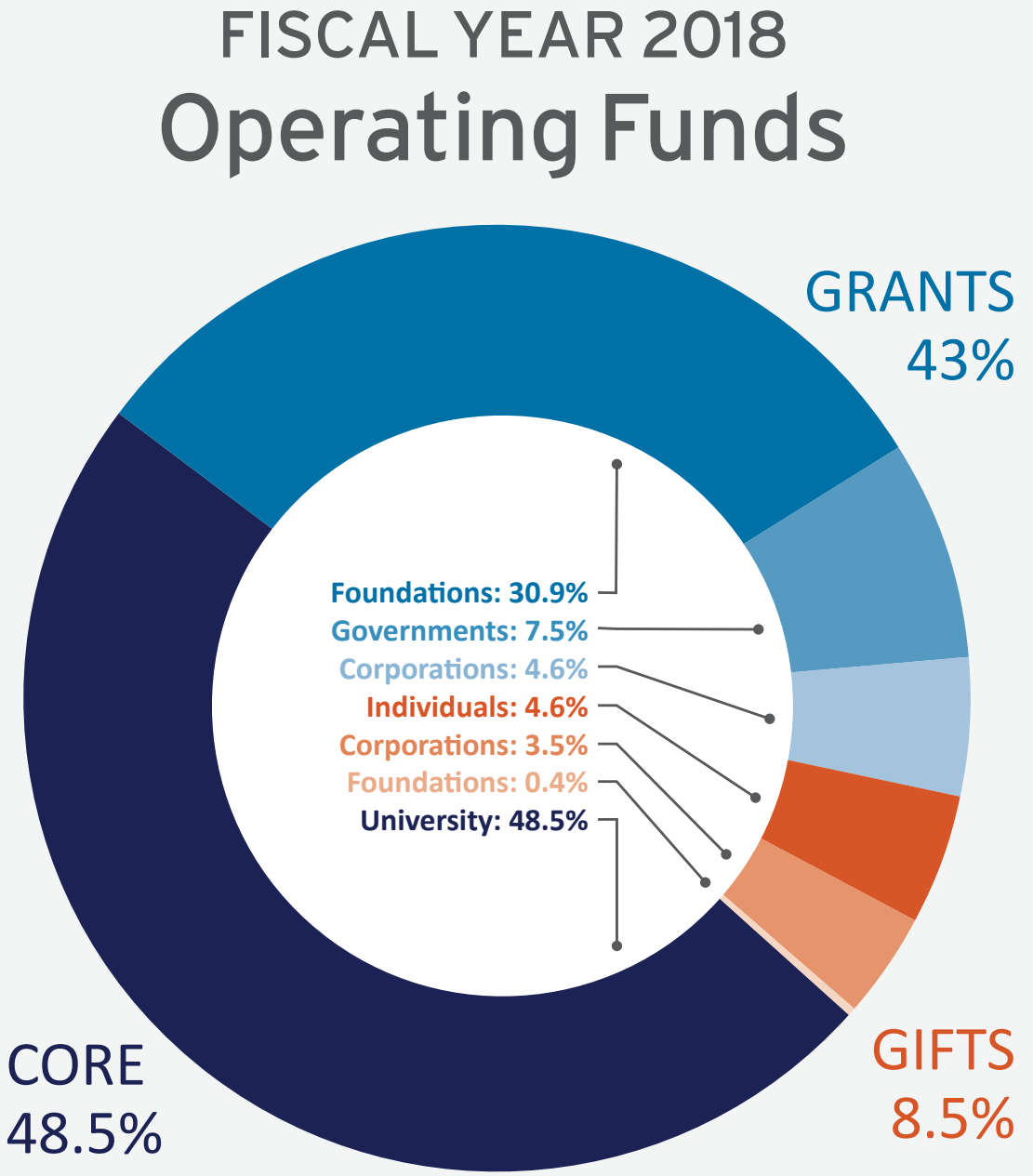
The Bridge Collaborative aims to spark cross-sector problem solving by developing common approaches to which the health, development, and environment sectors can agree. This report captures a set of principles identified and used by the Bridge Collaborative, along with a detailed set of guidance for creating comparable results chains across sectors and evaluating evidence from multiple disciplines in common terms. These principles and guidance reflect novel contributions from the Bridge Collaborative as well as restatements of existing recommendations that resonated among health, development, and environment researchers and practitioners.

