Resources
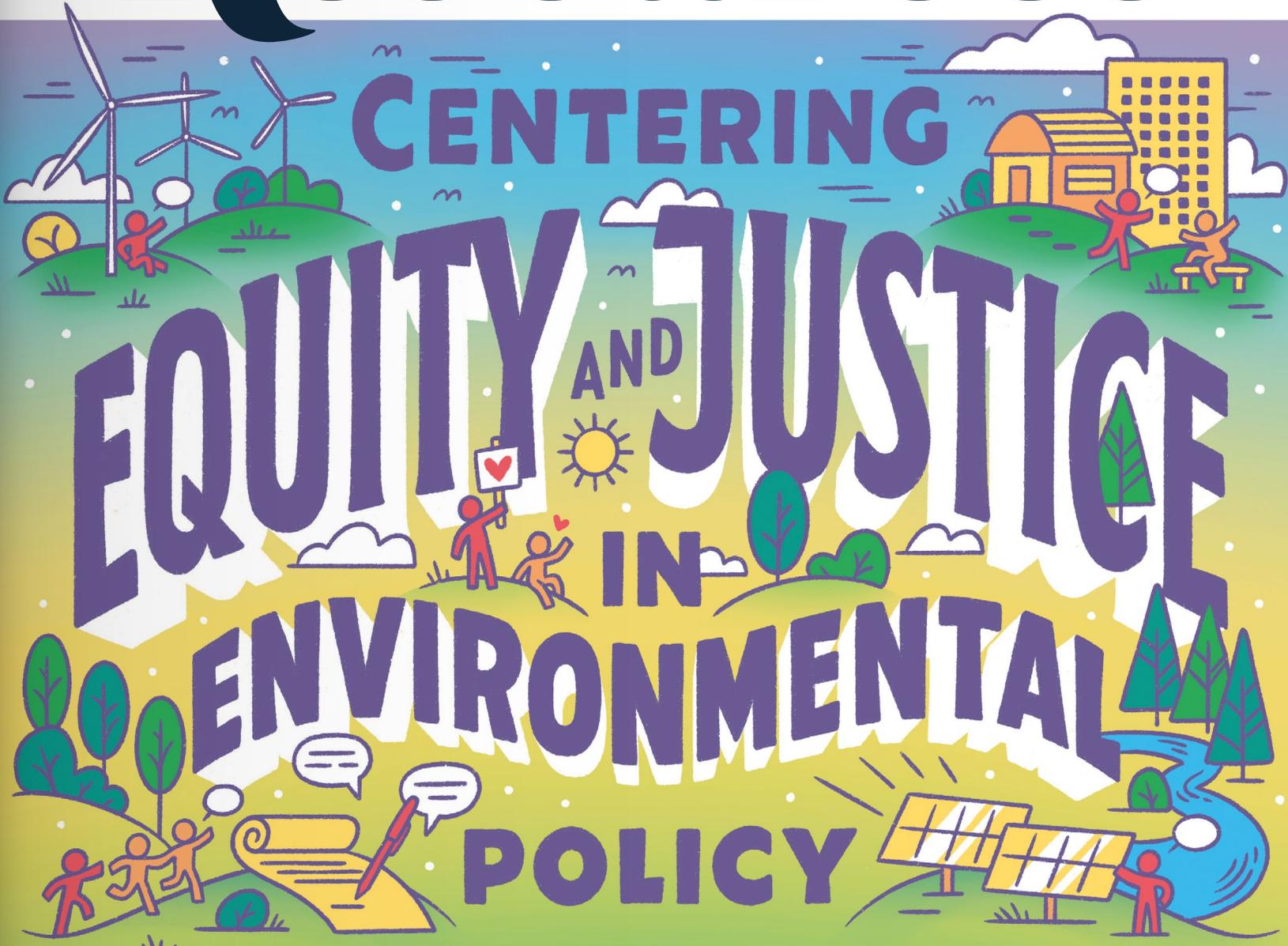

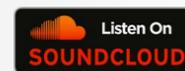## CENTERING EQUITY AND JUSTICE IN ENVIRONMENTAL POLICY

Will disadvantaged communities in New York benefit from cleaner air?

Solutions for cumulative impacts of pollution in overburdened communities

Including community concerns in the design of California climate policy

Illustration by Nils-Petter Ekwall

A Note from RFF's President

Equity in Research and Climate Policy

Researchers, policymakers, and communities may not agree on everything, but the past several years have made clear that our commitment to equity and to inclusive processes is integral to enabling a healthy environment and thriving economy. In this issue of *Resources*, we feature scholars, leaders, and organizations who all are working to make progress on the enormous opportunities and challenges in this space.

At an organizational level, Resources for the Future (RFF) has been on its own journey to integrate greater attention to equity and more diverse engagement into our research agenda and our organizational operations. Our external impact has a much stronger foundation with internal improvements, and we also recognize that this is hard and ongoing work that requires vigilance in a constantly changing world, as envisioned in RFF's commitment to a diverse, equitable, and inclusive future.

At the level of national policy, the Inflation Reduction Act of 2022 targets billions of dollars in support of the goals of the Biden administration's Justice40 Initiative, which calls for 40 percent of the benefits of certain federal investments to accrue to disadvantaged communities. At RFF, we think and act on these efforts most often in the context of our Environmental Justice Initiative, which aims to inform decisionmaking so that historically underserved and marginalized communities will see equitable environmental benefits.

We're creating true partnerships with community members and organizations, so they'll not just "have a seat at the table" for our research and policy engagement activities, but so they also can help design the menu, cook the meal, and invite the guests. Some notable recent examples of such partnerships at RFF have been the New York City Environmental Justice Alliance and the Southeast Rural Community Assistance Project—both described in this issue of *Resources*. We're working to interrogate and, as needed, change conventions in economic research and policy analysis so that our data, tools, methods, and questions help shed light on ways to make progress, rather than obscure inequities or leave them unattended.

And we hope to do things right. We're still in the early stages of these efforts, and we'll need to do plenty of work to make equity more central in our research and the policy outcomes from that research. We'll make mistakes along the way, fall short, and feel uncomfortable—all of which we can expect. Without foisting responsibility onto our collaborators to teach us what we don't know, we'll plan to stay open to learning from these experiences and from our community colleagues in the process.

Thank you for being our partner on this journey.

Richard G. Newell

Richard G. Newell
President and CEO, Resources for the Future

Prioritizing Justice in New York State Climate Policy: Aiming for Cleaner Air in Disadvantaged Communities

by Molly Robertson and Eddie Bautista

Image The Climate Leadership and Community Protection Act became a law in 2019 and sets decarbonization goals for New York State.

Julien Maculan / Unsplash

Climate policy aims to decrease greenhouse gas emissions, but another important outcome from decarbonization is improved air quality.

New research from a team lead by Resources for the Future and the New York City Environmental Justice Alliance asks the question:

Will disadvantaged communities see benefits?

Decarbonization and environmental protection often are discussed as interchangeable and completely aligned policy goals. In many ways, this equivalence makes sense, as many strategies for cutting greenhouse gas emissions also reduce conventional air pollutants, and vice versa. What often gets lost, though, is that some policies that aim to reduce greenhouse gases can increase air pollution at the local scale because of how the policies apply differently across space. For instance, the dramatic electrification of vehicles may increase demand for natural gas on the power grid, which can contribute to local air pollution in vulnerable communities near gas power plants. Understandably, analysis of climate policy often focuses on the core goal of reducing carbon emissions—but an equally important body of work investigates what's referred to as "ancillary benefits" such as improvements in air quality.

These ancillary benefits are particularly important for advocates in the environmental justice movement. Historically unjust systems and policies have led to neighborhoods in which low-income communities and communities of color bear disproportionate burdens from air pollution. In recent decades, advocates have been putting community concerns at the center of discussions about decarbonization, and the federal government and many state governments have resolved to meet their own respective climate goals while improving air quality conditions in disadvantaged communities.

This increased focus on community protection creates a pressing need for analysis that not only looks at the net benefits of a policy, but also offers more granular estimates of how specific communities will be impacted. For example, instead of estimating merely that a policy will increase electric vehicle adoption by 50 percent, new studies also can ask, Where are those vehicles deployed? How does the changing technology mix impact air quality in different areas? Do subsidies lead to disproportionate improvements in wealthy areas, while pollution remains high in disadvantaged communities? To answer these questions, we'll need detailed spatial information about

the location of disadvantaged communities, behavioral models with detailed demographic information, and advanced air-quality modeling that can process location-specific emissions changes and predict how emissions will migrate and chemically interact to form harmful air pollution.

To answer these critical questions, Resources for the Future and the New York City Environmental Justice Alliance, along with researchers at Yale, UC Davis, and Northeastern University, have partnered to investigate local air-quality impacts on disadvantaged communities due to the implementation of the New York Climate Leadership and Community Protection Act. Specifically, we compared two different sets of policies to a business-as-usual case projected for 2030, both in line with the statutory requirements of the law, but that differ in their ambition and the degree to which they focus on aiding disadvantaged communities. One policy case (the scenario inspired by the Climate Action Council) models what the New York State government may implement, which includes policies that have been discussed in other jurisdictions and proposed by New York policymakers. The other (the stakeholder case) was crafted by a team led by the New York City Environmental Justice Alliance and included many environmental and climate justice advocates in New York, who prioritized community protection and directing benefits to marginalized communities. We modeled the impact of policies on the electric power, on-road transportation, port, and residential building sectors; the effects of these policies on emissions of direct fine particulate air pollution ($PM_{2.5}$) and precursors to $PM_{2.5}$ (nitrogen oxides, sulfur dioxide, and volatile organic compounds); and the resulting $PM_{2.5}$ concentrations experienced by disadvantaged communities and non-disadvantaged communities alike.

