

An aerial photograph of a vast forest during sunset. The sun is low on the horizon, casting a warm, golden glow over the landscape. The trees in the foreground are dark green, while those further away are bathed in the orange and yellow light of the setting sun. The sky is a mix of blue, orange, and yellow.

Duke University

Nicholas Institute for
Environmental Policy Solutions

Annual Report 2021

New Horizons

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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 five programs, the Nicholas Institute mobilizes objective, rigorous research to confront the climate crisis, clarify the economics of limiting carbon pollution, harness emerging environmental markets, put the value of nature's benefits on the balance sheet, develop adaptive water management approaches, and identify other strategies to attain community resilience.

Joining Together for Greater Climate Impact

Since its founding in 2005, Duke University's Nicholas Institute for Environmental Policy Solutions has proven to be something unique in the academic world.

The Nicholas Institute builds bridges that connect Duke's scholarly research with policy makers to identify innovative solutions to critical environmental and energy challenges. As you'll read in the pages that follow, that vital work was as strong as ever over the last year, despite the challenges of a worldwide pandemic.

When the calendar changed to Duke's next fiscal year, something new appeared on the horizon as well.

On July 1, the Nicholas Institute began the process of merging with the Duke University Energy Initiative. The move is part of a university-wide effort to bolster Duke's already substantial commitment to advancing solutions for climate change and its impacts. Our two organizations share a similar focus and a commitment to interdisciplinarity, and we have a long history of collaboration. The merger will leverage our complementary strengths and expansive networks to bring even more value to our respective stakeholders, both within the university and beyond.

Those strengths are considerable. The Nicholas Institute's core team—policy experts, economists, scientists, and attorneys—develops non-partisan research and analysis to inform decision making and convenes officials at all levels for dialogue around environmental issues. The Energy Initiative has developed a sizable interdisciplinary energy community at Duke and built programs to strengthen the university's energy education, research, and engagement efforts. The merger deepens these ties across Duke, forming a stronger foundation for our work with external parties and amplifying our impact.

Our new organization will continue to take shape over the coming months with a variety of voices providing input. Through it all, research, education, and policy engagement will remain at the heart of what we do.

Some changes are already underway. By now, you've noticed that the face accompanying this director's message is not the one that you've become accustomed to seeing in previous annual reports. Some of you may know me from more than a decade directing the Nicholas Institute's Environmental Economics Program before going on to lead the Energy Initiative. I am excited to now serve as interim director of the newly merged institute and to work with university leaders to broaden its impact.

Before looking further ahead, I want to take a moment to acknowledge the tremendous contributions of Tim Profeta, the Nicholas Institute's founding director. Tim is taking a year of academic leave from Duke to work with the U.S. Environmental Protection Agency on advancing policies to meet the country's climate change ambitions. His direction of the Nicholas Institute has been instrumental in positioning Duke as a thought and action leader among universities on climate change.

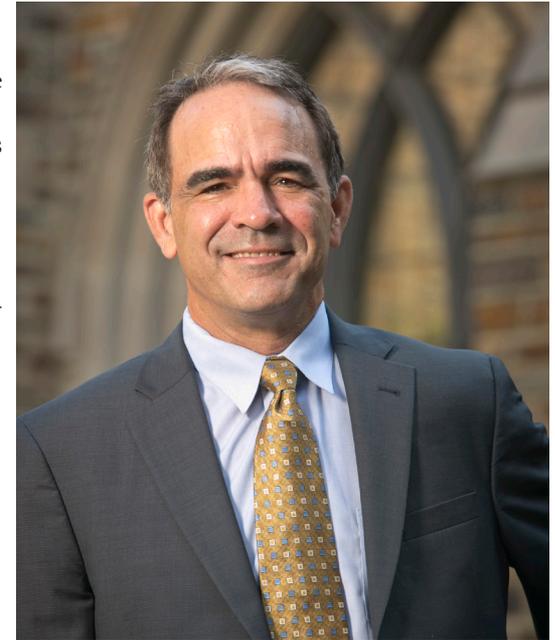
As the merger process unfolds, we will continue to deliver the high-quality work expected of the Nicholas Institute and the Energy Initiative, pursuing new projects within our expanded domains of expertise. Moving forward, we will especially focus on opportunities to forge Duke's climate-related expertise in areas such as energy transformation, natural systems resilience, data-driven discovery and solutions, and energy and environmental justice.

We welcome your input and support throughout this transition. Please reach out to share your ideas for the new institute or to discuss potential partnerships on research, engagement, and educational endeavors.

With gratitude,

– Dr. Brian Murray

Interim Director, Nicholas Institute for Environmental Policy Solutions and Duke University Energy Initiative



Climate 21 Project Creates Blueprint for “Whole-of-Government Approach” to Climate Change

by Jeremy Ashton

Over the last year, the phrase “whole-of-government approach” has become a more common part of the lexicon in Washington policy circles.

Perhaps no problem requires a whole-of-government approach more than climate change. Every part of society and the economy will be touched by it in some way. Consequently, it will affect—and be affected by—every government action.

“Not only does a whole-of-government approach offer a comprehensive way to ensure that all levers are moving toward a climate solution, it’s necessary that it does,” said Tim Profeta, founding director of Duke University’s Nicholas Institute for Environmental Policy Solutions. “For example, you don’t want the financial regulatory strategy at the SEC to be running contrary to where the government is trying to push the energy transition in other sectors.”

On the campaign trail in 2020, then-Democratic presidential candidate Joe Biden pledged to move quickly to step up the United States’ efforts in the fight against climate change. Four days after national media called the presidential race for Biden in November, a project facilitated by the Nicholas Institute released a blueprint for the incoming administration to take urgent and meaningful action across the federal government starting on Day One.

Bending the learning curve for a new administration

The [Climate 21 Project](#) began with a conversation between Profeta and Jeremy Symons, principal at Symons Public Affairs, more than two years ahead of Election Day and well before the presidential field fully formed.

At the time, progress to address climate change had stalled at the federal level or was being reversed by the Trump Administration. However, the impacts of the climate crisis—drought, wildfires, flooding, extreme weather events—are manifesting themselves more and more each day, while the greenhouse gas emissions fueling them continue unabated.

The 2020 election potentially presented an opportunity for a new president to reassert U.S. leadership on climate, both at home and abroad. As Profeta explained, though, every incoming administration faces a learning curve on how to use the tools of government effectively to implement its preferred policies. He and Symons saw that as a hurdle that could be overcome.

“We wanted to bring together the pre-existing knowledge of the federal executive and how it could act expeditiously on climate and put it down on paper so that a new administration could act quickly and decisively with a whole-of-government approach,” Profeta said.

