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DUKE UNIVERSITY

Nicholas Institute

FOR ENVIRONMENTAL POLICY SOLUTIONS

2016 Annual Report

Policy Work Affects Local Efforts

Pacific Islands | Durham | Diamond Valley

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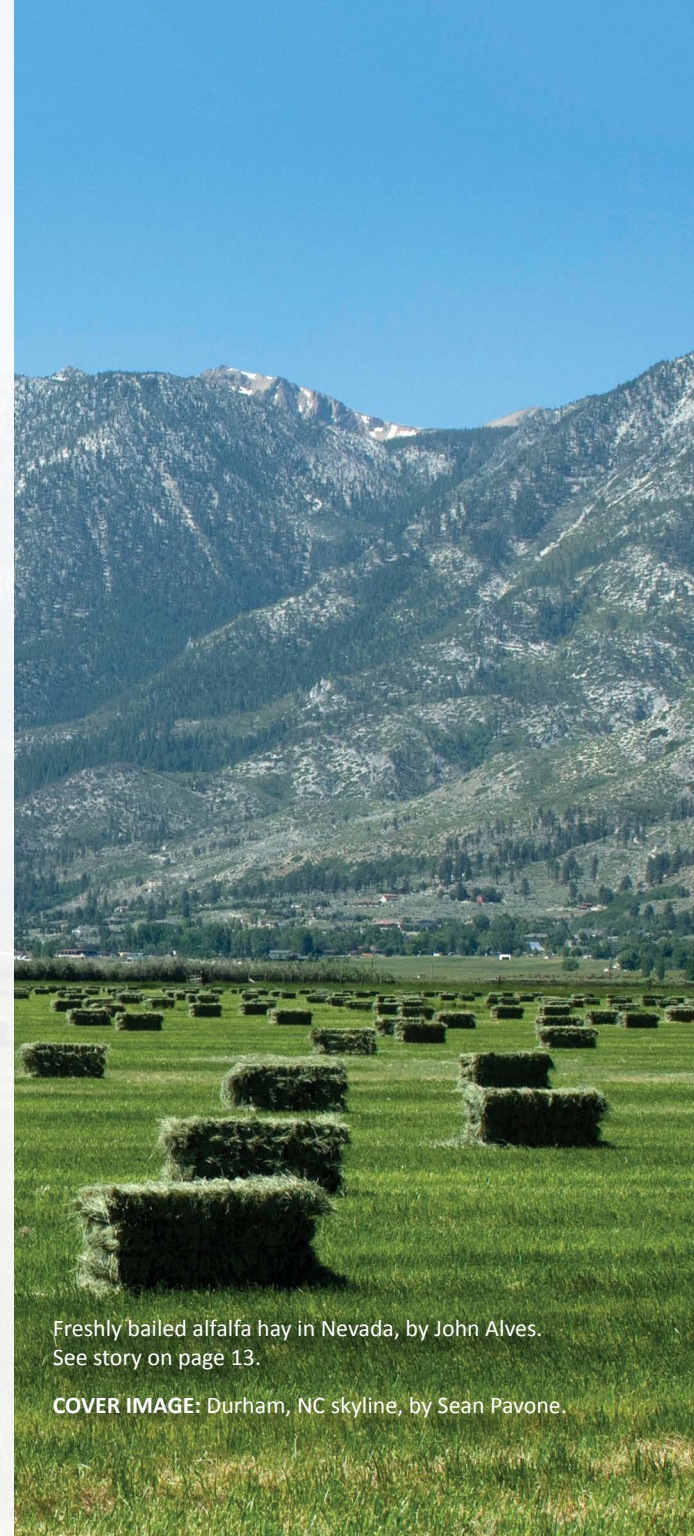
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*Established at Duke University in 2005, the **Nicholas Institute for Environmental Policy Solutions** helps decision makers create timely, effective, and economically practical solutions to the world's critical environmental challenges. Through its 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.*



Freshly bailed alfalfa hay in Nevada, by John Alves.
See story on page 13.

COVER IMAGE: Durham, NC skyline, by Sean Pavone.

FINDING OPPORTUNITY THROUGH ADAPTABILITY AND COLLABORATION

The Nicholas Institute for Environmental Policy Solutions helps decision makers better understand their options. We target our interdisciplinary research to problems as they arise to provide timely analyses of policy changes and their long-term implications. It's through our adaptability—and through the premium we place on collaboration—that we are finding opportunities to break down barriers to environmental progress.

In our feature, we describe projects that blur the distinctions among our programs, bringing together teams that draw on whatever expertise best illuminates the problem and its potential solutions. One project creates a blueprint for converting the American West's prior appropriation water rights system into a setup that keeps water withdrawals within sustainable limits, generates diverse income streams, and improves environmental outcomes. A second project half way around the world in the western and central Pacific Ocean looks to develop a strategy to ensure the world's last healthy tuna stocks will be maintained. And a third effort on environmental justice that is occurring in our backyard integrates three techniques to gather information from local residents that is shaping research questions and informing identification of policy mechanisms to address community-

prioritized issues. All three projects illustrate the value of interdisciplinary approaches to effect local changes that enhance sustainability across a wide array of geographies.

Three recent recruitments speak to our commitment to collaboration and to the increasingly high regard with which others hold the Nicholas Institute's expertise. In January, Water Policy Program director Martin Doyle began serving as a senior fellow of the U.S. Department of the Interior's Natural Resources Investment Center, which focuses on the use of market-based tools and innovative public-private collaborations to increase investment in water and habitat conservation. Ecosystem Services Program director Lydia Olander is providing guidance and recommendations on environmental issues for the U.S. Army Corps of Engineers as an Environmental Advisory Board member. And Environmental Economics Program director Brian Murray is helping the university develop its overall plan for leadership on energy as the interim director of Duke University's Energy Initiative. We consider it a credit to the Nicholas Institute that our staff members are sought out by other institutions. The connections they strengthen through these moves create new opportunities for engagement.

DUKE UNIVERSITY PHOTOGRAPHY



On April 22—Earth Day—more than 100 countries signed the Paris Agreement, which set an explicit goal to limit the rise of global temperatures, to end “bifurcation” in emissions reduction obligations without losing differentiation of the responsibilities of developed economies and those of developing economies, and to implement mechanisms for transparency, updating, and finance. Duke students and faculty, including our own Brian Murray, were in Paris in December to witness the process by which delegates hammered out the agreement. In our education section, we share a story of student mentorship, before and after the climate talks, and describe our role in side events that aimed to advance conversation on a variety of environmental policy topics.

As always, we invite you to contact us to discuss potential partnerships and research endeavors and to explore support opportunities.

— **Tim Profeta**
Director

Nicholas Institute for Environmental Policy Solutions

POLICY
WORK
AFFECTS
LOCAL
EFFORTS

THREE STORIES





Pacific Islands

Cooperation Aimed at Sustainable Fisheries, Poverty Reduction

The western and central Pacific Ocean is home to the world's richest tuna stocks. The region is also becoming the meeting place of poverty reduction and natural resource protection efforts by a handful of countries that benefit from control of this natural wealth. Although those countries' returns from tuna fisheries have increased significantly through improved fisheries management, they could be simultaneously bigger and more sustainable.

Papua New Guinea and Pacific Island countries supply some 34 percent of the global catch of tuna each year. For these countries, whose economic growth drivers

are constrained by their geographic isolation, management of tuna fisheries can make the difference between economic stagnation or a significant rise in per capita gross domestic product (GDP). That management—and more specifically, regional cooperation in it—will heavily influence whether some of the world's last healthy tuna stocks will be maintained.