Our analysis has revealed several key insights:

INSIGHT 01

Greenhouse gas reductions in 2030 are substantial under both cases relative to the business-as-usual case, but are greater under the

> **"Historically unjust systems and policies have led to neighborhoods in which low-income communities and communities of color bear disproportionate burdens from air pollution."**

> **"Because air-quality improvements are associated with public health benefits, the greater improvements in the stakeholder case would yield the greatest public health benefits."**

Figure 1   **Statewide Pollutant Levels Projected for 2030**
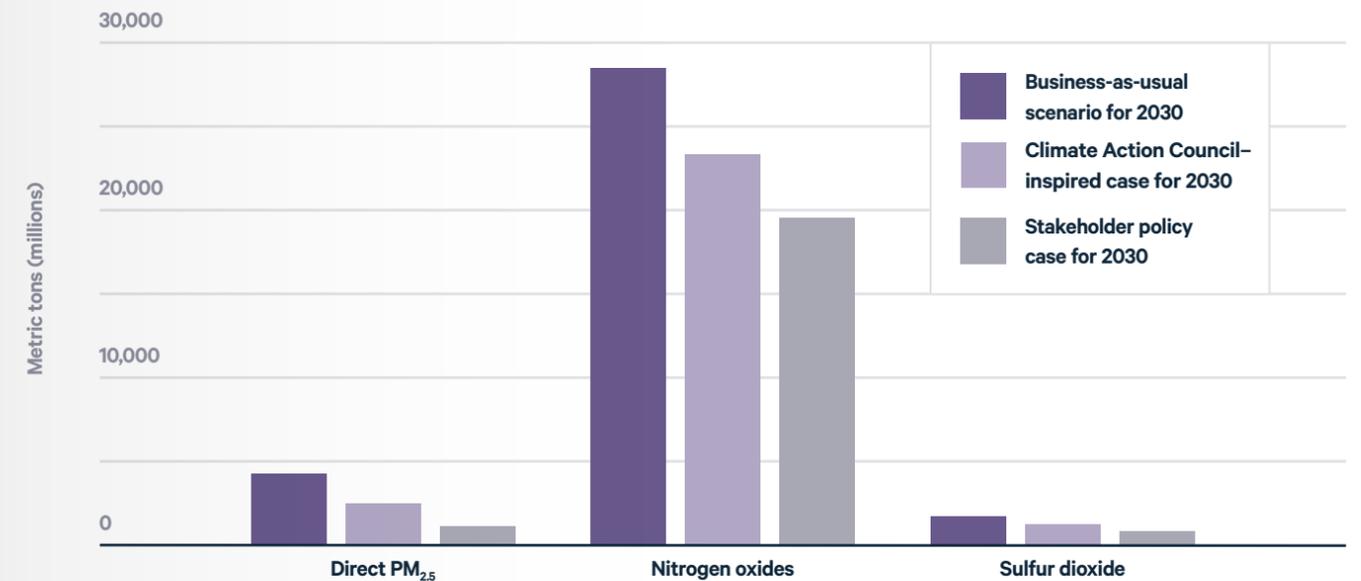
stakeholder case than under the Climate Action Council–inspired case (58 percent reduction versus 34 percent reduction, respectively). The stakeholder case also leads to greater statewide emissions reductions for pollutants that contribute to poor air quality (direct $PM_{2.5}$, nitrogen oxides, sulfur dioxide, and volatile organic compounds) than the Climate Action Council–inspired case (Figure 1).

INSIGHT 02

The stakeholder case leads to greater statewide air-quality improvements (as measured by $PM_{2.5}$ concentration reductions) than the Climate Action Council–inspired case. In the stakeholder case, air quality improvements in disadvantaged communities are greater than the improvements in non-disadvantaged communities (Figure 2). In the Climate Action Council–inspired case, statewide average air-quality improvements in disadvantaged communities are comparable to the improvements made in non-disadvantaged communities.

INSIGHT 03

On average across New York State, both policy cases improve air quality (in terms of reductions

in $PM_{2.5}$ concentrations); however, some census tracts do experience a worsening of air quality (increases in $PM_{2.5}$ concentrations). In the Climate Action Council–inspired case, about 6 percent of the roughly 5,000 New York tracts (296 tracts) experience worse air quality, one-fourth (75 tracts) of which are disadvantaged communities. In the stakeholder case, only 3 census tracts experience worse air quality, none of which are disadvantaged communities.

INSIGHT 04

The most vulnerable communities in New York State (the top 10 percent of tracts in the state's social vulnerability measure, and the 10 percent with the worst air quality historically) experience pronounced improvements under the stakeholder case.

INSIGHT 05

Because air-quality improvements are associated with public health benefits, the greater improvements in the stakeholder case would yield the greatest public health benefits. Furthermore, because elderly Black New Yorkers are particularly vulnerable to health complications related to $PM_{2.5}$ exposure,

Figure 2

Differences in PM$_{2.5}$ Concentrations Projected for 2030 Between the Stakeholder Case and the Climate Action Council–Inspired Case in Disadvantaged Communities

Improvements in PM$_{2.5}$ concentration (micrograms per cubic meter)

| -0.02 | 0.0 | 0.1 | 0.2 | 0.3 |

Blue tracts indicate areas where improvements are greater in the stakeholder case.

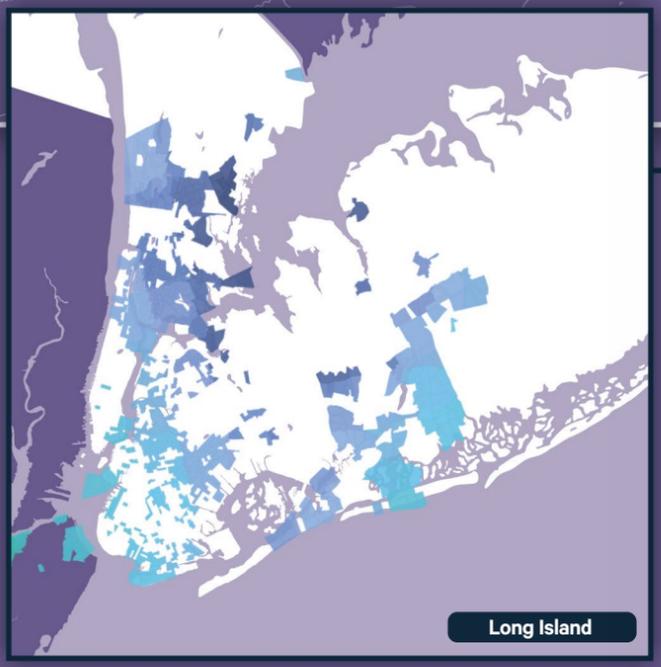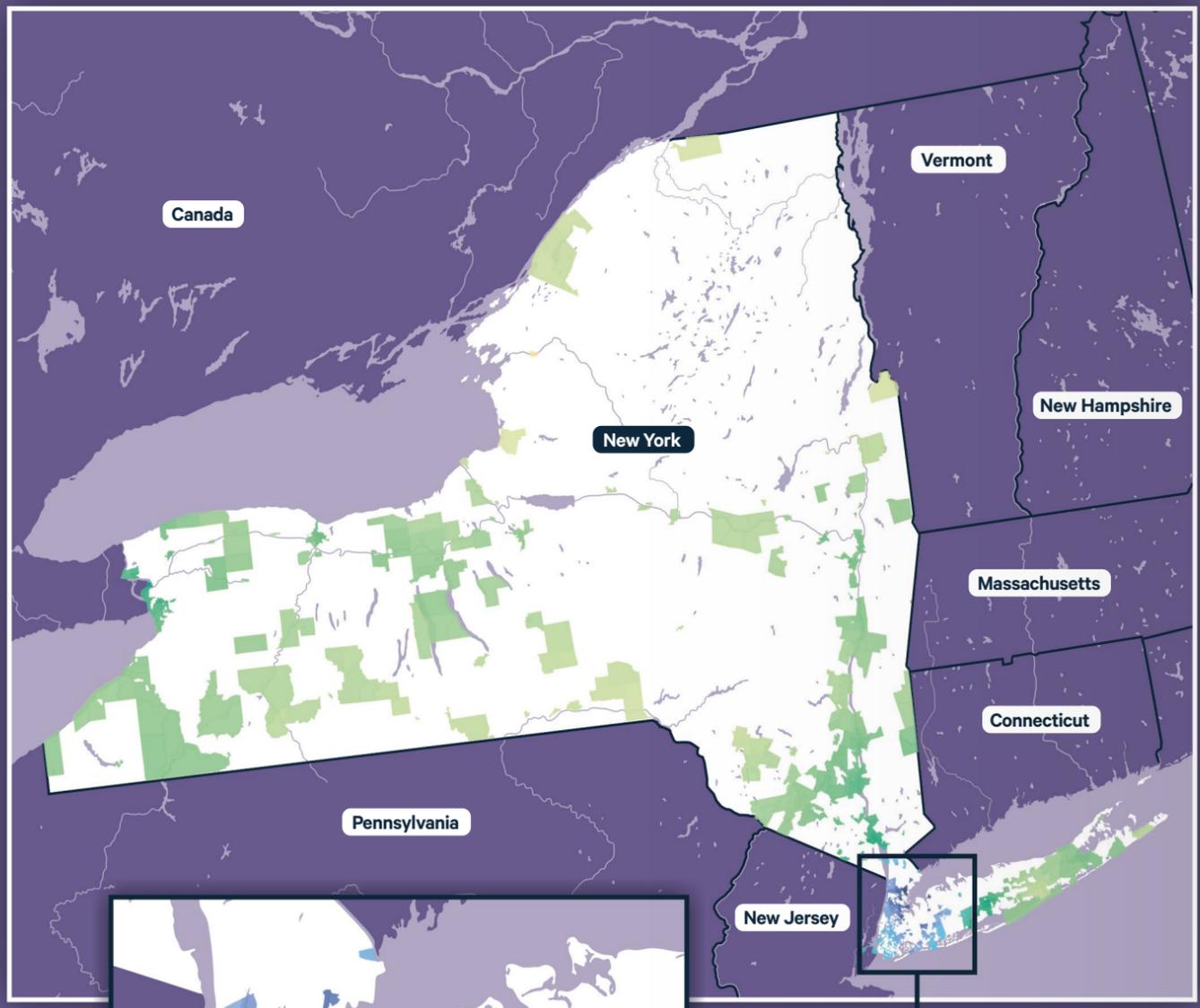this demographic group would experience disproportionate improvements in mortality risk relative to their Hispanic, Asian, and white counterparts (Table 1). We did not do a complete health-impact analysis, but in an illustrative calculation, we find that, while 22 percent of the New York City population aged 65+ is Black, this group accounts for 42 percent of the avoided deaths from PM$_{2.5}$ reductions compared to white residents (who make up 41 percent of the New York City population aged 65+, but account for 37 percent of the avoided deaths).