“The thing that really distinguished this was the focused work and planning and resources that began two years out from the election,” Symons added. “People always want to be prepared, but seldom do they take the time that far in advance.”

The process of gathering that knowledge began with recruiting Christy Goldfuss, senior vice president for energy and environment policy at the Center for American Progress, to be the project’s co-chair. Goldfuss brought considerable experience working with various parts of the federal government. Under President Barack Obama, she served first as deputy director of the National Park Service and later as managing director of the White House Council on Environmental Quality (CEQ), helping to develop and implement the administration’s environmental and energy policies.

With Goldfuss on board, the trio began approaching former government officials to join a [steering committee](#). They were met with an enthusiastic response from a group of individuals often short on spare time.

“People wanted to carve out space to imagine a better path forward,” Symons said. “It was not only important work, but it was also a liberating experience to think about what could be instead of dealing with the day-to-day of what was in front of us at the time.”

In the end, the *Climate 21 Project* drew on the expertise of more than 150 people with high-level experience inside the government, including nine former cabinet appointees.

A true whole-of-government approach

In an introductory letter to the Biden transition team, Profeta and Goldfuss wrote that the *Climate 21 Project* did not offer a specific policy agenda. Instead, the project’s recommendations focused on how a newly elected president could use existing federal authorities—with or without congressional action—to build an incoming administration’s capacity for quickly tackling the climate crisis.

The project ultimately delivered a series of memos to the transition team with recommendations for 11 White House offices, federal departments, and federal agencies, as well as government-wide recommendations on personnel and hiring. (A final memo on potential actions by the Department of Defense was published shortly after the inauguration.)

The memos covered departments and agencies most associated with federal action on climate change, such as the [Environmental Protection Agency](#), the [Department of the Interior](#), the [Department of Energy](#), and the [National Oceanic and Atmospheric Administration](#).

The project, however, also dove into parts of the federal government not typically thought of as being at the vanguard of climate policy (while noting that critical work will be required of others that were not studied). It included memos for agencies as far flung as the [Department of the Treasury](#), the [Department of Agriculture](#), the [Department of Transportation](#), and the [Department of Defense](#).

“So many of our government’s basic functions have deep implications for carbon emissions and climate change,” said Kate Konschnik, author of a *Climate 21* memo on the [Department of Justice](#) and director of the Nicholas Institute’s Climate and Energy Program, shortly after the memos were released. “By engaging career staff across the government in the climate project, an administration can activate a whole host of policies, investments, and information resources to achieve each agency’s primary missions while also driving deeper carbon reductions, promoting carbon sequestration, and supporting communities to become more resilient.”

People, not paper

Profeta was quick to note that the *Climate 21* memos were one of many positive contributions made to the transition—“They weren’t the Gospel,” he said—and they supplemented the incoming administration’s own

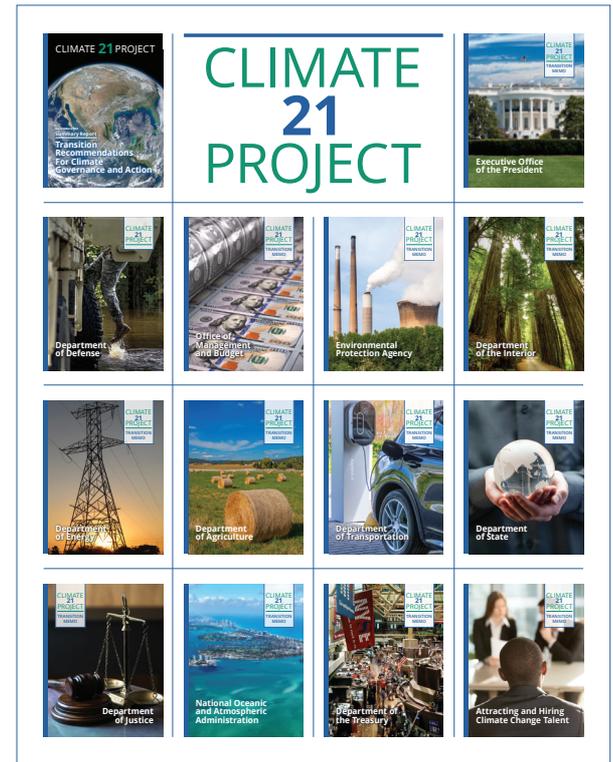
thought processes and strategies. The feedback from the transition team was that the memos were useful and pragmatic.

“Because they were steeped in knowledge from experienced hands, they tended to give advice that was more executable and realistic for the administration to be able to do,” he said.

As Biden rolled out his climate agenda during the transition and his first 100 days in office, some of *Climate 21*’s recommendations came to the surface.

In the words of the [Executive Office of the President](#) memo, the “single most important thing” for the new administration to do was create a centralized White House office to coordinate domestic and international efforts on climate change. The memo called for that office to be helmed by “a credible leader on climate policy” with direct access to the president. Biden filled that role in December by appointing former EPA Administrator Gina McCarthy as the nation’s first national climate advisor to lead the new White House Climate Policy Office.

During his first week in office, Biden issued an executive order laying the groundwork for his climate plans that included *Climate 21* recommendations. The National Climate Task Force, chaired by McCarthy, brings together the leaders of 21 federal agencies and departments to work together toward common goals. Biden also placed a focus on environmental justice through creation of the White House Environmental Justice Interagency Council.



Examples abound at the individual agency and department level, too. NOAA and the Department of the Defense are among the agencies that have created high-level, internal teams focused on climate responsibilities. The EPA has initiated rulemaking under the Clean Air Act for vehicles and methane emissions from the oil and gas sector. And the Securities and Exchange Commission is moving forward with its own rulemaking to improve disclosure of climate risks by corporations.

While these and other *Climate 21* recommendations have been implemented, the legacy of the project may be more about the people involved. More than half the project's steering committee and several of the memo authors took positions on the transition team or in the new administration. That list includes Brenda Mallory, chair of CEQ; Joseph Goffman, acting assistant administrator for EPA's Office of Air and Radiation; and now-former Nicholas Institute executive in residence Robert Bonnie, who is awaiting Senate confirmation as USDA's undersecretary for farm production and conservation.

"Our theory of change focused on people not paper," said Symons. "So many people who contributed to the project ended up being engaged with the transition or the new administration in some form. That certainly helped compared to a report that sits in a pile on a desk."

Work on this project was funded by the Hewlett Foundation, the Heising-Simons Foundation, and the Linden Trust for Conservation.