“The key challenge for Pacific Island countries is to sustainably harness a greater share of the benefits from their tuna fisheries without depleting fish stocks,” said John Virdin, director of the Ocean and Coastal Policy Program at Duke University's Nicholas Institute

for Environmental Policy Solutions. New work by the Nicholas Institute with partners at Duke and the World Bank aims to suggest a pathway to adoption of specific management reforms to meet those twin goals.

In [Pacific Possible: Tuna Fisheries](#), Virdin and other fisheries policy experts say that Pacific Island countries could refine existing regulations to significantly raise their net economic benefits from Pacific tuna fisheries. According to their work, with improved fisheries management the countries could gain as much as \$344 million per year in additional sustainable revenues and could create as many as 15,000 new jobs by 2040.

The additional contribution to GDP could be as high as \$88 million per year—with no depletion of the natural endowment on which the value of the Pacific tuna industry is based.

Improving on a Regional Tuna Fisheries Management Scheme

The many countries and fleets involved in the global tuna value chain make governance of tuna stocks for poverty reduction and sustainability an incredibly complex task. In 1982, eight Pacific island countries—the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, the Solomon Islands, and Tuvalu—joined forces as Parties to the Nauru Agreement (PNA) to manage waters where more than 50 percent of the world’s skipjack tuna is caught. The PNA members’ return from this resource has increased significantly since adoption of a vessel day scheme, the first regional tuna fishery management scheme of its kind.

Viridin describes the scheme as “something like a cap-and-trade system that allows for a fixed amount of fishing effort and for access transfer between countries.”

The scheme sets overall limits on the number of days that fishing vessels using purse seines—a specific kind of net—can be licensed to fish in PNA waters. Days are allocated to each PNA country according to an agreed formula. A country desiring additional days can pay a fee to one with spare days. By controlling the level of purse seine fishing, the scheme conserves tuna and increases its value.



Since the scheme's introduction in 2009, access fees have quadrupled. In 2014, they helped PNA members capture an estimated 13 percent of the delivered value of the purse seine catch. However, that success has created new pressures and challenges as companies potentially enhance their fishing technology to increase their per-licensed-day catch and as fishing activity and catch levels continue to grow in waters beyond the jurisdiction of the PNA countries—waters where some 23 percent of western Pacific purse seining takes place.

Five Strategies for Capturing an Increased Share of Tuna Fishery Benefits

A five-year review in 2015 revealed that the vessel day scheme could be improved to enhance tuna fisheries' contribution to member countries' sustainable development, essentially evolving to meet the next series of challenges. Beginning in mid-2015, the World Bank and the Nicholas Institute built on this review to outline a series of policy actions that over 25 years could lead to a best-case tuna fisheries scenario. The resulting report—part of a World Bank series exploring potentially transformative opportunities for Pacific Island countries that warrant further research and policy action—also quantifies the regional economic impact of those actions by 2040.

“There's already been some great progress in the region over the last five to six years,” Virdin said. “By improving sustainability through maintaining firm and shared catch limits, and by increasing economic value through collaborative access regimes such as



the vessel day scheme, Pacific Island countries have the potential to significantly boost public revenues and support thousands of new jobs.”

The report considers five external forces expected to shape the performance of tuna fisheries in the western and central Pacific Ocean. First, climate change could result in the migration of tuna stocks toward the central and eastern Pacific Ocean. Second, as the global supply of tuna reaches its natural limit, aggregate demand and prices could slightly increase. Third, technology improvements are likely to enhance fishing productivity, product quality, and fisheries monitoring. Fourth, Pacific Island countries' population is expected to grow by 50 percent. Finally, several Pacific Island countries' trading agreements with the European Union will likely erode, reducing the competitiveness

of regional tuna processors while foreign fishing subsidies for tuna fleets likely persist.

Given these forces, the report charts a course to achievement of four goals outlined in *Regional Roadmap for Sustainable Pacific Fisheries* and endorsed in 2015 by Pacific Island Forum leaders:

- ▶ Enhance sustainability of tuna fisheries resources as a prerequisite for greater benefits
- ▶ Enhance the economic value of the tuna fisheries without increasing production
- ▶ Increase Pacific Island employment in western and central Pacific Ocean tuna fisheries
- ▶ Enhance Pacific Island food security

To achieve these goals, the *Pacific Possible* report by the Nicholas Institute and the World Bank recommends five strategies:

- ▶ Continued regional cooperation on tuna management and eventual inclusion of key tuna resource owners such as Indonesia and the Philippines as partners in that management
- ▶ Strict fishing effort and catch limits to maintain valuable natural capital assets (and help constrain supply and hence increase prices) as well as investments to rebuild bigeye stock
- ▶ Flexible access and, eventually, output rights for fleets to enhance the value of fisheries without increasing production and to give interested PICs a tool to increase foreign investment in tuna processing
- ▶ Significant investment in skills and capacity to develop the world's top tuna managers
- ▶ Where feasible, inclusion of coastal communities in fisheries through dedicated access and inshore fish aggregating device (FAD) networks as well as investments in food security as coastal fish supplies stagnate and human populations grow.

"In every scenario that we looked at to get to a best-case scenario, the critical starting point was Pacific island countries working together to set hard limits on the amount of fishing in their waters," Virdin said. "Those countries are increasingly combining environmental measures with overall fisheries management measures, which are increasingly becoming the same."

Real-Time, Demand-Driven Policy Support

After Virdin and his co-authors incorporate comments in the final *Pacific Possible* report, the Nicholas Institute, the World Bank, and other institutions will continue work with the PNA Office to support PNA members' sustainable tuna fisheries management with real-time, demand-driven policy information and research. Virdin and his collaborators expect to provide policy advice on time-sensitive questions. They also expect to explore opportunities for student and faculty research through project-based courses and research assistantships and to engage in exchanges and capacity building through fellowships for Pacific island students, fisheries managers, and policy professionals.

Some of the new policy research will focus on the applicability of the PNA countries' model of regional cooperation to other large, migratory fisheries.

"Developing countries could learn from the Pacific island countries' vessel day scheme," said Virdin. "West African and Indian Ocean countries might be able to replicate many elements of the Pacific island countries' recent fisheries management efforts— with the improvements suggested by the *Pacific Possible* report and their own unique circumstances."

— by Melissa Edeburn

Work on the *Pacific Possible: Tuna Fisheries* report was supported by the World Bank.

VICTOR GRUBBS





Durham, North Carolina

Environmental Justice Project Engages Community in Collaborative Research

Last year the Kilombo Community Center on Geer Street in the heart of one of Durham, North Carolina's, metamorphosing neighborhoods closed its doors. For nine years, the center had been the site of free health clinics and legal counsel, tutoring, art and theater programs, computer literacy and language classes, community research seminars, public events on race and urban development, and weekly dinners—all volunteer efforts generated by and for local residents.

But the center had no answer for the area's rising rents. Its relocation away from Geer Street was one more sign of Durham's physical and economic transformation.

The fate of the Kilombo Center has become a cautionary tale for another Durham neighborhood. For at least a decade, long-time residents of Old East Durham have witnessed a redevelopment effort that has swelled the city's population and brought new businesses and jobs

but that has done little to protect them from rising housing prices and has even cut them off from some traditional support systems. Many are being pushed out of an area that they no longer find affordable. Many of those who remain are concerned about the changing character of their community—a community that increasingly reflects the desires of new affluent and predominantly white residents but not the needs of the mainly African American and Latino middle-class and blue-collar

families and business owners who have lived through the city's leaner times.