Improving Accounting for Ecosystem Services

Despite consensus around the general merit of accounting for ecosystem services, systematic guidance on what to measure and how is lacking. This article published in the journal *Ecological Indicators* proposes the use of a new type of indicator that explicitly reflects an ecosystem's capacity to provide benefits to society, ensuring that ecosystem services assessments measure outcomes that are demonstrably and directly relevant to human welfare. It describes a process for developing benefit-relevant indicators using causal chains that link management decisions through ecological responses to effects on human well-being.

Electricity Industry: Implications of Trends and Taxes

This analysis published in the journal *Energy Economics* examines how changes in market trends and technology costs are likely to affect electricity generation in the United States in the context of possible future carbon taxes. It uses the Dynamic Integrated Economy/Energy/Emissions Model to examine a wide range of sensitivity cases for technology and fuel costs under different economic conditions. The analysis finds that carbon taxes can be an effective way to quickly lower emissions.



Q&A *with* ARVIN GANESAN

In 2018, Duke University's Nicholas Institute for Environmental Policy Solutions welcomed three new members to its Board of Advisors. One of those three individuals was Arvin Ganesan, who leads Apple's energy and environmental policy. Ganesan sat down with our associate director of corporate and foundation relations to discuss his environmental career and how companies like Apple are grappling with how best to use policy to create our modern electricity system.

▸ You have worked in two branches of government as well as in an environmental nonprofit organization and now a global corporation. How has operating in three very different sectors influenced your perspective on environmental opportunities in each?

The pressures may be different in each sector, but the end goals definitely align. My work in the U.S. Senate and the U.S. Environmental Protection Agency during the Obama administration focused on using federal policy to set rules that improved the health and well-being of people across the country. Apple drives at those same end goals, but with different tools. Apple is powered by 100 percent clean energy not only because it makes financial sense, but because we want to make sure that the communities that we are in—including North Carolina—get the benefit of clean air from clean energy.

There is quite a difference among the private sector, government, and the nonprofit sector, but I'm lucky that my whole career—regardless of whether my e-mail address has ended in .com, .org, or .gov—has been focused on improving public health and the environment.

▸ What impact do you think the Nicholas Institute has had on Duke University?

Across the board, there is a need for innovation and creativity in policy work, and that is where the Nicholas Institute has a special role to play. We need to explore what existing laws can do better and develop new policy levers.

Specifically, as technology continues to advance, it is important to achieve the huge potential of technology-enabling policy.

▸ Apple envisions powering its supply chain through 100 percent renewable energy. How does this goal influence your thoughts about how to move policy forward without waiting on Washington, D.C.?

The majority of the United States is going through the same renewable energy transition as the rest of the world, which means Apple's challenges associated with this transition are neither new nor unique.

A transition to clean energy needs to be managed in a way that doesn't affect reliability and manufacturing needs. The good news is that we don't need to make tradeoffs between the two. Policy makers—along with environmentally focused companies like Apple—are actively seeking how best to use policy to create a 21st-century electricity system powered by clean energy.

—by Emerson Beyer

LAURENCE GENON

BOARD OF ADVISORS

William K. Reilly (Chair)
Former Administrator,
U.S. Environmental Protection
Agency (1989–1993)

Disque Deane Jr.
Chief Investment Officer
and Co-Portfolio Manager,
Water Asset Management LLC

Deborah Gallagher (Ex Officio)
Director, Duke Environmental
Leadership Program

Arvin Ganesan
Energy and Environmental
Policy, Apple

Judith Kelley (Ex Officio)
Dean, Sanford School of Public
Policy, Duke University

Suedeen G. Kelly
Partner, Jenner & Block

Mark Laabs
Managing Director of Modern
Energy; Chairman of Faro Energy;
and Chairman of the Rare Cancer
Research Foundation