Decarbonizing the North Carolina Power Sector

by Jason Gray

Following North Carolina Governor Cooper's climate change executive order, Executive Order 80, the state's environmental agency published a Clean Energy Plan (CEP) that set emission reduction targets for the power sector at 70 percent of 2005 emissions levels by 2030 and carbon neutrality by 2050. Recommendation A1 of the CEP called for a stakeholder process to evaluate policies designed to meet these targets, considering affordability, reliability, and equity. The Nicholas Institute and the University of North Carolina's Center for Climate, Energy, Environment, and Economics conducted the year-long study.

Speaking on The Squeaky Clean Energy Podcast, Kate Konschnik, Director of the Climate & Energy Program at the Nicholas Institute, commented, "Decarbonization of the power sector is a key building block on which you build a decarbonized society." Because of the "cost-competitive technologies in the power sector ready to deploy today ... a lot of decarbonization strategies look to cleaning up the power sector and then relying on that electricity to power more parts of our daily lives."

In March of 2021, the two organizations released their 245-page report reflecting extensive modeling, policy and economic analysis, and stakeholder engagement. This comprehensive report came after two public forums in September 2020 and monthly meetings with working groups consisting of environmental and justice advocates, industrial customers, low-income advocates, renewable energy developers, state agencies, universities, and utilities representatives. A broader community of interested stakeholders met every other month to receive updates and provide input.

The study determined that retiring coal plants and state renewables policies have cut power sector pollution but additional policies are needed to achieve the Clean Energy Plan emissions targets. Fortunately, the cost of generating electricity from renewables has become quite competitive with gas power plants. As a result, even small changes in natural gas prices or renewable costs could have an enormous impact in determining which power plants to build or run. Similarly, modest policy "nudges" could drive significant drops in carbon dioxide and local air pollutants that threaten public health. More expensive policies, such as those requiring the construction of offshore wind,

still drive positive economic development, creating jobs in component manufacturing, supply chains and maritime trades.

The report did not offer specific recommendations. Instead, its options for action and suggested metrics for comparing policies and policy combinations were intended to inform the design of effective, affordable, and equitable means to decarbonize the North Carolina power sector.

The report has had an effect in the wake of its release. One of the policies studied in the analysis—having North Carolina join Regional Greenhouse Gas Initiative (RGGI)—was the subject of a [petition](#) by the Southern Law Environmental Center to write this effort into state law. The petition used modeling from Power Sector Carbon Reduction report to make its case. This past July the petition moved forward when the state’s Environmental Management Commission [voted to approve the petition](#) and start a rulemaking process at the Department of Environmental Quality.

The energy bill ([HB 951](#)) recently passed by the North Carolina General Assembly codifies into law the emission reduction targets set by the Clean Energy Plan. The law also directs the NC Utilities Commission to work with

utilities and other stakeholders to develop a climate plan that will achieve these goals. The authors of the report helped inform members of the General Assembly with their analyses and descriptions of climate policies from other states.

Although there is pushback to the energy bill by some ratepayer advocates given that it allows Duke Energy to institute a multi-year rate plan, lacks language to protect ratepayers, and doesn’t include provisions for a special low-income rate, the bill was still a win for the climate according to Konschnik, because it expanded solar energy in the state and adopted the Clean Energy Plan emission reduction targets directly into law. However, the report’s authors—the Institute’s Kate Konschnik, Martin Ross, Jennifer Weiss, and Gennelle Wilson, and UNC’s Jonas Monast—hope to engage in the process of creating the state climate plan in 2022, to provide the NC Utilities Commission what it needs to forget an ambitious, credible plan that reduces air pollution and ensures affordable electricity rates for low-income ratepayers and trade-exposed industry. One of them, Jen Weiss, will be working on this issue from inside North Carolina government in 2022, as the Department of Transportation’s Senior Climate Advisor.



Nicholas Institute Dives into Making Water Services More Affordable

by Jeremy Ashton

The COVID-19 pandemic has disrupted every part of life across the United States and laid bare long-standing inequities in American society. Water services have been no exception.

During the first few months of the pandemic, states issued utility shut-off moratoria so people who lost their jobs could still get access to clean water, an absolute necessity for public health. Utilities needed federal assistance to make up lost revenue so they could pay their own bills, including debt payments.

The situation exposed an already growing gap in the affordability of basic water services in communities across the country. For utilities, the costs for providing drinking water, wastewater treatment, and stormwater management have steadily grown as a result of a variety of factors over decades. Meanwhile, the customers who rely on—and pay for—those services have seen their incomes largely remain stagnant.

“It’s such a complicated challenge made by hundreds of individual decisions over time to get where we are,” said Lauren Patterson, senior policy associate in the Water Policy Program at Duke University’s Nicholas Institute for Environmental Policy Solutions.

Everyone agrees there is an affordability challenge, but nobody knows the scale or the scope. Over the last year, the Nicholas Institute’s Water Policy Program has dived into exploring the water affordability gap.

Affordability challenges for utilities and their customers

In 2020, the Aspen Institute’s Energy and Environment Program and the Nicholas Institute convened the annual Aspen-Nicholas Water Forum to look at ways to make water services affordable and accessible for everyone while keeping utilities solvent. Over six virtual sessions, participants discussed topics such as long-term water affordability and financial resilience, reflections on the effects of the pandemic, other federally funded assistance programs, and how to advance water priorities in the new Biden-Harris Administration.

The forum offered a chance to reflect on how water affordability challenges have grown in the United States, both for utilities and their individual customers.

As described in the [forum report](#), utilities are facing a series of “compounding problems and challenges” that are outpacing technological and policy innovations. The one that draws the most national attention is the need to replace

aging infrastructure to reduce costs from leaks and maintain high-quality water services. In addition, climate change is increasing the costs of providing water services—utilities in the drought-stricken West spend more to procure water supply, while other utilities are dealing with the problems created by more frequent intense precipitation. Another driver of costs is the expense of treating polluted water to safe standards, particularly as we become more aware of emergent contaminants and their potential health implications.

As costs have risen, federal investment in water infrastructure has declined. In 1977, the federal government paid for 63 percent of capital expenditures; today, local governments account for 90 percent of those costs. The shift to utilities relying more on local customers has meant that as the costs of service rises, so do rates, with rates increasing faster than inflation over the past two decades. With up to \$1 trillion in new water infrastructure needed in the next 25 years, the burden on local ratepayers will only increase if business as usual continues.

The increased reliance of local utilities on local rate payers means the financial health of each utility is tied to the financial health of its community. The racial segregation of neighborhoods in the 20th century led to municipalities excluding communities of color from water and sewer services, leaving many underserved to this day. It also created suburban, wealthy utilities, while poor, inner-city utilities lose important sources of revenue, placing an increased burden on the remaining, often low-income, customers. Many of these inequities are baked into the water system and create affordability challenges that vary across and within a utility. For example, most rate structures are designed to charge the same amount for water regardless of the ability to pay, disproportionately affecting lower-income households.