INSIGHT 06

The greater improvements in the stakeholder case occur because environmental justice stakeholders prioritized more stringent policies than the policies that were included in the Climate Action Council–inspired case. In most cases, policies that reduce greenhouse gases also reduce co-pollutants that contribute to poor air quality. Key policy drivers of the greater improvements in the stakeholder case include the following: a higher price on carbon and co-pollutants, more generous subsidies for heat pumps targeted at low-income households, and stricter phaseouts of fossil fuels in the electricity and residential

sectors. While these more effective policies require higher levels of investment, a full cost-benefit analysis was outside the scope of this work. Previous regulatory analyses that evaluate the stringency of policies which aim to mitigate greenhouse gases and air pollution often find that the environmental and health benefits of added stringency often outweigh the costs; however, such an analysis was not performed for this project.

We see through our work that ambitious climate policies can yield the greatest impact on climate change mitigation and air-quality improvement across all communities. Our research offers unique insights into the air-quality impacts that differ among communities in New York State due to choices surrounding the implementation of the Climate Leadership and Community Protection Act in 2019. Our study provides a framework for evaluating future policies that could impact the magnitude and location of changes in emissions through addressing economic behavior, alongside methods that can be useful in evaluating how disadvantaged communities in particular will be affected. We've learned a lot, and we're still in the early stages; work in this field presents many opportunities for future research. ∎

Table 1 **Avoided Deaths by Race/Ethnicity in the Stakeholder Case Relative to Business as Usual**

Race / Ethnicity	Percent of New York City Population Aged 65+	Percent of Avoided Deaths in New York City
Asian	14%	6%
Black	22%	42%
Hispanic	22%	15%
White	41%	37%

Molly Robertson is a research associate at Resources for the Future. **Eddie Bautista** is the executive director of the New York City Environmental Justice Alliance.

Resources Radio, a podcast produced by the *Resources* editorial team and Resources for the Future, releases new episodes weekly, in which one of the hosts—Margaret Walls, Daniel Raimi, or Kristin Hayes—speaks with a guest about a new or interesting idea that's related to things like energy policy, environmental policy, climate impacts, and environmental justice.

This interview was originally released on February 14, 2023. The transcript of the conversation has been edited for length and clarity.

Images
Dick Swanson and Gary Miller / US National Archives

Environmental Justice and the Cumulative Impacts of Pollution

Margaret Walls talks with Ana Baptista, an associate professor at the New School in New York City and codirector of its Tishman Environment and Design Center, whose work often involves deep community engagement. Baptista discusses the cumulative impacts of pollution on environmental justice communities; the sources of pollution in these communities; and the groundbreaking legislation and data tools that are being employed by state governments, researchers, and environmental justice groups to mitigate cumulative impacts in overburdened communities.

IN CONVERSATION

Margaret Walls and Ana Baptista

Margaret Walls: Can you tell us how you came to work on environmental justice issues and pursue this combination of scholarship and community engagement that seems central to your work?

Ana Baptista: I grew up in a community called the Ironbound in the East Ward of the great city of Newark, New Jersey. Growing up in a place like Ironbound, you get a true sense of environmental injustice. I grew up close to industrial sites, the seaports, and what became the state's largest garbage incinerator.

Some of my earliest exposure was to issues that, at the time, I didn't know were called environmental justice or environmental racism. I understood it as people dumping in our communities. Residents there were organized and proud of their community. As a kid, I participated with my family in many of the protests, community meetings, and efforts to try to protect our community and improve our quality of life.

Growing up in that environment made me acutely aware of the differences between communities and neighborhoods and the lack

of protections for communities like mine. I ended up going off to study environmental science and, eventually, urban planning. My studies brought me full circle—I came back home to do a doctorate at Rutgers University on environmental justice, and I got sucked right back into local organizing work with the Ironbound Community Corporation. I was privileged to be able to take all the things I learned in school and apply them in my own community.

In your study, you say that cumulative impacts have been a focus in the environmental justice community for decades, even though they've risen to the forefront in the policy world only recently. What do we mean by "cumulative impacts," and why are we concerned about them, especially as related to environmental justice and disadvantaged communities?

Cumulative impacts represent the idea that, when a community has many sources of pollution, that community is exposed to a variety of chemicals from a variety of sources. Often, underlying socioeconomic and health conditions will shape a community's experience and increase its exposure, contributing to the combined effect of stressors.

Simply put, cumulative impacts cover multiple pollutants that are emitted by multiple sources in a community, along with the interactions of these pollutants with each other and the preexisting social vulnerabilities. The US Environmental Protection Agency (EPA) has a more scientific, precise definition that talks about the combined exposure to a broad range of stressors, including pollutants, chemicals, what you inhale, what you drink, and what you eat. All of those things increase your vulnerability to environmental hazards and can result in significant harms to the environment and public health and risks to people.

Do you also consider things such as exposure to flood risks, urban heat island effects, and climate impacts as part of that mix?

Definitely. Climate risks are part of the combination of factors that could impact an individual and a community's well-being.

Cumulative impacts include anything that increases the vulnerability and exposure to hazards by residents.

Do cumulative impacts typically fall through the regulatory cracks? If they do, can you explain how and why that happens?

This is one of the biggest challenges in the environmental justice movement. People in communities that are facing multiple sources of pollution often go to their federal, state, or local agencies and say, "We have too many exposures. We have too many pollutants." Oftentimes, environmental regulations are not set up to define cumulative impacts—the interaction of pollutants from multiple sources. The laws regulate pollutants by media and by pollutant type according to federal and state statutes. It's very frustrating for residents when they are experiencing a complex combination of factors that puts them at risk.

Our current environmental laws don't have a way to characterize those risks nor to include them in the decisionmaking processes for things like permitting new pollution sources or regulating those sources. It's definitely been an issue that has fallen through the regulatory cracks. It's an issue that agencies increasingly are aware of and have studied, but they've not yet created the legal and regulatory tools to address these cumulative impacts affirmatively.

In May 2022, EPA put out a report and an addendum that looks at the agency's legal authority to address cumulative impacts under current laws and statutes. In this report, EPA tried to distinguish where they have discretion and where they have an opportunity to consider cumulative impacts in the context of various types of decisionmaking settings. The document makes clear that these legal reviews are not meant to provide specific action on specific decisions. Those decisions are left to EPA offices, EPA programs, and the states.

I feel like permitting doesn't get enough attention, especially in environmental justice policy conversations. Can you talk about how permitting works and the important role of state agencies in this process?

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The laws regulate pollutants by media and by pollutant type according to federal and state statutes. It's very frustrating for residents when they are experiencing a complex combination of factors that puts them at risk.

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I have to emphasize how important permitting is. For many environmental justice communities and organizations, permitting is the bread and butter of many of the conflicts and fights that they engage in to protect their communities. Environmental justice communities have been grappling with permitting decisions for decades and oftentimes hit a brick wall, because no path forward exists to ensure that permitting considers cumulative impacts.

Permitting in the environmental context has continued to maintain and entrench patterns of environmental racism. We see a clear co-location of polluting industries in communities of color, Indigenous communities, and low-wealth communities. Permitting is one of the ways that those patterns continue to be entrenched, because permitting doesn't take into consideration historical patterns of land use that originally segregated these communities and created concentrated pockets of industries.

Environmental laws generally are the purview of the federal government and state governments. Most environmental laws, like the Clean Air Act, are passed at the federal level, while others are delegated to the states to carry out. States most often are the legal entities that issue permits under their own legislation. States can adapt and create their own version of the Clean Air Act that originally was delegated to them under federal laws.

Even though EPA sets the floor—in other words, the federal Clean Air Act is the minimum that states must implement—many states have the discretion to go beyond EPA's laws and federal laws. States have a lot of discretion in the level of enforcement and scrutiny that they can apply to their authority to permit industries. Some states go far beyond the stipulations of the federal laws, but many states barely implement the minimum federal requirements. We see quite a difference among states in terms of how they apply permitting.