Elizabeth Littlefield
Senior Counselor, Albright
Stonebridge Group

Peter M. "Pete" Nicholas
(Board Member Emeritus)
Co-Founder and Chairman,
Boston Scientific Corporation

Christine Dowding Nicholas

Edward Norton
Senior Advisor, TPG Capital

Diana Propper de Callejon
Managing Director, Cranemere

Cornelia Quennet-Thielen
Deputy Secretary of State,
Federal Ministry for Education
and Research, Federal Republic
of Germany

Diane Regas
President and CEO, Trust for
Public Land

Carter S. Roberts
President and CEO, World
Wildlife Fund-United States

James E. Rogers
Retired Chairman and CEO,
Duke Energy

William L. Rogers
Founder, TexWest LLC

William Rosenberg
President, E3 Gasification LLC

Virginia Sall
Co-Founder and Director,
The Sall Family Foundation

Jim Salzman
Professor, UCLA School of Law
and Bren School of the
Environment, UC-Santa Barbara

Douglas Scott
Vice President of Strategic
Initiatives, Great Plains Institute

Toddi Steelman (Ex Officio)
Stanback Dean, Nicholas School
of the Environment

Mark Tercek
President and CEO,
The Nature Conservancy

Susan F. Tierney
Senior Advisor, Analysis Group

Douglas Wheeler
Partner, Hogan Lovells US LLP

Junjie Zhang
Director, iMEP Program and
Environmental Research Center,
Duke Kunshan University;
Associate Professor, Duke
University and Duke Kunshan
University

Duke University President Vincent Price speaks with members of the Nicholas Institute's Board of Advisors at their bi-annual meeting in fall 2017.

STRATEGIC ADVISORY COMMITTEE

Deborah Gallagher (Chair)
Director, Duke Environmental Leadership Program

Lori Snyder Bennear
Associate Professor, Nicholas School of the Environment

Martin Doyle
Director, Water Policy Program, Nicholas Institute; Professor, Nicholas School of the Environment

Patrick Halpin
Associate Professor, Nicholas School of the Environment

Kate Konschnik
Director, Climate and Energy Program, Nicholas Institute

Lydia Olander
Director, Ecosystem Services Program, Nicholas Institute

Amy Pickle
Director, State Policy Program, Nicholas Institute

Billy Pizer
Faculty Fellow, Nicholas Institute; Professor, Sanford School of Public Policy

Tim Profeta
Director, Nicholas Institute

Steve Roady
Professor of the Practice, Duke University School of Law; Faculty Fellow, Nicholas Institute

Dean Urban
Professor, Nicholas School of the Environment

John Virdin
Director, Ocean and Coastal Policy Program, Nicholas Institute

Jonathan Wiener
William R. and Thomas L. Perkins Professor of Law, Duke University School of Law; Professor, Nicholas School of the Environment; Professor, Sanford School of Public Policy

Mark Wiesner
James B. Duke Professor of Civil and Environmental Engineering, Pratt School of Engineering

INSTITUTE SENIOR LEADERSHIP

Tim Profeta
Director
Nicholas Institute

Emerson Beyer
Associate Director
Corporate and Foundation Relations

Martin Doyle
Director
Water Policy Program

Kate Konschnik
Director
Climate and Energy Program

Sheri Matthews
Associate Director
Finance and Administration

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

P.O. Box 90335
Duke University
Durham, North Carolina 27708

1201 Pennsylvania Avenue NW
Suite 500
Washington, D.C. 20004

135 Duke Marine Lab Road
Beaufort, North Carolina 28516

Climate and Energy Program: 919.613.8725
Ecosystem Services Program: 919.613.8713
Environmental Economics Program: 919.613.8709
Ocean and Coastal Policy Program: 919.684.1141
State Policy Program: 919.613.8746
Water Policy Program: 919.613.8026

General Inquiries: 919.613.8709
Development: 919.613.7473
Media: 919.613.3652

E-mail: nicholasinstitute@duke.edu
Website: nicholasinstitute.duke.edu