“No matter how much your income is, if you use 6,000 gallons of water, you’re going to pay the same bill because we’ve valued equal payment as being fair vs. equitable payment—where a household pays up to a certain percent of income for basic water use,” Patterson said.

Shrinking cities, growing bills

Affordability challenges are particularly acute in communities that have experienced significant population declines in recent decades.

These “shrinking cities” are most prevalent in the “Rust Belt” of the Northeast and upper Midwest, where economic globalization, particularly in the manu-

facturing sector, has shifted jobs elsewhere. As water-intensive industries have shut down, the water systems built to support them have become oversized, leaving the residents who remain to pick up the financial slack.

In 2020, the Water Policy Program, working with graduate students from the Nicholas School of the Environment, authored a pair of reports on shrinking cities, one focused on [Pennsylvania](#) and the other on [these communities more broadly](#). Both reports describe a “trilemma” for water utilities as they try to balance ensuring affordable rates for their customers, maintaining high service and quality, and sustaining fiscal viability.

“Because their population is declining, the water utility doesn’t have the resources to fully address all three of those prongs, so tradeoffs exist to how well they can address any one of those at a given time,” said Walker Grimshaw, one of five then-students in the Nicholas School’s Master of Environmental Management (MEM) program who co-authored the Pennsylvania report.

The broader report in the *Journal AWWA* says water service providers in shrinking cities will need “innovative and flexible approaches” to address the challenges that they face.

Among the options outlined in the report, water systems could downsize by discontinuing service and connections to abandoned properties and decommissioning unneeded infrastructure, although that often comes with political and financial hurdles. Some water systems have attempted to diversify their revenue streams by using excess capacity to attract new businesses or selling it to a neighboring city or large customer outside the existing service area. Consolidation with other water systems or even privatization can offer the promise of economies of scale, but those options also come with their own challenges.

Understanding the scale of the affordability challenge

Discussions around the Aspen-Nicholas Water Forum also brought to the surface that the scale of water affordability challenges isn’t clear, Patterson said.

“One of the things that makes measuring affordability difficult is that the definition of affordability is values-based,” Patterson said. “For example, household affordability is defined as the ability for a household to pay for basic water services without undue hardship. How much water is enough to meet a household’s needs and what constitutes an undue financial hardship?”

To help provide some clarity, the Water Policy Program launched a [dashboard](#) developed by Patterson and a small team of graduate students. (A [companion website](#) provides additional context and a tutorial for the dashboard.) By the end of this September, the dashboard featured data from nearly 2,350 utilities

in seven states with readily available information on water service area or municipal boundaries.

The dashboard helps users explore four key questions:

- Who lives in the utility’s service boundaries?
- How much do water services cost?
- How affordable are water services given the costs and who lives in the utility?
- How does affordability change with water usage?

Users can gain a deeper understanding of affordability challenges utility by utility through the dashboard’s open, transparent, and repeatable approach that compares several affordability metrics at multiple volumes of water.

One of the striking takeaways from the project is how poverty undermines water affordability for so many households. More than three-quarters of utilities in the first five states added to the dashboard—California, North Carolina, Oregon, Pennsylvania, and Texas—serve communities where more than 20 percent of the population was below 200 percent of the federal poverty level. The team found that, depending on how much water a household uses, between a tenth and a third of households are working more than a day each month (approximately 4.6 percent of their income) just to afford their water bills.

The dashboard was the culmination of months of work for the project team, gathering data from an array of sources and manually entering it. With the hard work for at least seven states done, the Nicholas Institute has made the data and code behind the dashboard open source, enabling others to more easily use it to work toward improved water affordability and equity.

“If we are the exclusive holders of the data, we are a bottleneck,” Patterson said. “We wanted to put it out there and let people ask their own questions.”

Work on shrinking cities and the Water Affordability Dashboard was funded by Spring Point Partners.

'Ocean 100': With Big Profits Come Big Responsibilities

by Anna Nordseth

The world's oceans are an economic powerhouse. In 2018 alone, eight core ocean-based industries generated an estimated \$1.1 trillion in revenues—equivalent to the GDP of the 16th-largest economy in the world.

More than half of these revenues, however, were generated by 100 companies, according to [research](#) published in January 2021 by the Nicholas Institute for Environmental Policy Solutions and the Stockholm Resilience Centre at Stockholm University. The study's authors found that these top earners, dubbed the "Ocean 100," may play a dominant role in these ocean industries and could show leadership in making those industries more sustainable.

Ocean industrialization has occurred at staggering rates in recent decades, and the ocean economy is expected to continue growing faster than the global economy through 2030. This "[Blue Acceleration](#)" is putting the ocean on the radar—both as a place for economic development and a source of environmental and social concern.

"As our ability to industrialize the ocean grows, marine ecosystems face cumulative pressures from human activities and climate change," wrote co-author Jean-Baptiste Jouffrey, a sustainability researcher at the Stockholm Resilience Centre, for [China Dialogue Ocean](#). "This scramble for the seas also poses issues of equity and benefit sharing: if there is a rush for the ocean, then who is winning? And who is being left behind?"

The Ocean 100 concept grew out of [pioneering fisheries research](#) led by co-author Henrik Österblom, science director at the Stockholm Resilience Centre. This foundational work analyzed fishing company profits across the industry and found that a few "keystone companies" have a disproportionately large stake in global fisheries.

By taking a first step to identify keystone actors in the ocean economy, the Ocean 100 study spotlights companies with both a vested interest in ocean stewardship and potentially considerable power to impact its future. Now, the research team hopes to use this conceptual foundation to develop real solutions for sustainable and equitable ocean use.

"We have just done this accounting work to identify who the biggest companies are in the ocean economy by revenues," said co-author John Virdin, director of the Nicholas Institute's Ocean and Coastal Policy Program. "Now we want to know if the Ocean 100 would be willing to come together to better understand what the key challenges are in achieving our goals for sustainable ocean use, and what voluntary commitments they could make beyond what they're already doing to help us achieve our sustainability goals for ocean use."

"We now have a chance to work with a finite number of players for systems change in the ocean. There have been a lot of sector-by-sector efforts, but there hasn't been a way to connect the dots," added co-author Daniel Vermeer, executive director of the Center for Energy, Development and the Global Environment (EDGE) at Duke's Fuqua School of Business. "They all share the same ocean, they have overlapping incentives, and they need to work in a collaborative, cross-sectoral fashion to really get the scale to impact these big efforts."

Work on this project was funded by the Nicholas Institute, Walton Family Foundation, The David and Lucile Packard Foundation, The Gordon and Betty Moore Foundation, Erling-Persson Foundation, and the Swedish Research Council.