Your report provides an overview of what's happening among the states, including a detailed online tool that accompanies

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Communities don't want to wait for the perfect modeling and all the years and decades that science takes to study the problem. They want to have a bias toward action and push more definitive regulatory and protective approaches for communities.

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the report, with links to peer-reviewed studies and pieces of legislation. It's a good resource. Can you say more about what you found on the differences across the states and if states are trying to address cumulative impacts?

The effort to pull together this tool and resource that the report highlights came out of requests from environmental justice advocates in different states who are pushing cumulative-impacts approaches in their own states. They are having a hard time coming up with a methodology or model legislation, because no clear, standard set of guidance exists for across the United States.

So, we looked at where states are implementing or trying to implement cumulative-impacts approaches either through legislation, agency policy, or guidance documents. We took a broad look at how states are defining cumulative impacts, what kinds of methodologies or mapping tools they're creating, and how they're fleshing out the particular issues in their own states and communities.

We found that, in the last five years alone, there's been a huge uptick in legislative activity at the state level with respect to cumulative impacts. Several laws have been proposed—and some actually passed—in places like New York, New Jersey, and California. Many states are passing cumulative-impacts laws, and many states are proposing them, even though they're not getting passed or enacted. There's a big push from the environmental justice movement to advance cumulative impacts more forcefully.

The report also shows that, prior to the last few years, much of the cumulative-impacts work was happening in the form of studies, mapping, or guidance documents. The problem was being studied a lot. Jump to today, where we see states taking a much more proactive approach to enact actual cumulative-impacts mechanisms, which includes decisionmaking mechanisms. Communities don't want to wait for the perfect modeling and all the years and decades that science takes to study the problem. They want to have a bias toward action and push more definitive regulatory and protective approaches for communities.

Your home state of New Jersey seems to be at the forefront. In the latter part of 2020, the state passed a cumulative-impacts law. Long years of work elapsed to get this piece into legislation, in which you played a role. Can you describe what the law does and where things currently stand in implementing the law?

The law that passed in 2020 was almost a decade in the making. Environmental justice advocates in the state—groups such as Ironbound Community Corporation and the New Jersey Environmental Justice Alliance (of which I am a very active member)—had been pushing for an approach to cumulative impacts within our state regulatory agencies for a long time. Sometimes the political opportunity, interest, or will just was not there to pass a more aggressive law, but we continued in our efforts to develop strategies for approaching cumulative impacts.

Along the way, many people told us that this was impossible, that we don't know how to do cumulative-impacts policy, and that it's never been done. Not to be discouraged, we pushed on, and we found a wonderful champion in

Senator Troy Singleton (D-NJ), who is a New Jersey legislator. Senator Singleton championed this bill and entrusted environmental justice advocates to become thought partners and thought leaders alongside him and the New Jersey Department of Environmental Protection, with whom we worked closely to develop a specific law.

The law sets out which communities are environmental justice communities or, as the law defines them, "overburdened communities." The law makes this classification by looking at the percentage of people of color, low-income people, and linguistically isolated people across every census block of the state and sets a threshold that is around the state average. Community census blocks above that state average are considered overburdened, or environmental justice communities.

The law has a set of facilities and a set of permits—mostly major permits, such as air-quality permits and anything related to waste or hazardous waste. Eight different types of facilities and several different types of major permits trigger this law. For example, if you're an applicant seeking a permit (like an air permit

that falls under Title V of the Clean Air Act) in an overburdened community census-block group, you will be subject to the law and have to prepare an environmental justice impact statement.

How they prepare the cumulative-impacts assessment is a bit complicated and technical. The state developed a set of 23 stressors, looked at the levels of those stressors in overburdened communities versus non-overburdened communities, and set a 50 percent threshold. If an industry will be located in a community where those stressors are above the state average for non-overburdened communities, then the industry would be considered as causing or contributing to adverse environmental health and public health stressors. The state then must deny the permit. The legislation requires the state to say no to industries that will contribute any absolute amount of pollution in a community that's already experiencing above-average stressors.

The law also applies to renewals of permits. It allows the state to specify mitigating factors as conditions for existing permits at the time of renewal. This was the first and only law, until

New York recently passed their law, which requires the state to say no on the basis of cumulative-impacts considerations.

Recently, the public comment period was introduced. We submitted comments on the rules. Often people think, "Oh, the law is passed; we're done." But it took us two years to go through the rulemaking process, which is the technical process for how the state will implement the law. Those rules are important, because they detail exactly how cumulative impacts will be determined, and they define all the parameters that the state will use to do those reviews. [The rule has since been finalized and enacted, as of April 2023.]

How much pushback did you get from industry through all of this?

If you're not getting pushback or opposition to your rule, it's probably a bad sign that your rule is not strong. I took it as a good sign that we had significant industry opposition to the rule. They made many claims about how this rule is going to kill business in distressed communities, that it's going to push industries completely out of the state, and that it's too restrictive. Industry voiced a lot of concerns and opposition, many of which I think are largely exaggerated.

Many of the complaints reflect the attitude that we need these environmental justice communities as dumping sites. Without the ability to continue to place and concentrate pollution in these communities, the industries feel threatened—instead of thinking about how we can mitigate what we're doing or how we can distribute pollutants from these industries to other places. The response was telling, but very expected.

We also had opposition from labor unions that were being pushed by industries to make claims that this rule would kill union construction jobs. For the most part, many of the facilities that are covered by the law have little job potential, especially for local economies and local communities, other than construction permits. The law doesn't apply universally to every kind of facility type. It's narrowly focused on industries that are most impactful and polluting. We anticipated the pushback, we got

it, and we think we will continue to get industry opposition as the state denies permits.

I've heard people say that health-risk assessments, which underpin EPA regulatory impact analysis and guide policy, often are focused on a single pollutant. Your comment earlier suggests that we need to move on from that method of regulation. What research needs to be done around this topic? What gaps need to be filled?

We still have a lot of work to do; for example, evaluating the benefits of cumulative-impacts interventions. What is the value of different types of approaches? When we say no to permits, do the facilities move to other places and have similar impacts? Do we see conditions for mitigating impacts in communities?

We have good data on things like air quality, density of permits, and facilities. But we still don't know how to integrate qualitative local forms of information about stressors into quantitative cumulative impacts, assessments, and tools. We have gaps in knowledge about local conditions, which could make a big difference to community stressors and which are important to the health and well-being of local areas. We also don't have a lot of experience with integrating different types of data into cumulative-impacts analyses—things like participatory science and traditional ecological knowledge.

There's great science being done to get a better sense of community-level and personal exposure to nonchemical and chemical stressors. We know that communities that are most vulnerable to pollution also are facing circumstances of chronic stress; uncertain housing conditions; lack of access to public health care; and, increasingly, climate change–related risks. How do these things combine to heighten the impacts or risks from things like air pollution?

There's a lot that we can explore and better refine, because the reality is that our cumulative-impacts tools probably just are scratching the surface of what the real impact is on communities. Our tool likely is wildly underestimating how burdened communities are, but we also can't wait for the perfect methods of measurement. Improvements to the tool are important in parallel with taking action. ■

> "There's a lot that we can explore and better refine, because the reality is that our cumulative-impacts tools probably just are scratching the surface of what the real impact is on communities."

Left Traffic and haze on the Walt Whitman Bridge, which connects the New Jersey suburbs to South Philadelphia

Dick Swanson / US National Archives

Play It Again …

Hear more of the details about cumulative impacts that couldn't fit on the page, straight from Ana Baptista, by listening to the full podcast episode:

#MyResources
Spirit Week Photo Contest

One way staff at Resources for the Future (RFF) celebrated RFF's 70th anniversary was through "Spirit Week," five days that were packed with festive activities, including a game night, book discussion, and environmental film screening.

The highlight of the week was a photo contest, for which colleagues were asked to submit their best environmental photographs in three categories: Nature, Family & Friends, and Grab Bag. Winners were chosen through secret ballot. Turns out that we have many talented photographers on staff! This just might become an annual tradition.

