

Nicholas Institute

for Environmental Policy Solutions

Duke University



2013
Annual
Report

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About

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. 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.

Director's Message

Every year dozens of public and private entities contact the Nicholas Institute for Environmental Policy Solutions for help. These requests reflect our capacity to respond in a timely fashion with in-depth, fact-based analysis, often well ahead of our peers. But they also owe to four diligently pursued strategies.

Honing policy fluency through interdisciplinary engagements: Our research has demonstrated the value of bringing close-to-the-ground decision makers into dialogue with one another in a data-rich environment to grapple with policy challenges. That logic underpins ongoing projects with utility regulators, public land managers, and climate policy stakeholders.

Engaging in cutting-edge modeling: In FY 2013, our modeling played a key role in comparing the economics of climate and energy policy scenarios. It also yielded user-friendly tools for risk assessment of investment options by utilities and their regulators.



Taking innovative approaches to financing solutions for environmental problems: In FY 2013, we examined a range of ways to mobilize capital in smarter ways. Among other strategies, this work examined the risk-mitigating potential of green infrastructure for municipal water systems.

Offering a safe and neutral environment for stakeholders to discuss complex policy topics without a pre-determined outcome or advocacy position: As a convener, in FY 2013, we helped harmonize stakeholders' work on managing ecosystem services and on using the Clean Air Act to accelerate innovative technologies to meet air, climate, and energy goals.

These strategies define us as an organization and continue to advance our mission to serve society.

—Tim Profeta

Water Policy Program

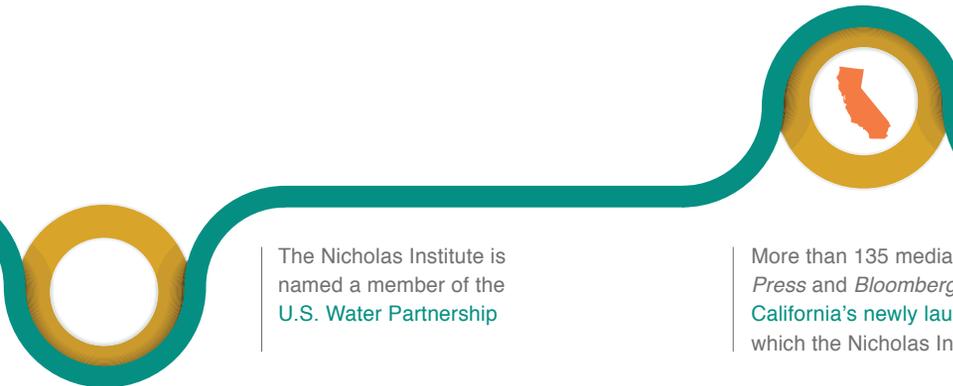
The Water Policy Program focuses on the long-term viability of water quantity and quality, both with regard to humans' basic water needs and water infrastructure. Program projects address adaptive water management in the face of climate change, opportunities and threats that emerging technologies pose for water supplies, and the intersection of federal and state governments in water resource management.

Martin Doyle was appointed the program's new director in FY 2013. He divides his time equally between this role and his current position as professor of river science and policy at Duke's Nicholas School of the Environment.

The program has made significant contributions to water resource management decisions in parts of the world severely threatened by climate change in the absence of strong governance: southeast Asia and sub-Saharan

Africa. Through a joint project with the Sanford School of Public Policy and the Nicholas School of the Environment, Nicholas Institute researchers traveled to Ethiopia's Rift Valley in FY 2013 for a study on water quality. Through household surveys and sample collection, researchers assessed the impacts of long-term exposure to contaminants such as fluoride in residents' drinking water. The work is intended to feed Duke faculty research assessing the health effects of climate change on water quality and availability.

Building on this track record of precisely focused, highly leveraged engagement, the program will now shift its attention to domestic challenges, such as managing water for ecological considerations and understanding the implications of shale gas extraction for water resources.