Resilience Roadmap Charts Path for U.S. to Plan for Climate Change's Effects

by Jeremy Ashton

The stresses and shocks of climate change felt all too real in the United States in 2021.

Severe winter storms shut down much of Texas' power grid in February. A years-long drought led to the first-ever federally declared water shortage on the Colorado River. Wildfires plagued western states most of the summer. And Hurricane Ida brought catastrophic flooding from the Gulf Coast all the way to the Northeast in late August and early September.

Climate-fueled disasters such as these expose vulnerabilities to wide swaths of the U.S. economy. Nearly a third of Americans live in a county that experienced a federally declared weather disaster over the summer of 2021, according to a [Washington Post analysis](#). While extreme weather events are the most dramatic examples of how climate change is manifesting, communities across the country also must prepare for chronic threats to air quality, food security, natural ecosystems, and more.

During his first week in office, President Biden issued a sweeping [executive order](#) to address the climate crisis that recognized the urgent need to “move quickly to build resilience, both at home and abroad, against the impacts of climate change.” The new [Resilience Roadmap project](#) seeks to help translate that vision into action. Convened by Duke University's Nicholas Institute for Environmental Policy Solutions and Susan Bell & Associates, the project taps a broad spectrum of resilience experts to offer actionable recommendations that inform the administration's national resilience agenda.

“America needs its new investments in housing, transportation, water, and energy systems to withstand and quickly recover from the fires, hurricanes, floods, snowstorms, and heat waves that have become — and will continue to be — common occurrences in this century,” said Lydia Olander, co-convenor



of the *Resilience Roadmap* and director of the Nicholas Institute's Ecosystem Services Program. “We need to move from shovel-ready to shovel-worthy investments that will build the resilience of our communities and economy.”

The *Resilience Roadmap* released its [initial, high-level guidance](#) in April ahead of a virtual climate summit between President Biden and more than 40 world leaders. Three overarching principles that are critical to all resilience efforts framed those recommendations:

Resilience building can and should deliver tangible, on-the-ground benefits, such as creating jobs, safeguarding public health and safety, and stewarding natural resources.

Resilience-building efforts must prioritize vulnerable communities, where the impacts of climate change fall most heavily on people who already suffer disproportionately from economic, social, racial, and environmental inequities.

Resilience building requires a vertically integrated, “whole-of-government” approach that includes federal government agencies, states, local communities, and Tribal Peoples, as well as community groups, civil society, and the private sector.

As part of U.S. Climate Action Week around the summit, the Resilience Roadmap hosted a [webinar](#) with resilience leaders inside the Biden Administration and from Tribes and regional interests. The virtual conversation touched on the new administration's approach to resilience planning, equity considerations, and how the federal government can work with local communities, as well as other subjects.

While headlines from the summit focused on ramping up efforts to tackle the causes of climate change, the webinar made clear that the administration is keenly aware of the need to address its effects, too.

“I think resilience is going to measure up, and I think the *Resilience Roadmap* that you have put together will help show us the way,” said David Hayes, special assistant to the president for climate policy, during the webinar.

The *Resilience Roadmap* project has continued to work with the administration to broaden engagement with the resilience community and harness the expertise that its members bring to bear.

Work on the first phase of this project was funded by Lyda Hill Philanthropies and the Walton Family Foundation. Their support for the project does not constitute or imply endorsement of the Resilience Roadmap.

COVID-19 and Energy Access in Sub-Saharan Africa

by Jason Gray

Quality access to reliable energy in Sub-Saharan Africa was already a problem. When COVID-19 spread across the globe, the issue only became more exacerbated. Many areas on the continent do not have a steady connection to large power grids, which, among other difficulties, makes it hard to operate medical facilities for local communities—almost a quarter of Sub-Saharan Africa’s medical facilities lack power and only 28% have a reliable source. Ventilators, oxygen masks, and most COVID-19 tests require power, as do efficient means of sanitizing medical equipment, and vaccines need refrigeration. With hospitals and care centers overrun with cases of coronavirus infections, a dire situation was compounded.

But there is opportunity for governments to see this crisis as a spur to make electrification a priority. While it would take many years to build out the electrical grid to reach rural facilities, minigrids can be set up much more quickly. In Nigeria it only took a [matter of weeks](#) to get a mini-grid running due to the work of the Rural Electrification Agency and private firms. These off-grid sources power hospitals treating COVID-19 patients and will continue to work long after the pandemic is over. The lowered costs of batteries and solar panels make such work entirely possible in many parts of Africa and other developing areas of the world. Other off-grid solutions like solar direct drives can be used to [keep vaccines cold](#), an essential function to stop the spread of the pandemic.

The James E. Rogers Energy Access Project, which is a partnership of the Nicholas Institute and several schools and units at Duke University, is running a number of projects to study and help implement these solutions. In coordination with the World Health Organization, World Bank, Sustainable Energy for All, and the International Renewable Energy Agency, and with partners at the World Resources Institute and the University of North Carolina at Chapel Hill, they will develop a [Global Assessment of Electricity in Healthcare Facilities](#). This assessment is investigating health facility access to electrification globally, including electricity reliability, affordability, and quality. The goal is to provide a comprehensive update on the status of health facility electrification and advise stakeholders, including government officials, private compa-

nies, funding institutions, and others regarding best practices for powering up healthcare in hard-to-reach places.

Also in progress is the work that studies how technological innovations like smart meters have aided in utility revenue collection in Pakistan and Kyrgyzstan given the challenges of the COVID-19 pandemic. Collaborating with the Kyrgyz State Technical University and Lahore University of Management Sciences, this research may identify ways in which innovative technology can help utilities maintain functionality in future crises.



The issue of how COVID-19 has affected off-grid energy access in developing countries will be explored in a panel at [COP26](#) that will feature Jonathan Phillips, co-director of the Energy Access Project. COVID-19 demonstrated that basic household electricity access is an essential good, according to Phillips. In the context of declining incomes and difficult sacrifices—skipping meals, selling productive assets—households largely continued to pay for electricity.

The Energy Access Project is looking ahead to spring 2022 for results from these studies and will be sharing their findings widely.

Webinar Series Promotes Sustainability in the Next Wave of Infrastructure Development

by Anna Nordseth and Jeremy Ashton

Following the economic downturn caused by the COVID-19 pandemic, many countries are investing in infrastructure to stimulate their economies. The record of large-scale infrastructure spending, however, indicates that a business-as-usual approach to rebuilding may only worsen the burden on the environment and millions of people in local communities around the world.