—Carlin Anderson
Director of development operations and analytics
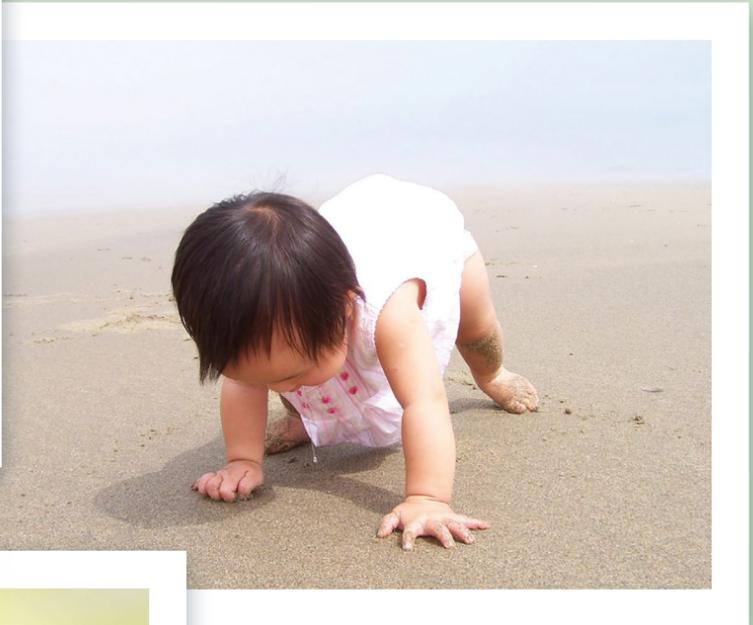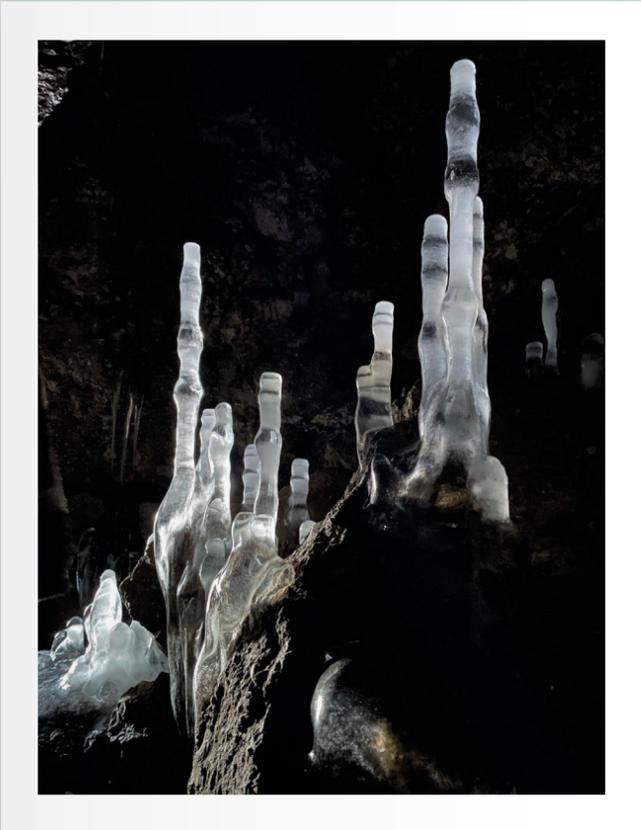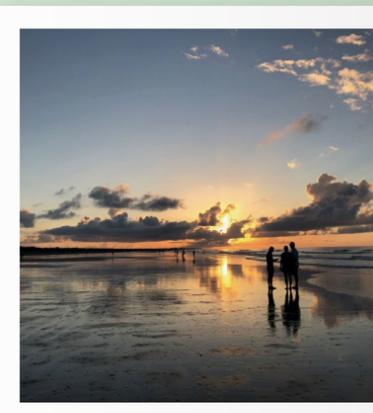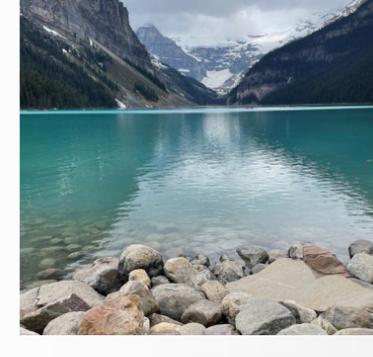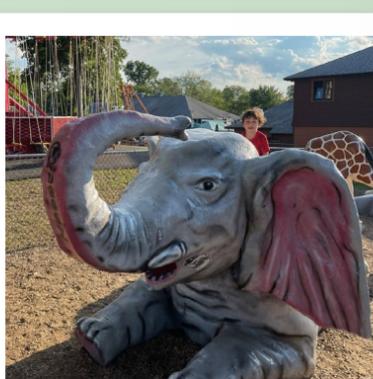
◄ **WINNER**

Sally Robson, Research analyst
Nature

Ice stalagmites formed from water dripping down cave walls in the Horse Caves of Granby, Massachusetts. The Horse Caves are a part of the Mount Holyoke Range, which is full of hidden gems in every season.

▲ **WINNER**

James Boyd, Associate VP for research and policy engagement; senior fellow
Family & Friends

My daughter's first birthday and her first day at the beach. An enduring love was born and a special memory for me. Seawall Beach Maine, with mist blending sea and sand.

◄ **WINNER**

Matt Fleck, Staff writer and reporter
Grab Bag

A former internship sent me to Cincinnati, Ohio, for half a year—long enough to appreciate the region, brief enough to keep the wonder that led me to imagine fish "flying" in a stagnant pond.

Achieving Justice by Putting Vulnerable Communities on the Map

University Fellow Eric Tate talks about his ongoing work to help prioritize communities that can benefit the most from federal investments.

IN CONVERSATION Eric Tate and Elizabeth Wason   **ILLUSTRATION** Jones & Co

Eric Tate, a university fellow at Resources for the Future and professor at Princeton University, studies social vulnerability to disasters, especially floods. He looks at how a population's geographic place and socioeconomic status affect how vulnerable they are to disasters and their likelihood of recovering from catastrophic events.

Right now, Tate is working with a group at the National Academies of Sciences, Engineering, and Medicine to analyze how mapping environmental information and demographic data can help the federal government prioritize support for communities that can benefit most. In particular, the group is looking at a screening tool that launched last year as a beta version by the White House, called the Climate and Economic Justice Screening Tool. The aim of the tool is to help meet the goals of the Biden administration's Justice40 Initiative, a whole-of-government strategy to ensure that 40 percent of certain federal investments benefit disadvantaged communities.

Resources: **What are screening tools, and what goes into building them?**

Eric Tate: Some of the problems we're currently dealing with—whether they're about climate adaptation, disproportionate pollution exposure, or other issues—have to do with environmental hazards, environmental justice, and social vulnerability. These topics are the focus of my research. So many different problems can lead to adverse outcomes, and so many different solutions are possible.

Ideally, we want to tailor each solution to each problem—but first, we need to understand where the problem is and how bad it is. The focus of these screening tools is to give a first-cut understanding of how severe the issues are and where they're spatially concentrated. Just by looking at a screening tool, you may not know exactly what to do to fix things, but you probably could understand, for example, some places to focus efforts toward investigating issues and finding solutions.

What goes into these screening tools, ideally, are data that the modeler of the tool believes is going to best reflect the process they're trying to understand. For example, take social vulnerability to hazards: Many disaster case studies have sought to understand which populations are most adversely affected in which situations. When you're building a screening tool, you can rely on that kind of understanding to select the variables that are most relevant. Likewise, for environmental justice screening tools, you can include information about the sources of disproportionate environmental exposures and who is most affected.

To build one of these screening tools, you should understand what's driving the inequity, decide on the purpose of the tool, and then select and combine data accordingly.

How are screening tools being used to achieve Justice40?

Executive Order 14008, called Tackling the Climate Crisis at Home and Abroad, came out in January 2021. It calls for the development of an environmental justice screening tool. The idea is to identify a subset of places in the country where the federal government will try to realize 40 percent of the benefits that derive from investments in mitigating pollution and improving energy, water, and transportation systems. Without the screening tool, we won't have a systematic idea of where those places are. Identifying the places where we should make federal investments is the main point of the screening tool for Justice40.

What are you doing with the committee you're co-chairing at the National Academies? Can you describe the Climate and Economic Justice Screening Tool that's been created by the Council on Economic Quality and how it works? How does it compare to other screening tools?

The Climate and Economic Justice Screening Tool (CEJST) from the Council on Environmental Quality was released as a beta version in May 2022. Then, the council released version 1.0 in November last year. This latest iteration is the operational version that agencies are being asked to use. They're open to refining it, so one of the things our committee will do is give them some guidance.

For our official charge, the first thing they want us to do is review the other tools that already exist. We'll ultimately focus on the CEJST, but first, we'll look at other tools out there that serve a similar purpose: how they're built, how they work, their quality, their spatial resolution. A tool is more than just its input data. You could have the same data as I do and come up with a totally different model.

For the CEJST, the federal government wants a spatial definition of what a disadvantaged community is, because they're going to focus

Justice40 investments in those disadvantaged communities. The job of our committee is to figure out how the CEJST compares to other environmental justice screening tools, what data should be incorporated, and how to combine all the information to get the information that federal agencies will need. We'll provide recommendations to the White House Council on Environmental Quality for how the CEJST can work well.

The CEJST is built at the national level at the census-tract scale of geography; by delineating these tracts, the US Census Bureau subdivides areas for statistical purposes. It focuses on eight different dimensions of climate, energy, and pollution hazards, which are separated into categories that are themes of exposure or environmental burden. Across these eight categories, about 29 specific indicators describe the hazards and burdens, which are themes, too, like the economic risk of wildfire or flooding, or the expected number of fatalities and injuries. This is some of the "internal wiring," or internal structure, of the CEJST.

So, if any of these census tracts has a high value for any of these indicators of environmental exposure, which the CEJST typically defines as above the 90th percentile, along with high rates of low-income households, then they get a check mark. They've qualified to be tagged in the CEJST as a disadvantaged community. That's what the model outputs, so federal agencies can use the CEJST as a principal screening tool.

And the different federal agencies often have their own different screening tools. The Council on Environmental Quality coordinates across agencies, so the CEJST is broad and serves as a first cut for all the agencies. But the mission of the US Environmental Protection Agency is to protect human health and the environment—so, their screening might focus on specific environmental toxins and hazards in populations. The US Department of Transportation might consider barriers to transportation access. The US Department of Energy will focus on other things that the other agencies aren't looking at. Each agency will include indicators of environmental burden that are associated with their mission. So, screening tools specific to each agency may be a little different, while the CEJST is

> **The idea is to identify a subset of places in the country where the federal government will try to realize 40 percent of the benefits that derive from investments in mitigating pollution and improving energy, water, and transportation systems.**

meant to reflect a broader, greater breadth of environmental exposures.

What are two or three challenges that you're most looking forward to tackling with the CEJST?

Some organizations have critiqued the CEJST because, for instance, the tool doesn't consider race—even though race is the most explanatory variable for disproportionate environmental exposures in this country.