The concerns of those long-time residents are now part of the Nicholas Institute for Environmental Policy Solutions' first project on environmental justice, which a 2001 U.S. Environmental Protection Agency memorandum defined as "the fair treatment of people of all races, income, and cultures with respect to the development, implementation and enforcement of environmental laws, regulations, and policies, and their meaningful involvement in the decision-making processes of the government." More recently, the concept of environmental justice has evolved to reference equitable distribution of environmental benefits and even recognition of local ways of life, local knowledge, and cultural difference as well as communities and individuals' capacity to flourish.

It is in that broad environmental justice context that the Nicholas Institute, along with the University of North Carolina (UNC) and North Carolina State University (NCSU), is engaging with Communities in Partnership, a new East Durham neighborhood non-profit, to document the unintended and collateral impacts of the city's revitalization. This Kenan Creative Collaboratory project, which is funded by the William Kenan Foundation, will eventually lead to proposals of policy mechanisms to address those impacts.

"This is a community-based research project, so the broad research agenda we began with is continually being reshaped by the specific research questions raised by our community



KAY JOWERS

partner and the community members themselves," said Kay Jowers, senior policy associate with the Nicholas Institute's State Policy Program. "Our aim is to complement the community's agenda and efforts and to support the community in dealing with the environmental justice issues it identifies as a priority."

Researchers proposed several activities to establish research questions for the project that would respond to community concerns. In one, local residents would engage in community mapping of spatial information related to environmental justice issues such as the economic impacts of rapid redevelopment efforts. In another, they would use a research technique known as PhotoVoice to depict challenges and opportunities in their changing neighborhood. In yet another, they would let their feet do the talking, taking research partners to the sites of their concerns. The project began with a town hall meeting to

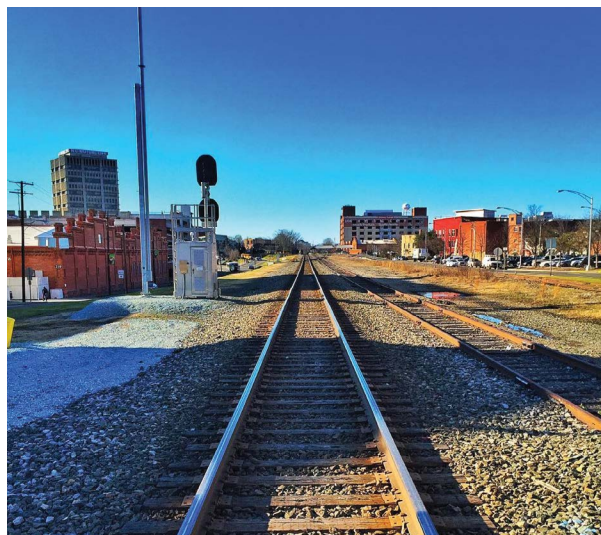
introduce these research activities and to collect information from community members.

Walkshops, PhotoVoice, and Community Mapping

Increasing residents' capacity to influence decisions affecting the Old East Durham neighborhood literally started with a step. This summer, community members joined the research partners on a "walkshop"—a walking tour of the neighborhood that focused on four areas of concern identified through a community survey.

"The goal was to physically explore the area to learn about the community's issues with transportation, housing, the environment, and the local economy," said walkshop organizer Kofi Boone from NCSU's College of Design. "To figure out the spots that the walkshop needed to visit, we had a meeting

DURHAM, NC, BY JAMES WILLAMOR, CC BY-SA. TRAIN TRACKS IN DURHAM, NC, BY JED RECORD, CC BY.



to identify them. Because housing was by far the biggest concern elicited by the survey, we asked participants to tell us the best places to see gentrification and displacement in the neighborhood. We also were interested in the locations of the best and worst affordable housing and the best-kept and most poorly kept properties.”

The second largest concern turned out to be the local economy, specifically, the state of businesses locally owned, locally patronized, or both. Therefore, the researchers asked community members to identify the places

they go in the neighborhood to meet their daily needs as well as the locations of local businesses that no longer exist. They were also asked to point out the locations of local economic development and job training.

Finally, they were asked to pinpoint areas associated with two other issues elicited in the survey: streetscaping issues—worst places to walk and catch buses, most dangerous street crossings, and poor street lighting—and environmental issues, such as areas of flooding, illegal dumping of waste, and poor maintenance.

“Our aim is to complement the community’s agenda and efforts and to support the community in dealing with the environmental justice issues it identifies as a priority.”

—**Kay Jowers**, senior policy associate, Nicholas Institute for Environmental Policy Solutions

The workshop documented long-standing problems that revitalization efforts have failed to address. To capture community members’ perceptions of neighborhood changes brought about by those efforts, the Kenan Creative Collaboratory project is using PhotoVoice, which Deborah Gallagher from Duke University’s Nicholas School of the Environment describes as a method for conveying impacts to policy makers and for creating solidarity within local networks.

“PhotoVoice is a platform for community members to share personal reflections about their neighborhood and to visually depict challenges and opportunities for change,” said Gallagher of the approach that cities around the world have used to address issues ranging from gun violence impacts to green space needs. “In this instance, we’re using it as an outlet for them to respond to a group-selected theme.”

For the Kenan Creative Collaboratory project, researchers will hold a series of workshops to select a “prompt question” suggested by community-identified environmental justice concerns—a question to which volunteer photographers will respond over several weeks this fall. The workshops will recruit and train those photographers as well as identify technical support organizations during the shooting period. Once the photos are assembled, the volunteers and Communities in Partnership will select photos for display, caption them, and vote on the display method. The display will be shared with city officials and planners.

Finally, to capture community members’ knowledge about the neighborhood changes depicted with PhotoVoice and walkshops, the project is incorporating community mapping, an increasingly common way of engaging communities in eliciting and recording data with methods ranging from hand-drawn sketches to sophisticated physical and computer models.

According to Danielle Spurlock at UNC’s Department of City and Regional Planning, the idea is to build on community residents’ expert knowledge about their own neighborhood to interpret and “ground truth” the information from a housing analysis.

“Residents decide how to integrate the community’s environmental amenities and disamenities and information from PhotoVoice and walkshops with affordability factors,” she said. “By incorporating the lived experience

of Old East Durham neighborhood residents, the maps can raise awareness and facilitate community discussions.”

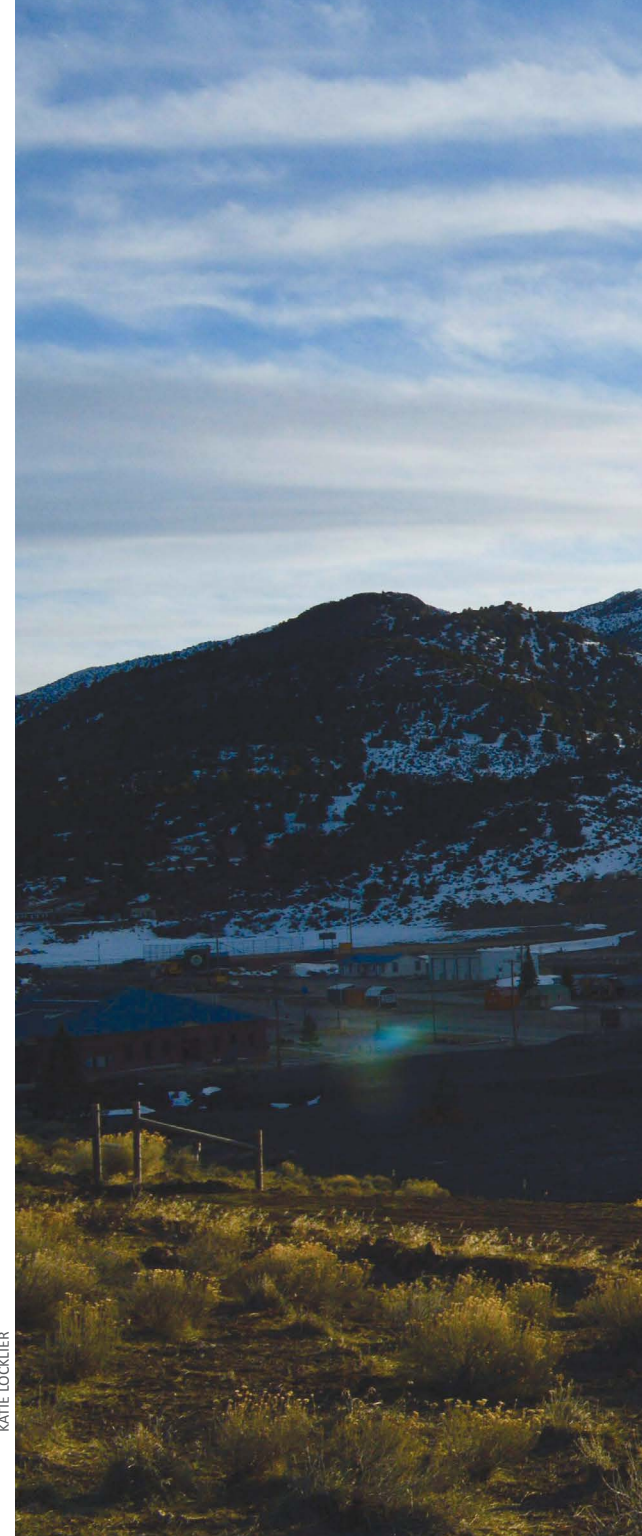
Finding Policy Mechanisms to Address Injustices