The Nicholas Institute is named a member of the [U.S. Water Partnership](#)

More than 135 media outlets, including the *Associated Press* and *Bloomberg*, feature staff discussing [California's newly launched cap-and-trade program](#), to which the Nicholas Institute provided design input

Environmental Economics Program

The Environmental Economics Program

employs sophisticated models and rigorous analytics to advance incentive-based solutions to environmental problems. Signature projects support the crafting of market-oriented policies to reduce tropical deforestation and the loss of coastal and marine ecosystems, to assess the effects of renewable energy subsidies, and to explore pricing mechanisms for guiding the stewardship of natural resources.

In FY 2013, the program focused on developing and applying its suite of models to examine the environmental and economic consequences of energy and climate policies. Program staff investigated the impacts of the U.S. renewable fuel standard and biofuel policy designs on global greenhouse gas emissions resulting from land use and agriculture. The work looked out to 2030, revealing that a renewable fuel standard

would substantially increase the portion of agricultural land needed for biofuel feedstock production—leading to a decrease in U.S. agricultural exports and an increase in greenhouse gas emissions and nitrogen use globally.

The program also debuted its newest model, developed by senior research economist Martin Ross. The Dynamic Integrated Economy/Energy/Emissions Model links a general equilibrium model of the global economy to a detailed representation of the U.S. energy system, allowing for evaluation of the impacts of economic and environmental policies at regional, national, and global scales. The model is currently being used to investigate impacts of Clean Air Act section 111(d) regulations on existing fossil fuel-fired electricity generators.



The Nicholas Institute establishes the [Duke Environmental Doctoral Scholars Program](#)



As a member of a National Research Council Committee of the National Academy of Sciences, Environmental Economics Program director Brian Murray co-authors a report on the [U.S. tax code and greenhouse gas emissions](#)

Climate and Energy Program

The Climate and Energy Program focuses on meeting the energy needs of a growing global population while protecting the environment, particularly from the threat of global climate change. The program's projects use interdisciplinary resources to weigh tradeoffs, illuminate associated trends, and assess how policies can work together to advance optimal solutions.

Much of the program's work in FY 2013 focused on the Clean Air Act and state utilities.

The program stepped up its analysis of cost-effective options for regulating greenhouse gas emissions under the Clean Air Act, a priority in the Obama administration's Climate Action Plan. Research focused on key economic and legal questions surrounding the design of forthcoming regulations and considered comprehensive strategies for deploying innovative energy technologies through

combinations of regulatory mandates, standards, tax policy, and government funding that may shape long-term policy.

In partnership with the Nicholas School of the Environment, the Nicholas Institute helped state policy makers develop strategies to ensure an affordable and reliable electricity sector while reducing emissions of carbon dioxide and other air pollutants. The team trained electric utility regulators to use modeling tools for infrastructure planning during periods of regulatory and economic uncertainty. Staff also launched a series of workshops in North Carolina to explore the overlap of utility commission decision making and environmental regulation and released research analyzing the state's role in energy innovation.



Tim Profeta is featured as an expert in the [Rational Middle Energy Series documentaries](#), which look at how energy is produced throughout the world



The Nicholas Institute co-presents the program for the [2013 Navigating the American Carbon World Conference](#), North America's largest carbon event, with Climate Action Reserve

Ecosystem Services Program

The Ecosystem Services Program ensures that the environment can sustain future generations by helping public and private decision makers value the benefits and processes natural ecosystems supply for humankind's well-being and prosperity. The program provides information and assessment frameworks that support the development of public and private policies, economic incentives, and environmental markets to maintain and enhance ecosystem services—such as the purification of air and regeneration of soil fertility—that maintain life on Earth.

In FY 2013, the program undertook projects related to agricultural carbon offsets, reducing emissions from deforestation and degradation (REDD), blue carbon, endangered species mitigation, and water quality trading. It began work on the Federal Resource Management and Ecosystem Services (FRMES) project under the auspices of the National Ecosystem Services

Partnership (NESP), a Nicholas Institute initiative. In partnership with federal agencies, NESP began developing an online guidebook that will describe how ecosystem services can be integrated into agencies' planning and management processes. The guidebook is slated for completion in late 2014.