Others have said that exceeding just one of the indicators means that a census tract gets tagged as a disadvantaged community. But what if a community exceeds the threshold for more than one of these indicators and, in some cases, many more than just one? The CEJST doesn't differentiate among those cases in designating a community as disadvantaged.

Mostly, I think the challenges for the committee are related to the fundamental statement of task. How can we best assess the state of knowledge, and how much does the CEJST align with other screening tools? What are the best practices for building these tools?

A whole field exists for constructing indicators. We're actually used to seeing these types of indicators or indices. We may not think about them as indices, but we see them online, in terms of the top 10 colleges, the 15 best places to live, or the top 10 soccer teams in the world— these are all indices. They take indicators that measure what's good in soccer; for instance, What's your win-loss record? How well have you done in high-profile games? What's the margin of victory? They put these variables together somehow, and they get one number, which ranks the teams. That's what's happening with the CEJST and other screening tools, as well.

The challenges involve marrying these ideas of indicator construction with our understanding of environmental justice and injustice, climate injustice, transportation, and all these things.

One could argue for the benefits of standardized screening tools—but on the other hand, a screening tool that's tailored specifically to a certain region or sector (like energy or transportation) could be even

> **The challenges involve marrying these ideas of indicator construction with our understanding of environmental justice and injustice, climate injustice, transportation, and all these things.**

better. Do you think a single tool makes sense for every federal agency? Or would using specialized tools be better?

It depends on what the objective is. Instead of adopting a single-tool strategy, the Biden administration is saying that the CEJST should be used by the federal government to define disadvantaged communities for Justice40. But federal agencies are free to and already are developing agency-specific tools that are aligned with their mission; they can use agency-specific tools to figure out what solutions are most germane for their agency.

The objective of locating disadvantaged communities is a different objective than locating the greatest risks, which may be different from locating the populations that are most disenfranchised (something I do in a lot of social-vulnerability indices for my hazards research), which may be different from locating the greatest needs, which may be different from identifying where we should invest. With this proliferation of screening tools, some people are getting lost and thinking, "Not another tool!"

But I think the best tools are going to be clear on the objectives for their use. There can be danger in thinking that one tool will work for everything; I don't necessarily think that's a great idea.

States and cities have been developing their own screening tools, which incorporate various kinds of local data. What do you think of these?

I think it's a great idea. Those tools can reflect the local context for values and priorities. For instance, California has CalEnviroScreen, and Maryland has MD EJSCREEN. The demographic characteristics, dominant industries, and risks in California are, in many cases, quite different than those in Maryland. State-specific and theme-specific tools can pick up these differences.

We can take an example from a paper I'm working on right now on social vulnerability to floods. Let's take the Los Angeles metropolitan area. Reducing vulnerabilities will need to be a little bit tailored to what's going on in the Los Angeles area. The populations that are highly vulnerable in Los Angeles may be

different than the metro area of Houston. They both might have high vulnerability, but in one place, maybe the exposure is driven by a combination of insufficient health insurance and linguistic isolation, whereas in another place, the exposure is due to poverty and racial discrimination. So, both locations may be highly vulnerable, but you'll likely want to have different interventions in these places.

The screening step gets you to look at these places. And the second step involves determining what we're going to do about the issues there, which needs to be driven by the context of how this vulnerability came to be and the local geographies, actors, and capabilities in that local area.

I think creating state-level screening tools is good because, ultimately, the value in these tools is in understanding more about how inequities work—how they're produced, how they're reproduced, what their effects are, and what to do about them. It's sometimes hard to understand that until you're looking at specific places. And I think these tools help identify these places. And ideally, if people are curious or really want to solve problems, the next question is what we can do about it. If we don't understand why, then I don't think we're ever going to have effective solutions.

Would you like to add anything about how your research intersects with environmental justice? What are some of the touchstones and goals that guide your work?

Thinking about vulnerability to natural hazards involves a lot of overlap with environmental justice. It's just that, traditionally, environmental justice tends to focus on anthropogenic hazards like pollution, while natural hazards focus on things like heat, floods, and earthquakes. But if you start thinking about why people are vulnerable, or why some groups are more affected than others, the focus becomes not on the hazards themselves, but on our social structures that enable hazards to become disasters.

How have we arranged ourselves as a society, so that some groups persistently are more affected than others? It's not an accident. This is how we've built things. Whether intentional or not, this is how we've designed things.

I used to be an engineer; I studied floods. I spent six years working as a contractor for the US Federal Emergency Management Agency building a flood-risk model called Hazus. When we thought about floods, we'd ask, Where is the rain coming down hardest? How is the water running off into streams? How fast is the water moving? How deep is it? How is the flood affecting bridges and buildings? We focused on natural science and engineering to examine the problem. This focus aligns with the largely traditional viewpoint that physical processes drive problems. But when we think about environmental justice or social vulnerability, we also think about societal disparities in who is affected as sources of the problem.

The federal government mostly consists of people who are in the physical sciences or engineering when it comes to environmental hazards. Only in the past five years or so, efforts like the CEJST have put a spotlight on social characteristics. And the more we dig into environmental justice, social vulnerability to hazards, and disproportionate human impacts, the more we will see that social processes drive or work in concert to produce these problems. Depending on how people diagnose the source of a problem, they'll tackle the problem very differently.

A big campaign in disaster research encourages people to not use the term "natural disaster." Starting roughly in the 1970s, people began to understand that most major disasters aren't "natural." Yes, we see a lot of rain or a big wildfire—but people decided to build there. Discrimination and exclusion have restricted certain populations to be more represented in floodplains and high-risk areas. Those aren't natural processes at all.

So, how are we going to understand disproportionate exposure to pollution hazards and natural hazards by focusing on the hazards themselves? We'd never truly understand, because these issues aren't due to natural systems. The consequences of hazards often are driven by human decisions—our decisions. In fact, the results are almost predictable by the way we organize society. If we pay more attention to the interactions of social and physical factors, then we'll get more to the heart of the problem, and then I think we can arrive at more sustainable solutions. ∎

How have we arranged ourselves as a society, so that some groups persistently are more affected than others? It's not an accident.

Left Floodwaters rise around houses in Austin, Texas.

RoschetzkyIstockPhoto / Getty Images

Eric Tate is a university fellow at Resources for the Future and a professor at Princeton University. **Elizabeth Wason** is senior manager, editorial, on the communications team at Resources for the Future.

RESOURCES FOR THE FUTURE WELCOMES THREE NEW FELLOWS

Resources for the Future welcomes three new fellows to the research team whose work spans electricity markets, international climate policy, state and local policies, and environmental justice: Jenya Kahn-Lang, Milan Elkerbout, and Suzanne Russo.

TEXT Matt Fleck   **ILLUSTRATIONS** James Round

As climate and energy issues evolve over time, research at Resources for the Future (RFF) likewise evolves to meet those challenges—which includes building up our team of scholars. In recent years, RFF has heightened its focus on environmental justice and on the tricky challenges of the energy transition, such as decarbonizing heavy industry.

Bearing expertise in these fields and more, new RFF Fellows Suzanne Russo and Milan Elkerbout have joined this fall, and Jenya Kahn-Lang will join in 2024. Let's take a look at how these new fellows may inform policy and the field of environmental economics as they start their work at RFF.

JENYA KAHN-LANG

Before finishing her PhD in May 2023, Jenya Kahn-Lang already was making news with her research. A pair of articles published last spring cited Kahn-Lang's study on price discrimination in residential electricity markets in Baltimore, Maryland. Energy suppliers in the city may have targeted their marketing toward lower-income households, resulting in higher electricity prices for those households.

To uncover these pricing inequities in Baltimore, Kahn-Lang collected consumer data, surveyed electricity ratepayers, and modeled the electricity market. The data suggest a few explanations. Unlike most US states, Maryland's electricity market includes multiple firms that supply electricity to consumers. Higher-income households tend to find and choose options that are less expensive, perhaps because these households can afford to spend the time to search for better deals. Once households become customers at one firm or another, lower-income households may be less likely to monitor monthly price changes. Firms that raise rates after a few months tend to retain lower-income households that don't notice the increase, while higher-income consumers more often change electricity providers.

Lower-income households may be more likely to buy electricity from firms that raise rates over time, in part because these firms target their in-person marketing efforts at those households. Lower-income households tend to be closer together, so these efforts cost less for firms. The result? "More households in those areas are signing up through direct marketing, and they sign up at relatively high prices when they do," Kahn-Lang says in an article for Inside Climate News.

This work on pricing inequities reflects Kahn-Lang's interest in energy justice, which she plans to explore in her research at RFF. Kahn-Lang draws on five years of experience consulting for state agencies and electric utilities; she's built a wide network of contacts in industry and government.

"Above all, I aim to impact energy and environmental policy through rigorous economic research," she says. "This goal aligns exactly with what RFF is built to do, and I'm especially excited to work with policy leaders and help grow RFF's Environmental Justice Initiative to advance an equitable climate transition."

Kahn-Lang earned her PhD from the University of California, Berkeley, and currently works as a postdoctoral researcher at Stanford University, where she's spending half her time engaging with RFF researchers.

" **I'm especially excited to work with policy leaders and help grow RFF's Environmental Justice Initiative to advance an equitable climate transition.** "

I nitially, Milan Elkerbout had the longest commute of the new fellows, relocating from Brussels, Belgium, to Washington, DC. He worked for almost a decade at the Centre for European Policy Studies, most recently as the head of its climate policy program. Elkerbout's research on EU climate policy has earned attention from policymakers. In 2022, the European Parliament commissioned Elkerbout to coauthor a report on the extent to which the Fit for 55 package (the bloc's signature set of climate policies) addresses gender equity.