Once the Kenan Creative Collaboratory project’s research phase is completed, Jowers and the research team will continue working with Communities in Partnership to identify policy mechanisms—for example, community-based land trusts and community benefits agreements with brownfield redevelopers—to address issues that the community prioritized. The collaboratory partners are hoping their input will inform future development decisions—both public and private—affecting the neighborhood.

“What’s novel about the collaboratory project is not its research techniques but its combination of those techniques,” said Jowers. “We’re using the full range of the academic partners’ expertise to come up with what we think is a fairly robust protocol for identifying, documenting, and communicating the environmental justice issues of priority for one community. It’s a protocol that could work for other communities facing redevelopment challenges or other urban environmental justice issues.”

—by Melissa Edeburn

Work on this Kenan Creative Collaboratory project is supported by the William R. Kenan, Jr. Funds and administered by the Kenan Institute for Ethics at Duke.



Diamond Valley, Nevada

Nevada City Tests Blueprint for Buying, Selling Water Rights

Tucked in between the Sulphur Spring Range and the Diamond Mountains in Nevada's Eureka County is a valley known for its farms of alfalfa and grass hay.

With Desert Land Entries in the late 1950s and 1960s and increased availability of electricity in the early 1970s, farming took off in the Diamond Valley and has remained a steady base of employment for many residents. It's the valley's groundwater—about 95 percent goes to farming—that's so essential to ensuring these crops remain an economic driver in the rural region.

But the aquifer that Diamond Valley farmers depend on to irrigate crops is expected to dry up within 30 years absent measures to sustain it from excessive pumping and over allocation.

The area, as elsewhere in many western U.S. states, relies on a system that originated more than 150 years ago to determine who gets water from the aquifer and who doesn't. The essence of the doctrine of prior appropriation promises rights to a set amount of water on the basis of who first began using it.

With water shortages worsening in Nevada, the state's Office of the State Engineer declared Diamond Valley a critical management area. The declaration comes with a mandate to create a sustainable use groundwater management plan within 10 years or face water restrictions.

"If a groundwater management plan is not developed and approved by the end of this 10 years, the State Engineer, the ultimate authority over water allocation and use in Nevada, is obligated to regulate by priority," said Jake Tibbitts, Natural Resource Manager

for Eureka County, Nevada. “This means that there will be strict regulation according to water rights seniority. So, junior water rights holders will be simply cut off, regardless of type of use, efficiency, or economic output.”

An effort to conform to this mandate could be under way as early as spring 2017, when the Diamond Valley is expected to test a blueprint for buying and selling water rights to redistribute the valley’s water. The trading should shift supply to where it’s needed most and should allow those with surplus supply to profit from it.

The blueprint was developed by researchers at Duke University’s Nicholas Institute for Environmental Policy Solutions and builds on lessons from Australia’s search for a water rights and management framework that would increase the contribution water makes to the economy, the environment, and the community.

“The blueprint gives shareholders incentive to manage water very efficiently,” said Mike Young, a visiting fellow at the Nicholas Institute who led creation of the blueprint.

Young, who is also a professor at the University of Adelaide, is one of the acknowledged architects of Australia’s current water right and trading system. Work on the development of this system began in the mid-1990s. “Australia was lucky,” Young said. “By the time the extent of the millennium drought set in, the new water rights system was there to help pull the country out of its worst drought on record with much less damage to crops and impacts to stream flows than otherwise would have been the case.”

Applying the Blueprint to the Diamond Valley

The basis for the blueprint Young developed with other Nicholas Institute colleagues for the Diamond Valley proposes a move from the “prior appropriation” system to water “shares.” All irrigators in the valley become shareholders, just like shareholders in a company. Before the start of irrigation season, an appointed board makes allocations in proportion to the number of shares held. Allocations per share are to be reduced every year until the water table of the aquifer stabilizes.

“The blueprint aims to ‘unbundle’ water rights by allowing shareholders to sell their allocations, with no risk to their water rights, to those shareholders that may need more of the resource,” Young said. “Initially, senior water rights holders will be given more shares than their junior counterparts. To keep administrative costs low, it is proposed that Eureka County hold sufficient shares to offset impacts of water taken by households and businesses.”

Young compares the system for keeping track of these transactions to a bank account. When allocations are made, money is transferred to that selling shareholder’s account and debited from the buyer’s account.

Water use is recorded and tracked with a metering system. To discourage overuse, shareholders receive penalties on the basis of the number of days their account is in deficit, and surplus allocations carry over to shareholders’ accounts the next year.

“Under the current prior appropriation system, there is little incentive to innovate and ensure water use is maximized,” Young said. “In a proposed unbundled water rights system, innovation is encouraged. Investment and risk taking is rewarded. A blunt, all-or-nothing irrigation system is replaced with a smart one that encourages every water user to be as efficient and productive as they possibly can. Two water markets soon emerge, one for shares and the other for allocations.”

The blueprint developed for Diamond Valley in the Nicholas Institute report [*Unbundling Water Rights: A Blueprint for Development of Robust Water Allocation Systems in the Western United States*](#) is serving as a guide to development of a share-type system that best meets the valley’s needs.

“As with a blueprint used by a home builder, there are changes we are making to adapt to our local needs and desires as well as legal and political constraints, but the foundational

“This drought issue does not start and end in the West. This same challenge is on the rise in other geographies where a similar method may be scaled and transitioned for use there—possibly even across jurisdictions.”

—Tim Profeta, director, Nicholas Institute for Environmental Policy Solutions



KATIE LOCKLIER

Mike Young hosts a February meeting in Nevada to develop a groundwater management plan to aid transition to a water rights sharing system.

structure built off of the blueprint remains,” said Tibbitts, who is helping facilitate the process being developed by water users in Diamond Valley with the assistance of agencies. “The water users like the idea of a market-based system that provides ultimate flexibility in using water that’s best for their operation, does not promote waste, and allows quick sale, lease, trade, etcetera for water shares in times when needed—excess or drought.”