Founded in 2020, the [Sustainable Infrastructure Community of Learners](#) (SI-CoL) is helping steer this new wave of infrastructure development toward a sustainable future with long-term economic, social, and environmental benefits. Led by the Nicholas Institute and the U.N. Environment Programme (UNEP), the community is aiming to help the world “build back better” by consolidating, disseminating, and discussing the existing body of knowledge on sustainable infrastructure. The SI-CoL coalition has started that work through a monthly interactive webinar series, [Sustainable Infrastructure: Putting Principle into Practice](#), hosted by Duke, UNEP, Conservation International, the International Coalition for Sustainable Infrastructure, French Ministry for Ecological Transition, and Project ECHO.

“With infrastructure at the heart of ‘building back,’ it becomes essential to consider what ‘better’ infrastructure really looks like and how new infrastructure projects can be rooted in sustainability and systems change from the get-go,” said Elizabeth Losos, senior fellow at Duke University’s Nicholas Institute for Environmental Policy Solutions and a lead researcher on the project.

The webinar series is centered around UNEP’s 10 International Good Practice Principles for Sustainable Infrastructure, which were released earlier in the year. The principles guide policy makers to help integrate sustainability throughout the life cycle of an infrastructure project, from planning and design to construction and operation all the way to decommissioning. The principles are intended to be adaptable to the unique circumstances of different global geographies and infrastructure sectors.

The series kicked off in May 2021 with more than 200 participants—engineers, architects, scientists, economists, students, and others—from more than 40 countries joining to get an introduction to the good practice principles. Each subsequent session has focused on one specific principle. After a brief overview of the principle, experts and practitioners provide technical presentations and case studies to outline available tools, share best practices, and discuss potential pitfalls.



The presentations are intended as a starting point for a broader discussion. Interactive activities in each webinar encourage presenters and participants to exchange ideas about how to navigate sustainability challenges within real-world projects. SI-CoL has also established a [LinkedIn group](#) as another venue to keep the conversation going beyond the webinars.

Looking forward, Losos said SI-CoL plans to develop smaller hubs within the global sustainable infrastructure network it has created. This will facilitate specialization based on regions or topics and allow participants to deepen relationships with colleagues facing similar issues in different localities.

The goal of all these efforts is to get sustainable infrastructure tools and helpful resources into the hands of key stakeholders as quickly as possible.

“With the tsunami of new infrastructure investments just over the horizon, we have little time to ensure that those financing, regulating, planning, and building are equipped to make the most appropriate and sustainable decisions,” Losos said in [an interview](#) with the International Council on Sustainable Infrastructure, one of the partners on the webinar series. “The pathways they pick will affect us for decades to come.”

Helping Whistleblowers Report Corporate Climate Risks

by Jason Gray

The Global Financial Markets Center at Duke Law, the Nicholas Institute, and the National Whistleblower Center partnered to launch the Climate Risk Disclosure Lab in 2020. The lab’s goal is to address both the lack of a framework to disclose climate-related risks that corporations face and any effective enforcement of laws that businesses break. The idea is to improve the accountability in corporate reporting of climate-related risks, making it easier for people to come forward with information that would be useful for govern-

ments, investors, and the general public in regard to corporate environmental behavior.

Right now, most corporations are only required to voluntarily report any climate-related risks in their business, if they report it at all. Because of this, companies can “greenwash” or obfuscate their actions to appear more ecologically friendly. The Lab will provide a hub for academics, NGO policy experts, and industry leaders to develop ideas that regulatory agencies and legislators can use to improve climate-risk disclosure standards and strengthen whistleblower programs.

Capitalist systems are meant to be transparent, and risks should be disclosed for investors to make the most sound decisions, said Tim Profeta, Nicholas Institute founding director. “The Climate Risk Disclosure Lab will provide an evergreen resource for investors, executives and whistleblowers regarding what is required in the disclosure of climate risk.”

The Lab’s founders believe that if investors were provided with accurate assessments of corporate climate risks, they would be more likely to move capital away from problematic fossil fuels and into renewable and low-carbon sources of energy.

“Climate change is the great and most urgent issue of our time, yet short term financial incentives serve to prevent scientists and investors from assessing its real impact,” said Lawrence Baxter, the David T. Zhang Professor of the Practice at Duke Law and the Global Financial Markets Center’s faculty director.

The Lab will have both in-house policy experts gathering available research and contributing their own, working with outside researchers and industry leaders to produce reports, and a forum for outside experts to submit work on climate-risk disclosure proposals.

So far, in its first year of operation, the Lab has generated 13 publications and gathered current and proposed standards for climate-risk disclosure. The Lab’s focus will begin with U.S. laws and public companies subject to U.S. laws, but will move on to address disclosure laws in other countries as well as disclosures by privately-held companies.

More information about the lab can be found at their website: climatedisclosurelab.duke.edu.



CLIMATE RISK
DISCLOSURE LAB

Stakeholder Initiative Takes Aim at Energy Insecurity in the Southeast

by Jason Gray

The problem of energy insecurity in the southeast is a big challenge. For the many families who have difficulty paying their energy bill, a choice often needs to be made on whether to use their limited income on energy or food or housing or other essentials.

Realizing the seriousness and complexity of this issue, the Nicholas Institute’s Climate and Energy Team, along with the organizations Appalachian Voices and the North Carolina Justice Center established the Southeast Energy Insecurity Stakeholder Initiative to facilitate conversations on energy insecurity and find solutions for affected citizens.

“There were opportunities for a larger group to learn from each other and collaborate on policy solutions that could really drive transformational change,” said Jen Weiss, Senior Policy Associate on the Institute’s Climate and Energy Team.

The three organizations working together first created an Advisory Board of 14 energy insecurity experts from around the southeast to provide a solid footing for the initiative and help guide the first stakeholder meeting.

The new group held a virtual workshop in May 2021 with the goals of fostering a community of energy insecurity stakeholders in the Southeast, creating a shared understanding of energy insecurity landscape with common terminology, and beginning to identify challenges and barriers faced by those experiencing energy insecurity. Over 80 stakeholders took part in the workshop (and over 150 have joined the group all together), including people who have had trouble paying their energy bills; those working with individuals who are directly impacted; utility representatives; state and local decision makers; representatives from state and local weatherization programs; and religious, nonprofit, and community leaders. Together, they identified challenges and established focal areas in data access and improvement, housing considerations, community engagement, systemic change, and potential policy, program, and utility solutions.

The six working groups that emerged from the workshop have continued to meet regularly to establish a set of recommendations for presentation at a second virtual workshop in November 2021. There, the recommendations will be refined and turned into a report set to be published in early 2022.

A recording of the first workshop is available on the [Institute website](#).