Recent US climate policy drew Elkerbout's attention from Brussels across the Atlantic, and his experience with EU policy is a welcome addition to RFF's International Climate Policy Initiative. "With the adoption of the Inflation Reduction Act, I believe that the United States can become the driving force for industrial decarbonization across the globe," Elkerbout says. The Inflation Reduction Act, which became law in 2022, contains provisions that aim to decarbonize industries, such as steel and cement, that historically have relied on carbon-intensive technologies.

Elkerbout has worked on the implementation of low-carbon technologies with stakeholders in the steel and cement industries. He is

wrapping up a project on the potential for carbon capture, utilization, and storage in the steel industry, and he recently completed an analysis on the development of clean hydrogen (produced using renewable energy) in the European Union. Tax credits in the Inflation Reduction Act incentivize both carbon capture and clean hydrogen, and RFF in the past year has prioritized research on these technologies.

Elkerbout has closely followed the European Union's response to the Inflation Reduction Act, as well. Last winter, the European Union proposed its Green Deal Industrial Plan, which aims to boost the bloc's domestic clean energy industry. "We [wouldn't] have these proposals without the shock and awe triggered by [the Inflation Reduction Act's] generous subsidies," Elkerbout says in an article he published with the Centre for European Policy Studies.

At RFF, Elkerbout looks forward to informing policies on both sides of the Atlantic, particularly around industrial decarbonization and trade. "With geopolitical volatility, energy crises, and accelerating climate change, contributing to effective and efficient climate policy on both sides of the Atlantic never has been more important, nor more interesting," he says.

> " **With geopolitical volatility, energy crises, and accelerating climate change, contributing to effective and efficient climate policy on both sides of the Atlantic never has been more important.** "

S uzanne Russo has built her career around communities—what climate policy and sustainability look like for households and neighborhoods. After earning a master's degree in community and regional planning from the University of Texas in 2007, she joined the New York City Department of Housing Preservation and Development. When the city experienced a slew of foreclosures in 2008 as the housing bubble burst and the financial crisis hit, Russo discovered that some households that were at risk of foreclosure found themselves choosing between paying mortgages or their energy bills.

"[These households] ended up foreclosing, because you can't live without power," Russo says on the *Climate Champions* podcast. "If we can get energy bills more affordable—if we can tackle energy efficiency and housing—we can help make living more affordable."

Russo organized a team of researchers that collected data on energy poverty in the city and recommended investments in energy efficiency and affordable housing. City officials bought in and developed a set of policies to bolster residential energy efficiency. The experience convinced Russo of the value of community-level data, both as a tool to demonstrate that a problem exists and to inform potential solutions.

Pecan Street, the nonprofit at which Russo served as CEO before joining RFF and still serves as a board member, embodies this devotion to data. The organization collaborates with households and communities to measure home energy use and generation (for households with rooftop solar) and then provides that data to researchers and firms. Under Russo's leadership, Pecan Street expanded from collecting only energy data to also collecting data on water consumption, transportation, and agriculture.

Russo also established the Center for Race, Energy, and Climate Justice at Pecan Street to help ensure that benefits from climate solutions can accrue to communities that historically have been marginalized. "Equal access to energy (and its many benefits) is a fundamental tenet of equity in a modern economy," says Russo in a case study she published on race and energy.

Russo joined RFF in September and will work on state and local policies, environmental justice, energy efficiency in buildings, and electricity markets. "The technologies that we need exist, or are close to existing," says Russo. "Now, we have to get the policy right. As the country decarbonizes, I'm excited to be close to the policy world at RFF and contribute to a broader understanding of climate solutions and the economic pathways that produce equitable outcomes across society." ▪

> " **I'm excited to be close to the policy world at RFF and contribute to a broader understanding of climate solutions and the economic pathways that produce equitable outcomes across society.** "

Sailing Uncharted Waters

International Trade Becomes an Element of Climate Policy

by Ray Kopp, Kevin Rennert, and Billy Pizer

The European Union has launched its Carbon Border Adjustment Mechanism as a way of extending its domestic climate policy to the international trade system. But aligning climate policy with international trade comes with complications.

Image *SHansche / Getty Images*

O ctober saw the introduction of the European Union Carbon Border Adjustment Mechanism (CBAM). The CBAM law marks the first time a group of nations have imposed their domestic climate policy on other nations. The law requires importers to purchase EU Emissions Trading System allowances equal to the amount of carbon embedded in the products they wish to import into the European Union. If an importer that's covered by the CBAM can demonstrate that the manufacturing sector of the country of origin has a carbon price that's equal to the price of an EU allowance, then the cost of the allowance purchase will be rebated to the importer. Although the European Union holds the position that the CBAM is not an international trade policy, but rather an extension of its domestic emissions trading system, many exporting nations instead consider the CBAM to be a straight-up tariff on embedded carbon.

The CBAM is a member of a class of policies called carbon border adjustments (CBAs). CBAs are fees imposed on the imports of commodities and products based on the quantity of greenhouse gases (GHGs) that are emitted during the production process. The purpose of a CBA is to allow producers that are located in countries with highly ambitious climate goals to remain competitive in their domestic markets against imports from less-regulated jurisdictions and to prevent emissions from "leaking" out of the ambitious jurisdiction.

While not a new idea, CBAs have not been part of the actual climate and international-trade policy mix until now. Motivated by similar issues of domestic competitiveness that gave rise to the CBAM, multiple CBA bills have been introduced and are under development in the US Senate. Little to no historical evidence exists to help us understand the efficacy of such trade policies on competitiveness or emissions, the tractability of their implementation, and the impact of such policies on the global system of rules-based trade and the welfare of developing nations. These are uncharted waters in which the European Union and US Senate are sailing to address international competition and emissions leakage. Though the course is complex and without precedent, CBAs remain as the primary option, given that the preferred course—globally harmonized emissions policies—have continued to prove elusive.

Efficacy

C arbon border adjustment policies can have at least three climate-related goals. The goal one hears most often is to protect domestic industries that are competitive and subject to ambitious climate policies. Protecting competitiveness translates into preventing the export of domestic industries and employment to nations that have less ambitious climate policies. A second goal is to reduce the "consumption" of carbon that's contained in imported products. Over the past decade, countries with ambitious climate policies have reduced the emissions from their domestic manufacturing sectors, only to have those reductions offset by emissions from less ambitious countries and carbon that's embodied in products which get exported back to high-ambition countries. This phenomenon has come to be known as carbon leakage, or the "carbon loophole." A third goal is to encourage global ambition by creating incentives for nations with less ambitious policies to strengthen their policies and thereby avoid the CBA charged on their exports.

Protecting domestic industries from international competition is not a new policy. In fact, this type of policy often is associated with tariffs imposed on primary commodities and manufactured products. The Section 232 tariffs imposed on steel and aluminum during the Trump administration are obvious examples.

The effectiveness of such policies, when measured against the goal of maintaining and perhaps increasing domestic manufacturing activity, is subject to debate. A multitude of reasons help explain why developed countries have lost manufacturing activity over the past several decades. How effective a CBA will be at reversing this trend is yet to be seen. And such policies challenge the traditional role of industrialized nations in promoting rules-based trade and reducing trade barriers.

Addressing the carbon loophole by using a CBA is a matter of targeting specific high-carbon imports and imposing a fee of sufficient magnitude to significantly reduce the importation of those products. This goal of reducing leakage seemingly is more modest and may have a better chance of success. However, consequences still may arise for rules-based trade and the imposition of retaliatory trade measures.

Economic analysis has explored the use of CBAs to incentivize exporting nations that have low ambition to take more aggressive action. Various factors beyond theory and modeling contribute to the development of domestic climate policy; hence, we are unlikely to know the effectiveness of CBAs at incentivizing the adoption of ambitious policy until such policies are in widespread use.

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> " While many greenhouse gas accounting protocols are in use by countries, facilities, and individual firms, none of these protocols are directly relevant to estimates of the greenhouse gas intensity of a specific manufactured product. "

Tractability

A carbon border adjustment is a complex animal that has several design elements and requires many policy decisions. Implementing a CBA requires that policymakers define "embodied carbon" for products that the CBA covers, or more generally, the GHG intensity of those products (the amount of carbon dioxide emitted during production divided by the weight of the product). While many GHG accounting protocols are in use by countries, facilities, and individual firms, none of these protocols are directly relevant to estimates of the GHG intensity of a specific manufactured product.

The accounting protocol for the products that are covered by a CBA must align with the harmonized system, a standardized system of codes that classifies traded products, which is the basis for customs tariffs in over 200 countries and the only option for standardizing GHG intensity. The regulations for implementing the CBAM during its transitional phase are the first attempt at developing formal accounting guidance. A quick review of these regulations reveals that accounting for product-level GHG emissions imposes a not-insignificant burden on the would-be importer (termed the "declarant") of products that the CBAM covers. The significance of the barrier that this accounting poses for imports is unknown at this point.

Linked to the product-level accounting that's required for the harmonized system is the definition of what emissions actually get counted. For example, the emissions accounting could be limited to the direct emissions associated with production at a particular facility, which are known as Scope 1 emissions. The CBAM includes these direct emissions in its definition of GHG intensity. One also can include the emissions associated with the generation of electricity purchased from the grid that's used by the production facility, which are known as Scope 2 emissions. The CBAM also includes these emissions that are associated with purchased power. The last bit of complexity refers to emissions associated with other, non-electricity inputs to the production process; for example, the emissions associated with mining iron ore for producing steel that's subject to the CBAM. These "upstream" emissions are classified as Scope 3. The CBAM does not include any upstream Scope 3 emissions. Estimating the upstream emissions embedded in a product that's subject to a CBA will be quite challenging for the declarant, who may be familiar with the emissions from the production of steel but wholly unfamiliar with the emissions associated with mining iron ore.