While all the particular details are being worked out, an advisory panel is making progress. Those leading the effort for the Diamond Valley hope to have a draft plan approved by

all water rights holders and submitted to the State Engineer for feedback in October 2016. If all looks good, it’s on to the legislature with the start of sessions in February 2017.

“Even before Critical Management Area designation, there have been many efforts for local water users—primarily farmers—for many years to find local, grass-roots solutions to reduce pumping that will leave the local community intact while preserving our socio-economic stability,” Tibbitts said.

With this plan, the hope, according to Tibbitts, is that Diamond Valley can “Keep as many

farming families farming as possible, albeit likely farming differently than the status quo today. We want to keep the same economic outputs from Diamond Valley even with less pumping, all while stabilizing the water table declines.”

Nevada and Beyond

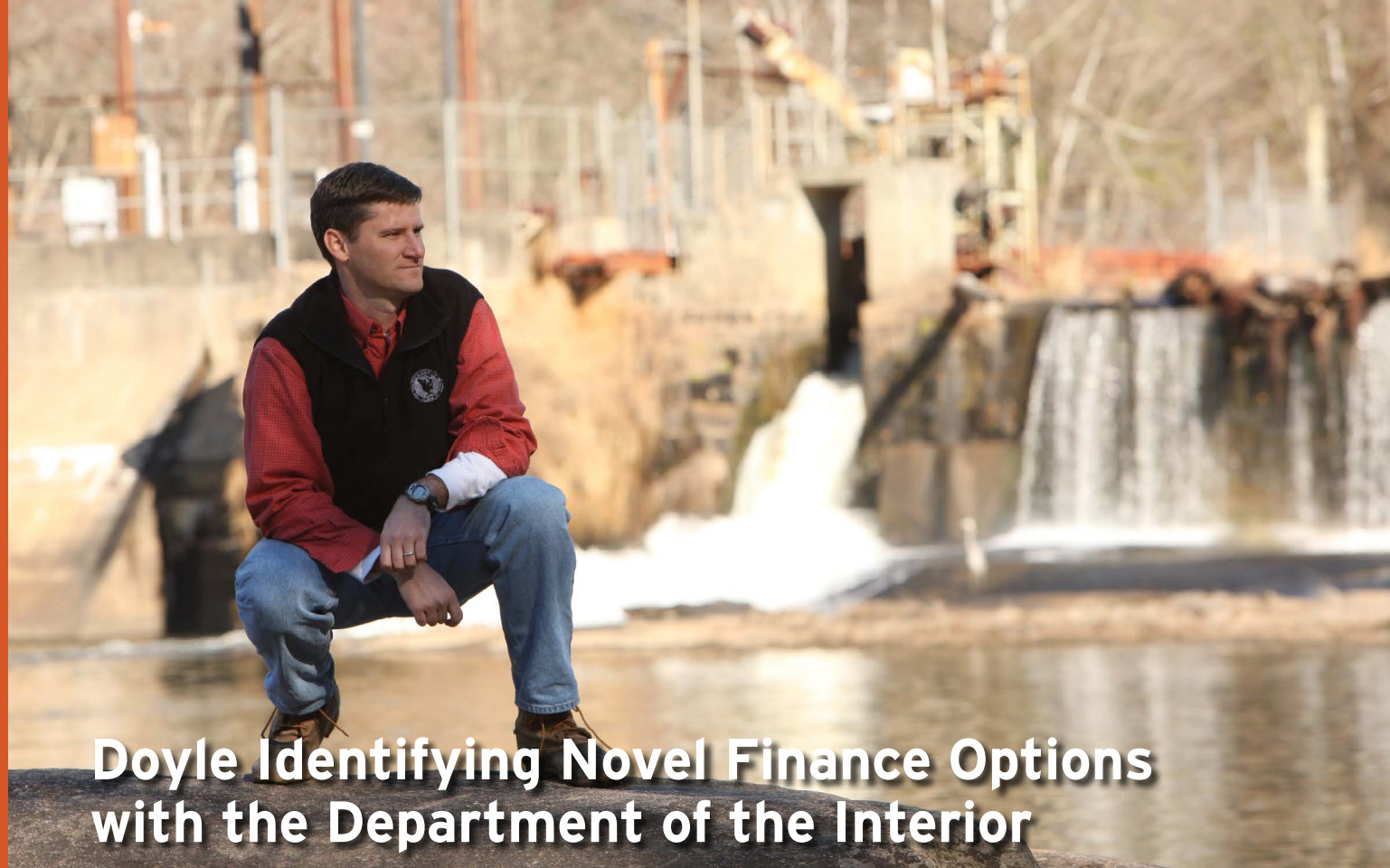
In the same Nicholas Institute report detailing the blueprint for Diamond Valley, authors share an idea for another potential pilot site in Nevada—the Humboldt Basin. A more multifaceted project involving ground and surface water, the basin would require unbundling of its water rights in stages—an avenue representatives are exploring with the Nicholas Institute.

Young and other members of the Nicholas Institute say the frameworks used to create the blueprints for Diamond Valley and the Humboldt Basin have application elsewhere. The Nicholas Institute is now working with groundwater district managers in California, but many sites in other states could be test beds.

“This drought issue does not start and end in the West,” said Nicholas Institute director Tim Profeta, who is also involved in the project. “This same challenge is on the rise in other geographies where a similar method may be scaled and transitioned for use there—possibly even across jurisdictions.”

—by Erin McKenzie

Work on this project was supported by The Rockefeller Foundation, the Walton Family Foundation, the S. D. Bechtel, Jr. Foundation, and the Pisces Foundation.



Doyle Identifying Novel Finance Options with the Department of the Interior

JIM WALLACE

A growing population, aging infrastructure, and climate change have led to water stress in the American West, creating tradeoffs that sometimes come at the expense of species and ecosystems. As competition among water users and uses increases, appropriations from Congress remain stagnant or decrease. It is increasingly clear that water challenges will not be met with typical sources of finance.

In January, Martin Doyle began a one-year term as the inaugural senior fellow with the U.S. Department of the Interior's Natural Resources Investment Center (NRIC), which is finding ways to bring private investments to address some of these growing finance needs. The center aims to increase investment in water conservation and critical water infrastructure as well as build up water supply resilience.

"Drought grabs our attention, but water scarcity, aging infrastructure, and species loss are ongoing, chronic problems across much of our nation. Solving them requires new approaches that blend public and private investments," said Doyle, director of the Nicholas Institute for Environmental Policy Solutions' Water Policy Program and a professor of river science and policy at Duke's Nicholas School of the Environment. "This new center

is a great chance to make a concerted effort in this direction.”

Doyle is helping guide NRIC’s identification of new financing options for projects that conserve water resources and protect species habitat in water-scarce western states. With the Bureau of Reclamation, he is working on existing projects that use water markets to increase water efficiency and conservation. He often assists buyers and sellers in negotiating specific barriers to a transaction.

“Because of the novelty of water and species habitat markets, each transaction is unique and requires shepherding through the regulatory process. There’s constant dialog between the private and public sectors,” Doyle said, noting the work regularly takes him to central Oregon, Denver, Phoenix, and Las Vegas—anywhere that water is scarce.

For alternative finance programs involving agencies such as the Bureau of Reclamation and the Army Corps of Engineers, Doyle is developing pilot projects that would use public-private partnerships to facilitate infrastructure rehabilitation.

NRIC is part of two initiatives: President Obama’s Build America Investment Initiative, which calls on federal agencies to increase investments in ports, roads, water and sewer systems, broadband networks, and other vital infrastructure projects and Pay for Success, an initiative that employs market-based management tools to ensure government services produce intended outcomes.

—by Erin McKenzie

Murray Named Interim Director of Duke University Energy Initiative

In January, the Nicholas Institute’s Environmental Economics Program director Brian Murray was named interim director of the Duke University Energy Initiative.