Winter Internships Keep Students Engaged Over Extended Winter Break

by Rosa Golchin

The extended winter break during a pandemic year left many Duke students without an option to meaningfully pursue their academic interests over a seven-week period. To address this, the Nicholas Institute for Environmental Policy Solutions extended internships to 30 undergraduate and graduate students in its five core programs, the James E. Rogers Energy Access Project at Duke, and the Internet of Water to encourage sustained engagement during the recess from courses.

Student involvement ranged from developing databases to modeling and science communication. The winter internship program supported career development for the involved students, who received unique insights into the field of environmental and energy policy in return for contributions to their projects.

Some students undertook new work over the winter recess. Leah Roffman, an undergraduate student studying public policy, began research for the Energy Access Project during her seven weeks away from classes. The goal of Roffman's project is to quantify the benefits that result from different electrification strategies in various low- and middle-income countries. The development and transformation of energy systems is critical to economic growth, job creation, and well-being.

Roffman was responsible for ranking nations' energy access in different tiers and worked to generate parameters that would eventually be used in models. As the project progresses, she plans to calculate the benefits of electrification in low-income countries, evaluated upon energy access attributes reported by households. Roffman sorted through data from the World Bank to create the tiered system, which accounts for eight attributes such as the availability and quality of energy. The data are being prepared for use to construct models that predict the effect of different levels or strategies of electrification on various household parameters.

"It was really nice to have an ongoing project to do over break," Roffman said, and she "definitely appreciated" the chance to make progress in this endeavor. She noted that her ability to work over the winter break allowed her to "familiarize [herself] with the

project and the process and all the tools" before delving deeper in the spring semester.

Other students were able to continue project work from the fall semester over the winter break. Iqra Ahmed, a graduate student in the Master of Environmental Management program at the Nicholas School of the Environment, extended her work in a year-long research assistantship project with the Nicholas Institute's Ecosystem Services Program.

Ahmed's work focuses on the role of federal agriculture programs administered by the U.S. Department of Agriculture in making progress toward North Carolina's statewide climate goals. She used this time to investigate literature and resources from agricultural experts that would help her begin to construct a report. Ahmed reflected on her findings as shedding light on "the carbon benefit potential of specific conservation practices" in addition to "how the programs are administered by the NRCS [National Resources Conservation Service], how they are implemented specifically within North Carolina," and challenges faced by the agency.

Ahmed shared a similar sentiment to Roffman, saying she found the winter experience was "a good way to continue the work I was doing over the fall semester without the distraction or stress of classes." This allowed her to dedicate all of her attention to research, which she described as refreshing and setting her up well to carry the project work into the spring semester.

Over the winter, students were provided a unique opportunity to participate in projects hosted by the Nicholas Institute, with some continuing work from past semesters, and others setting out on new endeavors. The work of these students strengthened the projects and served as a unique chance for them to dedicate time toward research in the absence of classes

Partnership Between Duke and FAO Illuminates Importance of Small-Scale Fisheries

by Jeremy Ashton

The Nicholas Institute for Environmental Policy Solutions is aiming to shed more light on the benefits of small-scale fisheries by joining educational counterparts at Duke University in a new partnership with the [Food and Agriculture Organization of the United Nations](#) (FAO).

Small-scale fisheries have a big role to play in feeding an ever-growing population, particularly in developing countries. They also provide jobs for millions in local communities around the world and are pivotal to protecting natural habitats and biodiversity. Yet their contributions to creating a sustainable future for the planet are not well understood by policy makers and often overlooked.

Announced during a [virtual event](#) in October 2020 and formalized through a memorandum of understanding, the partnership builds on ongoing research collaborations between FAO and Duke's Nicholas School of the Environment, Marine Lab, and Nicholas Institute for Environmental Policy Solutions. The agreement also opens the door for FAO and Duke to collaborate on additional areas of study, potentially including seafood markets, aquaculture, mangrove restoration and forests.

“The partnership with FAO allows us to connect our faculty and the U.N. effectively to try to eradicate hunger and pursue this noble idea of ending poverty,” said Toddi Steelman, Stanback Dean of the Nicholas School of the Environment. “It’s a vote of confidence in the importance of multilateral institutions at this time.”

Small-scale fisheries have the potential to help countries around the world achieve several of the [Sustainable Development Goals](#) (SDGs) under the U.N.’s 2030 Agenda for Sustainable Development. Through the new agreement, FAO and Duke will work together to build a scientific evidence base for policy makers to develop strategies and solutions to support these fisheries. One major effort is already underway—development of the forthcoming [Illuminating Hidden Harvests](#) study that will be released with the [WorldFish Center](#) in 2022. The project is exploring the social, environmental, economic, and governance contributions of small-scale fisheries at the global and local levels, as well as threats and opportunities for the sector.

Global partnerships are necessary to reach the Sustainable Development Goals, and they are key to enhancing FAO’s programs that support capacity

building in member countries, said Marcella Villareal, FAO director of partnerships and U.N. collaboration. With more than 75 partnership agreements signed since 2017, Villareal described universities and research institutions as “natural partners” for FAO because of their shared commitment to scientific, evidence-based solutions for addressing policy issues such as food security.

“We believe [the Duke partnership] is a very important step forward supporting sustainable seafood and small-scale fisheries and helping FAO members in their achievement of the SDGs now and in the future,” Villareal said. “We look very much forward to achieving great outcomes with Duke University that we are sure will benefit small fisherfolk worldwide.”

Duke students who are motivated to have a “greater purpose and meaning” in their lives are already benefiting from collaboration with FAO, Steelman said.

In a [video](#) produced for the partnership announcement, current and former students in the Nicholas School of the Environment and the Marine Lab



spoke about the experience they gained through various research opportunities with FAO. The partnership will further enhance these opportunities for students to apply their knowledge to “real-world research projects with direct global policy impact,” said Xavier Basurto, assistant professor of sustainability science at the Nicholas School of the Environment.

“It will allow them to get exposed to an understanding of how global diplomacy works and the fisheries, science, and policy interface within the United Nations system,” Basurto added in the video.

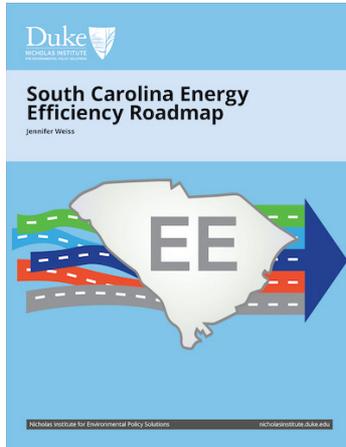
Manuel Barange, director of FAO’s Fisheries Division, described the partnership as “reciprocal enlightening” in which FAO and Duke help each other overcome “structural limitations in a way that adds value to what we individually do, as well as collectively.”