The program also advanced efforts of the Technical Working Group on Agricultural Greenhouse Gases (T-AGG), which synthesizes and translates scientific knowledge to support agriculture as a climate change mitigation option in the United States and abroad. In FY 2013, T-AGG worked with researchers in California to assess the potential for greenhouse gas (GHG) reductions in the agricultural sector to contribute to the state's GHG reduction targets. This effort builds on T-AGG's comprehensive synthesis of scientific understanding regarding GHG mitigation potential in the agricultural sector.



Lydia Olander serves as guest editor of a special issue of *Environmental Research Letters*



The Nicholas Institute is named one of the top 10 climate change economics and policy focused think tanks by the *International Center for Climate Governance*

Blue Carbon

Protecting and Enhancing Coastal Marine Ecosystems

Destruction of coastal habitats could result in an annual carbon dioxide release of

1 billion tons

Preserving and restoring coastal habitats, such as mangroves, salt marshes, and sea-grasses, could help curb climate change. When these habitats are drained and destroyed, their stored carbon—or so-called blue carbon—is released as carbon dioxide. Since 2010, the Nicholas Institute has been examining whether payments for blue carbon or simply managing coastal habitats for blue carbon might promote the habitats' conservation.

The Nicholas Institute brought international attention to blue carbon with *State of the Science on Coastal Blue Carbon: A Summary for Policy Makers*, a paper showing that a large body of scientific information clearly demonstrated the carbon potential of coastal ecosystems, allaying the fears of many influential policy makers unwilling to commit to blue carbon efforts in the absence of reliable science. Our transformative finding: the economic value of carbon storage and other ecosystem services in coastal habitats often is greater than the value of activities that degrade them. But getting communities to

protect these resources has been a challenge. A second paper, *Green Payments for Blue Carbon*, demonstrated that payments for the carbon stored in coastal ecosystems could provide an incentive for landowners and governments to protect these areas. Like payments to reduce emissions from deforestation and degradation (REDD+), incentives to retain rather than emit blue carbon could preserve biodiversity and other ecosystem services as well as reduce greenhouse gas emissions.

A third publication proved pivotal in putting blue carbon on the map. *Estimating Global "Blue Carbon" Emissions from Conversion and Degradation of Vegetated Coastal Ecosystems*, written by a team led by Ocean and Coastal Policy Program director Linwood Pendleton and published in the journal *PLOS ONE*, found that destruction of coastal habitats could result in an annual carbon dioxide release of as much as 1 billion tons—an amount 10 times higher than previously reported.

“On the high end of our estimates, emissions were almost as much as the carbon dioxide emissions produced by the world’s fifth-largest emitter, Japan,” said Brian Murray, director for economic analysis at the Nicholas Institute and co-author of the *PLOS ONE* study. “This means we have previously ignored a source of greenhouse gas emissions that could rival the emissions of many developed nations.”

The *PLOS ONE* paper helped blue carbon gain recognition in the Intergovernmental Panel on Climate Change’s Fifth Assessment Report review process. It and the other Nicholas Institute reports on the topic have been delivered to policy-making audiences from the international to the state and regional level. Murray has used them in domestic and international trainings with USAID and the Conservation Strategy Fund.

The Nicholas Institute’s blue carbon work is slated to continue through a proposed four-year, \$4 million Global Environmental Facility Blue Forests Project, which will assess the market and policy implications of blue carbon in sites around the world.

“This project builds on our findings that maintaining blue carbon stores not only helps meet national emissions reduction goals but also can help pay for coastal management,” said Pendleton.

Nicholas Institute staff will guide the project’s Science and Technical Advisory Panel and develop tool kits on carbon science methods, carbon accounting, and ecosystem services assessments in coastal habitats.



Brian Murray talks with Reuters about blue carbon
<http://reut.rs/OpazZM>



Ocean and Coastal Policy Program

The Ocean and Coastal Policy Program

seeks ways to better manage marine resources, particularly the ecosystem services they provide, for the benefit of humankind.

Program projects operate in the space between science and policy and facilitate the appropriate science to guide management decisions about the ocean.