Murray took over for Richard Newell, the founding director of the Energy Initiative, after Newell stepped down to pursue other opportunities in

research and public service. Murray will hold the spot—splitting time between the Nicholas Institute and the Energy Initiative—while Duke conducts a search for Newell’s permanent replacement.

“I am grateful to Brian for stepping in and providing continuity as we continue to develop an overall plan for energy at Duke,” said Sally Kornbluth, Duke’s provost and Jo Rae Wright University Professor.

The Energy Initiative is a university-wide interdisciplinary collaboration focused



Duke University Photography

on advancing an accessible, affordable, reliable, and clean energy system.

The initiative reaches across business, engineering, environment, law, policy, and the arts and sciences to educate tomorrow’s energy innovators, develop new solutions through research, and improve energy decisions by engaging business and government leaders. Since the Energy Initiative launched at Duke in 2011, it has grown to encompass more than 130 faculty and researchers in 6 schools offering 55 courses to 1,400 students.

Work Valuing Nature Contributes to Board Appointment

Many ecosystem services—or the benefits nature provides to people—are increasingly important, but many of these services are not reflected in traditional decision processes and assessments.

For the past few years, Lydia Olander, director of the Ecosystem Services Program at the Nicholas Institute for Environmental Policy Solutions, has coordinated a group of experts who have worked to clarify best practices for ecosystem services assessment in the context of federal decision making.

This work has been largely undertaken through the National Ecosystem Services Partnership, a Nicholas Institute’s initiative. NESP produced the *Federal Resource Management and Ecosystem Services Guidebook* and a companion report that surveys methods to enhance the credibility and consistency of ecosystem services approaches to management.

These efforts contributed to Olander’s three-year appointment with the U.S. Army Corps of Engineers (USACE) Environmental Advisory Board. The board is tasked with providing independent guidance and recommendations to the organization’s chief of engineers on environmental issues over which USACE has oversight. The board is chartered by the Federal Advisory Committee Act and reports to the secretary of defense through the secretary of the Army, the assistant secretary of the Army for civil works, and the USACE.

Since joining the board last summer, Olander led work on a report that describes the rationale, benefits, and challenges of using ecosystem services in USACE decision making. The report also provides three recommendations for how the USACE might incorporate these assessments in its communication, collaboration, and decision-making efforts.

“It is an honor and significant responsibility to be part of the team that provides advice on how the Army Corps of Engineers can transition from an era of construction aimed

at controlling nature to one of renewal and restoration focused on building with nature,” Olander said.

Because the Army Corps covers a variety of environmental issues—from flood protection and ecosystem restoration to environmental regulation and wetland and stream mitigation—Olander and other board members’ expertise is being used to think broadly about how to better integrate environmental stewardship and sustainability into USACE operations.

—by Erin McKenzie



Class Offers Students Chance to Experience Climate History



In Paris, students from Duke and other U.S. schools met with the Managing Director for the White House Council on Environmental Quality Christy Goldfuss to discuss how the climate agreement will be translated into policy at the domestic level.

For some years, Nicholas Institute for Environmental Policy Solutions staff have helped lead a course that immerses students in the process of negotiating a global climate agreement.

The United Nations Climate Negotiations Practicum course not only teaches students about international climate negotiations and policies under the United Nations Framework Convention on Climate Change—it takes them across the world to witness and be involved in the negotiations at one of the U.N.'s annual climate conferences.

At the most recent conference in late 2015, students in the practicum course were part of history. They participated in the process to reach a landmark agreement whereby more than 190 countries pledged to hold the global average temperature increase to “well below” 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit that increase to 1.5 degrees Celsius.

“Like many in the climate community, I am elated following the Paris Agreement,” Seth Brown, a dual masters of public policy and masters of business administration student,

[wrote](#) on the *Duke to Paris* blog just days after a global climate deal was reached in Le Bourget, France, in December 2015. “This was a moment 23 years in the making! Something that once seemed impossible. Being part of this class was special: it made us feel like we contributed in some small way.”

DUKE PARTICIPATION

In the past five years, students in the practicum course have worked with a variety of clients, including country governments and non-governmental organizations, directly involved in the climate conferences.

Since 2013, the fall semester course has been co-taught by Billy Pizer, Nicholas Institute faculty fellow and professor at the Sanford School of Public Policy, and Jonathan Wiener, Perkins Professor of Law and Environmental Policy at the Law, Nicholas and Sanford Schools, along with graduate student leadership. In fall 2015, with graduate student leaders Emily Pechar and Siqi Han, the course took students from across Duke units to preliminary U.N. climate meetings in Germany. Then, most of the class went on

to Paris to attend the annual conference, assisting client organizations with research and text drafting, observing side events, and following the developing agreement.

During the two-week conference, the students met up with Brian Murray, director of the Environmental Economics Program at the Nicholas Institute and a speaker at more than half a dozen side events covering everything from carbon markets to oceans policy. He was also serving as a mentor to the Duke students—a role someone at the Nicholas Institute has played since 2009 for students attending the conference with and without the class. In France, Murray introduced students to high-ranking environmental leaders, including members

of negotiating delegations from the United States, Canada, and Ethiopia. They also met with Ontario’s Minister of the Environment and Climate Change and with the chairman of the International Emissions Trading Association.

“There is no better way for students to understand the complexities and nuances of the negotiating process than to meet with and, in some cases, provide technical support to the negotiators,” said Murray. “The Duke students distinguished themselves in this venue by being extremely knowledgeable, passionate and practical, as conveyed to me by the many participants they met and worked with.”

— by Erin McKenzie

Students Assess Whether Food Waste Could Help Duke Achieve Carbon Neutrality

Last fall, six Duke students assembled at Loyd Ray Farms, a project of the Duke Carbon Offsets Initiative (DCOI), to learn how its hogs, in the words of one student, Andrew Seelaus, “are cranking out some of North Carolina’s most valuable carbon offsets and renewable energy credits.” Seelaus and the other five students—members of an energy-themed Bass Connections project partnering the DCOI, the Nicholas Institute for Environmental Policy Solutions, the Pratt School of Engineering, and the Nicholas School of the Environment—were out to learn whether an on-campus anaerobic digester could cost-effectively do for food waste what the digester at Loyd Ray Farms was doing for hog waste, thereby helping Duke meet its goal of carbon neutrality by 2024.

To answer that question, the students undertook a feasibility study with three components: a food waste audit at Duke; a survey of relevant federal, state, and university policies; and an economic modeling exercise, which was executed with guidance from team member Brian Murray, Environmental Economics Program director at the Nicholas Institute and interim director of the Duke Energy Initiative.