With a modest workforce and budget, FAO benefits from the research methods that Duke has developed, Barange said. And while the inclusion of students clearly enhances Duke’s educational mission, Barange also sees their presence as an important part of FAO’s food security mandate.

“The involvement of young researchers in the IHH study is not just a way to train a new generation of scientists; it is an attempt to bring fresh eyes to an old problem,” he said. “We expect young researchers to find what we don’t seek, to ask the questions we thought did not need answers, to quantify our qualifiers.”

South Carolina Energy Efficiency Roadmap

Energy efficiency (EE) is widely considered a least-cost option for meeting energy demand while reducing energy costs and carbon emissions. While EE has experienced slow and steady growth in South Carolina, much more can be done to maximize the full potential of this least cost resource. The Electric Power Research Institute (EPRI) estimates that South Carolina has 16,902 GWh of cost-effective electric energy efficiency economic potential by 2035. To explore this opportunity, leading EE and energy experts—including academic experts, consumer advocates, environmental nonprofits, commercial entities, state agencies, and utilities—participated in a series of meetings to determine where and how to deploy EE at a significantly greater rate. This report makes recommendations for increased and effective EE deployment in South Carolina.



How a Green Bank Can Drive the North Carolina Clean Energy Economy: A Market Opportunity Overview

This report provides an analysis of clean energy finance opportunities that will accelerate the transition to a clean energy economy in North Carolina. Green Banks have been proven as an effective engine for job creation by leveraging public resources to catalyze private investment,

which is particularly relevant in this time of high unemployment.

Exploring the Use of Ecosystem Services Conceptual Models to Account for the Benefits of Public Lands: An Example from National Forest Planning in the United States

This study describes an approach for identifying and monitoring the types of resource benefits and tradeoffs considered in National Forest planning in the United States under the 2012 Planning Rule and demonstrates the use of tools for conceptualizing the production of ecosystem services and benefits from alternative land management strategies. Efforts to apply these tools through workshops and engagement exercises provide opportunities to explore and highlight measures, indicators, and data sources for characterizing benefits and tradeoffs in collaborative environments involving interdisciplinary planning teams. Conceptual modeling tools are applied to a case study examining the social and economic benefits of recreation on the Ashley National Forest.

Recognize Fish as Food in Policy Discourse and Development Funding

The international development community is off-track from meeting targets for alleviating global malnutrition. Meanwhile, there is growing consensus across scientific disciplines that fish plays a crucial role in food and nutrition security. However, this ‘fish as food’ perspective has yet to translate into policy and development funding priorities. We argue that the traditional framing of fish as a natural resource emphasizes economic development and biodiversity conservation objectives, whereas situating fish within a food systems perspective can lead to innovative policies and investments that promote nutrition-sensitive and

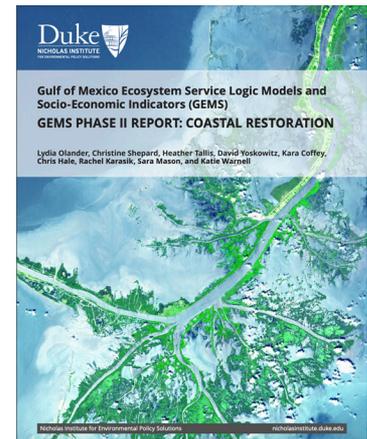
socially equitable capture fisheries and aquaculture. This paper highlights four pillars of research needs and policy directions toward this end.

Lessons for Modernizing Energy Access Finance, Part 2 – Balancing Competition and Subsidy: Assessing Mini-Grid Incentive Programs in Sub-Saharan Africa

This policy brief summarizes a review of 20 mini-grid incentive programs in sub-Saharan Africa, 17 of which are still being implemented. The programs analyzed primarily used one of two mechanisms to stimulate investment: auction programs and results-based financing (RBF) programs.

GEMS Phase II Report: Coastal Restoration

This Phase II report of the GEMS project identifies metrics available to monitor the social and economic outcomes of a wide variety of coastal projects funded in the Gulf, using ESLMs to illustrate how these projects’ impacts cascade through the biophysical system to result in social and economic outcomes. Phase II expands the focus to assess socioeconomic metrics for 16 coastal project types, including habitat restoration, recreational enhancement, and water quality improvement projects.



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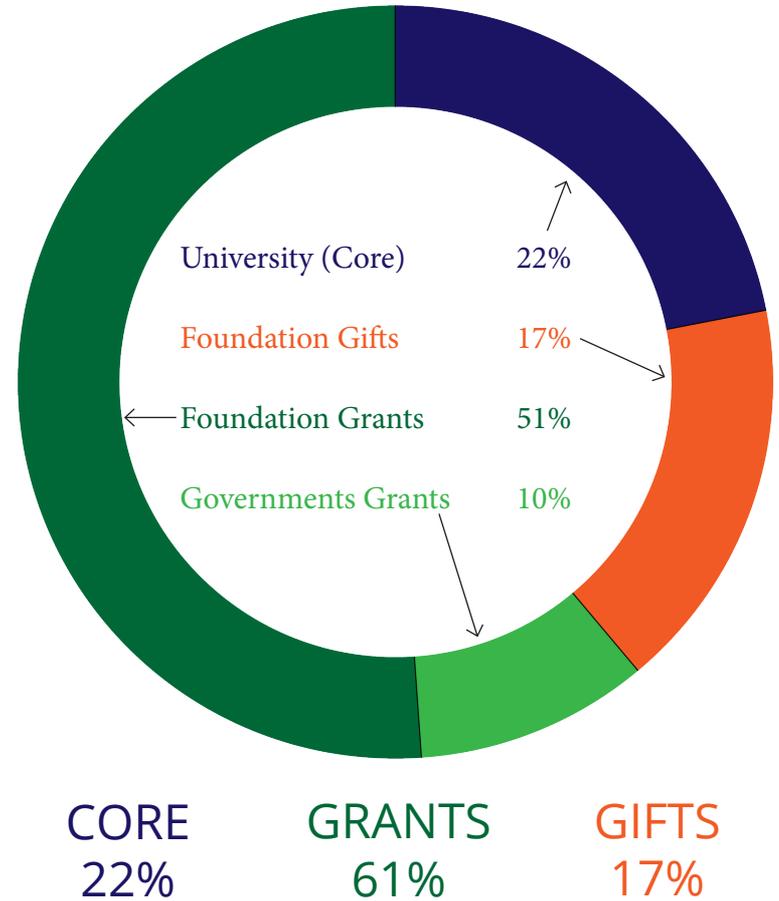


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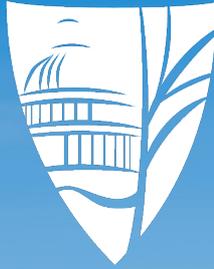
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