In FY 2013, the program focused on complex emerging issues in ocean management, including new science and policy to deal with ocean acidification, strategies for managing deep sea industrialization, and policies for harnessing the carbon-storing capacities of coastal habitats. Using webinars, listservs, and international and regional meetings, the program brought together more than 500 marine ecosystem stakeholders, policy

makers, researchers, economists, and environmental managers with the Marine Ecosystem Services Partnership. On its website (www.marineecosystemserves.org), this community of practice grew its repository of marine and coastal valuation studies to more than 800 and its estimates for marine ecosystem services to 2,000.

The program also provided high-level policy advice to ocean planners. Program staff served in residence as advisor to the French Marine Protected Areas Agency and also worked with the United Kingdom's Plymouth Marine Lab to facilitate the VALMER project. VALMER will explore methods to quantify and communicate the value of marine and coastal ecosystem services, with a focus on the Western Channel and waters of southwest England.



The *Chicago Tribune*, *Washington Post*, and other major media outlets pick up results of “surfonomics” research quantifying a wave’s economic value



Amy Pickle is appointed to the North Carolina Mining and Energy Commission, where she develops regulations governing hydraulic fracturing (“fracking”) of **underground shale reserves**

State Policy Program

The State Policy Program works with local, state, and regional decision makers to design policies and practices to protect valuable resources and build environmentally and economically sustainable communities. The program tracks political, economic, and social forces shaping environmental issues and builds on existing legal and regulatory frameworks to design and implement innovative policy solutions in the areas of urban sustainability, water resources, energy, and adaptation to climate change.

In January 2013, Amy Pickle was appointed program director. Formerly the Nicholas Institute's senior attorney for state policy, Pickle has assisted the North Carolina General Assembly in grappling with water allocation and impaired drinking water reservoirs, and

she has helped local decision makers interested in protecting important natural resources wrestle with new regulations. She replaces Bill Holman, who served as director of the program for six years.

Under Pickle's leadership, the program began developing accounting approaches to make the value of green infrastructure easily understood by multiple stakeholders. With the guidance of water utility professionals, representatives of the Governmental Accounting Standards Board, and accounting professionals on advisory groups, the program designed two accounting frameworks to fit within the "required supplementary information" in a financial report. Three partner utilities began pilot testing the frameworks.



Linwood Pendleton and Amy Pickle cover the economic and human health importance of stormwater regulation in an Amicus brief for the U.S. Supreme Court case *NRDC v. Los Angeles County*



Linwood Pendleton ends a stint as NOAA's acting chief economist, having advanced efforts to create an oceans account for the GDP, improve estimates of the economic impacts of severe weather, and incorporate ecosystem services in management and conservation decisions

Selected Publications

Reports

Clean Air and Technology Innovation: Working Concepts for Promoting Clean Air Technology Innovation Under the Clean Air Act

A Spatial-Economic Optimization of Swine-Waste Derived Biogas Infrastructure Design in North Carolina

Customer-Side Clean Energy in the Southeast: Opportunities for Combined Heat and Power, Solar Water Heating

Regulating Carbon Dioxide under Section 111(d) of the Clean Air Act: Options, Limits, and Impacts

Effects of U.S. Tax Policy on Greenhouse Gas Emissions

Climate Change, Foreign Assistance, and Development: What Future for Ethiopia?

Energy Efficiency and Greenhouse Gas Limits for Existing Power Plants: Learning from EPA Precedent

An Economic Evaluation of North Carolina's Biogas Development Potential

Incorporating Blue Carbon as a Mitigation Action under the United Nations Framework Convention on Climate Change: Technical Issues to Address

Forum Summary: Socioeconomic Considerations and Human Dimensions of Fishery Management

Journal Articles

Alternative U.S. Biofuel Mandates and Global GHG Emissions: The Role of Land Use Change, Crop Management, and Yield Growth
Energy Policy

Measuring the Effects of Stormwater Mitigation on Beach Attendance
Marine Pollution Bulletin

Operationalizing REDD+: Scope of Reduced Emissions from Deforestation and Forest Degradation
Current Opinion in Environmental Sustainability