Read the students’ own interpretations of the final agreement and learn more about their experiences in France on the [Duke to Paris](#) blog. Watch video of the Nicholas Institute’s Brian Murray, Billy Pizer, and Tim Profeta discussing the significance of the agreement at a Duke event: <http://nieps.org/YdrUh>

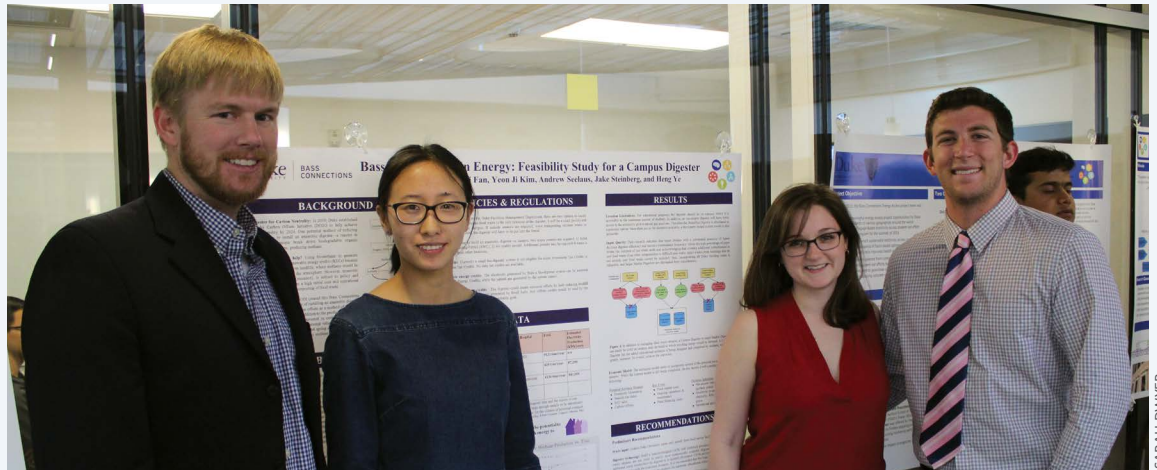
Brian Murray (far right) and students with Christian de Perthuis, Climate Economics Chair at the Université Paris-Dauphine.

For Murray, just as important as the study's main aim was its provision of an intense interdisciplinary energy education—one requiring students to calculate biogas yields and understand renewable energy credit markets.

“The learning curve was steep,” said Murray. “The students had to study the operating requirements of various types of commercial anaerobic digesters, determine whether the quality and quantity of our waste stream was suitable for one of them, and research policies that would limit the scenarios for the economic analysis.”

Over the course of the project, the students identified several obstacles to operation of an on-campus digester. Duke's waste stream is too small for all but one commercially available digester, necessitating a custom-built facility. The stream could be increased if Duke partnered with other food facilities, but that option is precluded by a university policy prohibiting waste from being brought onto campus. Accommodating additional waste by siting the digester off campus would mean distancing the digester from any infrastructure that would utilize methane production to generate electricity, increasing costs and reducing the project's educational potential for Duke students.

Ultimately, the economic feasibility analysis indicated that, as a standalone project, a campus digester is not cost competitive given the low electricity rates paid by Duke and the low price of natural gas. According to the students, nearly every scenario they modeled yielded a negative return.



The Campus Digester Feasibility Study team won a blue ribbon in the student poster contest at the 2016 State Energy Conference of North Carolina.

SARAH DWYER

“It was an avenue we needed to explore, and now we're pretty clear on the hurdles that the project would have to jump,” said DCOI's Charles Adair. “That's valuable information to have as we continue to explore carbon neutrality strategies.”

But the students did conclude that a small food-waste digester could be justified on the basis of its educational value if students were allowed to design and build it on campus, where students and faculty could readily access it as a learning lab. Validation of that educational value, they said, could come in the form of grants covering some or all of the project's capital costs.

Duke University Facilities Management vice president John Noonan has expressed willingness for his staff to help students design, and find a location for, a facility. One of the project's other faculty partners, the Pratt

School's Marc Deshusses, is contemplating a course that would offer students an opportunity to pursue the work.

For the students who were part of the initial project, the takeaways go beyond the feasibility study's conclusion. Undergraduate Eva Kim picked up problem management skills that she wasn't getting in the classroom.

“Defining the problem was an unfamiliar task,” Kim said. “Typically I get assignments for which the problem is clear and solving it is like ticking off a checklist. That would be an unrealistic situation in the work force. Working on a Bass Connections team taught me that you have to be able to grasp the problem in all its complexity and then you have to use that understanding to put together periodic work goals. The work plan's not going to be handed to you.”

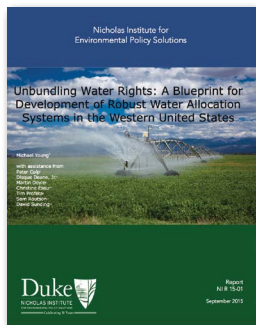
—by Melissa Edeburn

SELECTED PUBLICATIONS

[A Review of British Columbia's Revenue-Neutral Carbon Tax](#)

In 2008, British Columbia implemented the first comprehensive and substantial carbon tax in North America. This *Energy Policy* article reviews existing evidence on the effect of the tax on greenhouse emissions, the economy, and the distribution of income, and it provides new evidence on public perceptions of the tax. Empirical and simulation models suggest that the tax has reduced emissions in the province 5-15 percent, has had negligible effects on the aggregate economy, and has had little impact on distribution of income. Polling data show that the majority of the public supports the carbon tax.

[Unbundling Water Rights in the Western United States](#)



This Nicholas Institute report lays out a blueprint for transitioning to robust water rights, allocation, and management systems in the western United States—using Nevada's Diamond Valley and Humboldt Basin as test cases. If implemented, the blueprint's reforms would convert prior appropriation water rights into systems that keep water withdrawals within sustainable limits, allow rapid adjustment to changing water supply conditions, generate diverse income streams, and improve environmental outcomes.

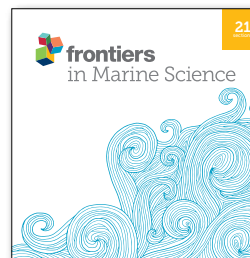
[Mass-Based Trading under the Clean Power Plan: Options for Allowance Allocation](#)

Many states are considering mass-based allowance trading programs to meet federal Clean Power Plan (CPP) requirements. Under a mass-based trading approach, states work with a certain number of allowances, or an allowance "budget," that matches the total emissions limit for each year of the program. States have many options for distributing the allowances that power plants will need to cover their carbon dioxide emissions. This Nicholas Institute working paper describes the choices and their effects as well as explores potential goals and the allowance allocation methods best suited to achieve them.

[Decline of Greenhouse Emissions in RGGI States](#)

The Regional Greenhouse Gas Initiative (RGGI) is a consortium of northeastern U.S. states that since 2009 has sought to limit carbon dioxide emissions from electricity generation through a regional emissions trading program. This *Energy Economics* analysis uses econometric models to quantify the emissions reductions due to RGGI and those due to other factors such as the recession, complementary environmental programs, and lowered natural gas prices. It shows that without RGGI, emissions would have been 24 percent higher. It also finds that the program accounts for about half of the region's post-2009 emissions reductions, which are far greater than those achieved in the rest of the United States.

[Impacts to Coral Reefs Underestimated](#)



Ocean acidification, climate change, and other environmental stressors threaten coral reef ecosystems and the people who depend on them. This *Frontiers in Marine Science*

analysis suggests that interaction of these multiple stressors might affect a multitude of physiological and ecological processes, hastening negative coral reef impacts and increasing their severity. The implications are, one, coral reef ecosystems may start to die or change much sooner than anticipated and two, coral reefs that are damaged, whether by storms, bleaching, or human-created actions, can't rebound as they once could. The authors call for a regionally targeted strategy of mesocosm-level research that addresses this complex interaction of stressors and that provides more realistic projections of coral reef impacts in the face of global environmental change.