Estimating Global "Blue Carbon" Emissions from Conversion and Degradation of Vegetated Coastal Ecosystems
PLOS ONE

Carbon Markets 15 Years after Kyoto: Lessons Learned, New Challenges
Journal of Economic Perspectives

Implications of Alternative Agricultural Productivity Growth Assumptions on Land Management, Greenhouse Gas Emissions, and Mitigation Potential
The American Journal of Agricultural Economics

Reducing the Average Cost of CO₂ Capture by Shutting Down the Capture Plant at Times of High Electricity Prices
International Journal of Greenhouse Gas Control

Sustainability and Earth Resources: Life Cycle Assessment Modeling
Business Strategy and the Environment

Working Papers

Deploying Low-Carbon Technologies Series: The State Role in Technology Innovation

Benefits of Early State Action in Environmental Regulation of Electric Utilities: North Carolina's Clean Smokestacks Act

Biogenic Carbon Accounting: Considerations to a Revised Framework

Policy Briefs

Americans Think the Climate Is Changing and Support Some Actions

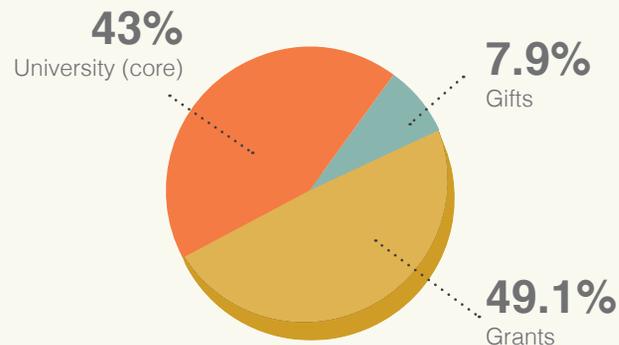
Greenhouse Gas Mitigation Opportunities for Livestock Management in the United States

Coastal Blue Carbon and the United Nations Framework Convention on Climate Change: Current Status and Future Directions



<http://nicholasinstitute.duke.edu/publications>

Fiscal Year 2013 Operating Funds



Of the 7.9% allotted in gifts, 5% was attributable to individuals, 0.1% to corporations, and 2.8% to foundations.

Grant funding came from three sources: foundations (26.2%), corporations (11.4%), and governments (11.4%).

Nicholas Institute Leadership



Tim Profeta
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Nicholas Institute



Larry Shirley
Director
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Emerson Beyer
Associate Director
Corporate and Foundation Relations



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Sustainability Forum



Jonas Monast
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Climate and Energy Program



Brian Murray
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Lydia Olander
Director
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Linwood Pendleton
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Amy Pickle
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President and CEO
The Nature Conservancy

Douglas Wheeler

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Hogan Lovells US LLP

Q&A with Douglas Wheeler

In FY 2013, the Nicholas Institute appointed two new members to its Board of Advisors: William Rosenberg, president of E3 Gasification LLC, and Douglas Wheeler, an environmental lawyer focused on federal regulatory issues. Wheeler recently discussed his work in the environmental space with the Nicholas Institute.

What attracted you to the Nicholas Institute Board of Advisors?

I'll admit to a bias in favor of Duke University (Law '66) and to admiration for the policy leadership of Tim Profeta and his staff. The Nicholas Institute's people and projects exemplify essential elements of innovation. And I cannot help but respect the diverse skills of fellow board members, who provide thoughtful guidance for the institute from the perspective of long experience in related fields, public and private.

What does it take to implement innovative solutions to environmental problems?

Creativity, sound science, the courage of one's convictions, and persistence. Pushing the envelope of conventional wisdom, even in the face of apparently inflexible laws or policies, is important.

If you had to name one environmental issue that people should pay attention to, what would it be and why?

I've thought from the very beginning of my career that the absence of effective land use planning is the root cause of most environmental problems. As we now confront the very real prospect of sea level rise, we should not attempt to armor the seashore, but instead should plan to rely on the buffering effect of resilient, dynamic ecosystems.



<http://nicholasinstitute.duke.edu/content/douglas-wheeler>



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