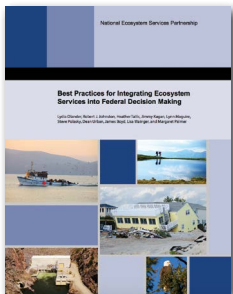
[Understanding the Clean Power Plan's Proposed Federal Plan and Model Rules](#)

The Clean Power Plan requires each state to develop a plan to comply with carbon dioxide emissions standards for certain existing power plants. If a state fails to submit an adequate plan, the Clean Air Act authorizes the U.S. Environmental Protection Agency to develop and implement a federal plan for the state. In 2015, the EPA proposed mass- and rate-based

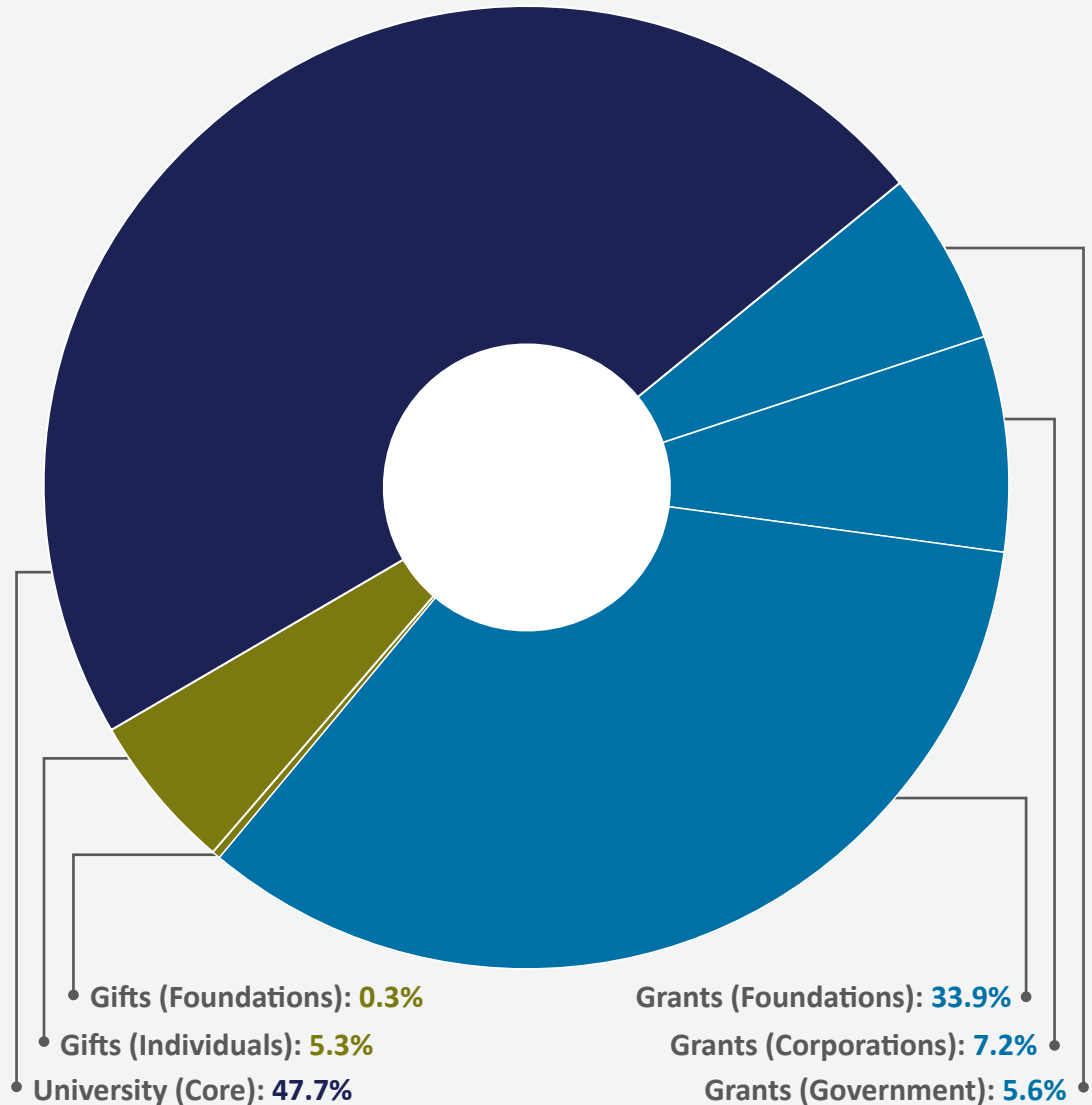
FISCAL YEAR 2016 Operating Funds

versions of a federal plan as well as more flexible mass- and rate-based model rules, which states could choose to adopt or to adapt by substituting their own provisions subject to EPA approval. This article in the *Environmental Law Reporter* summarizes the final Clean Power Plan rule, describes the mass- and rate-based proposed federal plans, identifies areas in which the model rules differ, highlights key issues for states and other stakeholders as they evaluate the tradeoffs between plan pathways, and discusses the EPA's timeline for finalizing the federal plan and model rules.

Best Practices for Integrating Ecosystem Services into Federal Decision Making



This Nicholas Institute report describes the minimum best practice for ecosystem services assessments. The authors describe this practice as the use of measures that stop short of a resource-intensive formal assessment of people's preferences but that are carefully constructed to reflect a given ecosystem's capacity to provide benefits to society. Use of benefit-relevant indicators ensures that ecosystem services assessments provide measures of outcomes that are demonstrably relevant to human welfare. This minimum best practice is broadly achievable across agencies and decision contexts with current capacity and resources.



At the Nicholas Institute's tenth anniversary forum, advisory board chair and former World Wildlife Fund president William K. Reilly interviewed board member Carter Roberts, current WWF president and CEO. This is an excerpt from their conversation about leadership of the environmental movement.

Reilly ▶ I looked recently at the Millennium Development Goals, which have been remarkably successful, but I don't have the impression that the conservation objectives did so well.

Roberts ▶ There were eight goals, and you're right that they galvanized the world's attention and made great progress, except for number seven, achieve environmental sustainability, which was unlike almost all the other ones in that it was poorly defined and didn't have great metrics. I am pleased to say on September 25, 2015, the nations of the world came together and committed to a new version of those, the Sustainable Development Goals. There are now 17 goals, and when you look at them as a set, you see the environment embedded in at least half. It is remarkable how much the world now recognizes the importance of the environment to human health. I predict that these goals will drive a lot of change in the world.

Reilly ▶ What are the implications of emerging issues and new strategies for the way you make decisions about which areas deserve priority protection?

Roberts ▶ Ten years ago, our strategy was to conserve the 19 most important places on Earth by whatever means. Now the question is, can we get to scale fast enough to make a difference? So we set six big goals and started talking about what institutions are most important to achieve those goals, and we reoriented ourselves to think about how we influence those institutions and the systems in the world that they either drive or influence. It relies on our staff thinking very much about larger systems.

Reilly ▶ For the students who are here: What are you hiring for? What do you look for when you think about strengthening your staff?

Roberts ▶ The great things that happen in our field come from people who can connect the dots between government policy, private sector levers, the financial markets, science, and civil society. People who understand and know how to serve the intersections—that is where the good stuff happens. In your studies, if you can, take courses in other schools. Interdisciplinary studies here at Duke are superb. Learn how to connect the dots



MICHAEL WOJCIK

in a Time



Leadership of Rapid Change

between disciplines, and do that in your career as well.

Reilly ▶ Ten years ago we conducted a poll before starting up the Nicholas Institute that revealed that the public saw the environment as a “solved problem” and additional environmental initiatives as likely to cost jobs. Today we see tremendous support in the polls for recognizing that the climate is changing and humans are contributing to it, but very little consequential action in terms of votes. How do we get at the “country at large?”

Roberts ▶ Among our population, the awareness, the appreciation, the understanding, and commitment is moving, but how do you change the politics in our country? We need to change the narrative in a big way, and I am convinced it will happen. There is no question that it helps change the narrative when the chairman of Cargill says we should be very afraid about how we are going to grow crops to feed the world with a changing climate. And it begins to change the narrative when the Department of Defense starts talking about the importance of a stable climate ensuring security in the world.



Watch video of this interview and other sessions from the anniversary forum:
<http://ow.ly/U3y9c>

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