Consistency with Rules-Based Trade

Following the end of World War II, the United States and allied nations established the General Agreement on Tariffs and Trade, which went into effect in 1948; this agreement was superseded by the World Trade Organization in 1995. The goal of the General Agreement on Tariffs and Trade, and now the World Trade Organization, was to increase the breadth and depth of international trade by establishing rules to reduce the barriers to trade associated with quotas, tariffs, and direct subsidies. Global trade today is estimated to be 45 times greater than before the establishment of the General Agreement on Tariffs and Trade, and the agreement has been credited with lifting many nations out of poverty due the accelerated global economic growth that resulted.

The introduction of CBAs as a component of climate policy is viewed by many as a violation of rules-based trade, which now is overseen by the World Trade Organization, and could lead to a return to retaliatory tariffs and other trade barriers that diminish the global benefits of trade. While the European Union is adamant that its CBAM is consistent with the rules for trade, we can expect the CBAM to be contested by nations as inconsistent with those rules. Questions of consistency of CBAs with the rules-based trade system will await these inevitable challenges; however, given the current dysfunction of the provisions laid out by the World Trade Organization for settling disputes, we will be waiting quite a while. While we wait, more CBAs are likely to be introduced into the international trade system.

Welfare in Developing Countries

The economic welfare of many developing countries depends on global demand for their commodities and manufactured products. In many cases, the GHG intensity of products from developing countries is greater than the intensity of similar products that are manufactured within fully developed economies. This difference in emissions is to be expected and is reflected in the principle of "common but differentiated responsibilities and respective capabilities" contained within the original drafting of the United Nations Framework Convention on Climate Change (UNFCCC). But exactly how this principle is put into practice, and when developing countries will become sufficiently capable, has remained elusive for the past three decades.

Given the relatively high GHG intensities, especially for primary products like steel, fertilizer, cement, and aluminum, developing countries can expect to face CBAs. A recent study by the World Bank has produced one of the first measures of the economic exposure of developing countries to the CBAM. To no one's surprise, many developing nations have a relatively high exposure. How developed nations with high climate ambition will ameliorate this impact, while at the same time ensuring the efficacy of the CBAs they have developed, remains to be seen.

Raymond J. Kopp is a senior fellow and director of the International Climate Policy Initiative; **Kevin Rennert** is a fellow, director of the Comprehensive Climate Strategies Program, and director of the Federal Climate Policy Initiative; and **Billy Pizer** is the vice president for research and policy engagement at Resources for the Future.

> "The economic welfare of many developing countries depends on global demand for their commodities and manufactured products."

> "How developed nations with high climate ambition will ameliorate this impact, while at the same time ensuring the efficacy of the carbon border adjustments they have developed, remains to be seen."

Charting a Path Forward

We are entering a period in which nations are just beginning to align their climate policies with international trade. We have very little historical experience to help guide this alignment, and we face a good deal of uncertainty over the efficacy of linking these two policy regimes to achieve climate goals. At present, the development and implementation of CBAs is undertaken absent the benefit of mechanisms and venues for communication, collaboration, cooperation, and negotiation among trading partners. Given the potential significance of widespread deployment of CBAs for achieving climate policy goals, and the unfettered operation of the international trade system, one hopes that such mechanisms and venues can be developed, so that CBAs can achieve the desired policy outcomes. ∎

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The Big Picture
Community–Engaged Research in New York City Classrooms

Resources for the Future Fellow and Transportation Program Director Beia Spiller is working with Fordham University and three local community organizations to measure, analyze, and reduce the effects of traffic pollution on classroom air quality and educational outcomes in New York City public schools.

So far, the collaborators on this community-engaged research project have installed weather stations and air-quality monitors inside and outside of 17 schools in all New York boroughs except Staten Island, with an ultimate goal of installing monitoring equipment at 20 schools. Spiller says that they've already noted a strong correlation between indoor and outdoor air quality: students can't just go inside to escape the pollution from roads near their schools. ■

Right
Allard Schager / Getty Images

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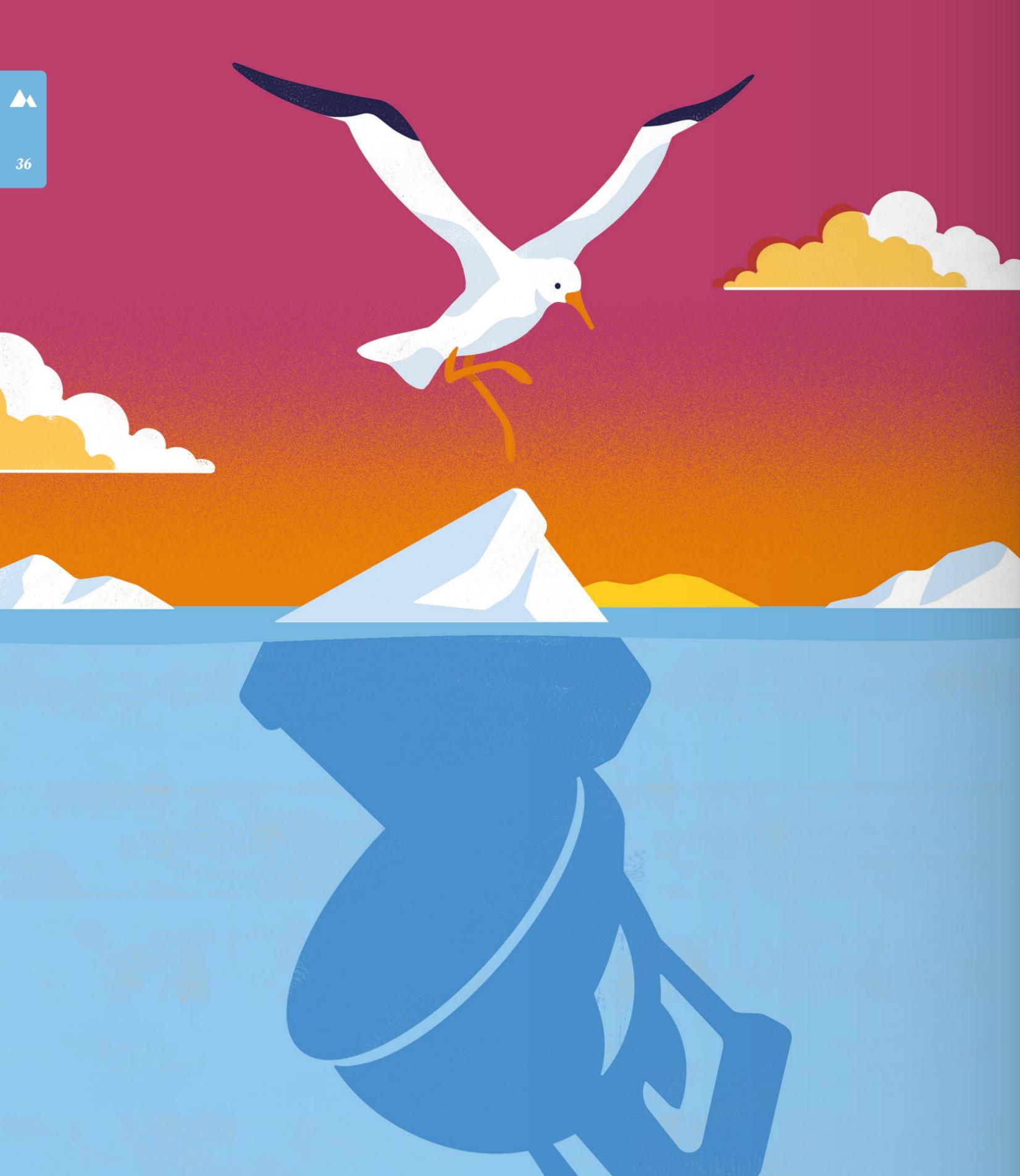
As Sea Levels Rise, So Does Wastewater

Sea level rise poses a threat for waste disposal infrastructure. In houses with septic systems, rising wastewater can cause unhygienic overflows and system failures. More funding and community involvement can help address this expensive, growing problem.

TEXT BY
Margaret Walls, Emma DeAngeli, and Yanjun (Penny) Liao

ILLUSTRATION
Chris Gash

O ne serious manifestation of global climate change, in terms of its insidious destruction of prevailing infrastructure and natural systems, is sea level rise. Average global sea levels have increased by about eight or nine inches since 1880, and scientists expect the rise to continue—and even accelerate in some locations—through the end of the century. Along the contiguous US coastline, sea levels are expected to rise, on average, as much over the next three decades—between 10 and 12 inches—as they have over the last century. With 40 percent of the US population living in coastal counties, sea level rise has potential impacts on a large number of people.

Sea level rise causes myriad problems. It exacerbates tidal flooding and the storm-surge flooding associated with hurricanes, disrupting daily life and damaging property and infrastructure. It also leads to saltwater intrusion into soils, which causes problems for drinking-water aquifers and agriculture. It alters land-cover types: beaches, dunes, salt marshes, and wetlands gradually turn to open water, and neighboring lands may convert from forests or farmland to wetlands. And the rising water table creates problems for the functioning of infrastructure.

One particular type of essential infrastructure that is affected by sea level rise is onsite waste disposal, or septic, systems. Many rural communities are not served by public sewer, and households in those communities must rely on individual, or sometimes community-based, septic systems for waste disposal. According to the US Environmental Protection Agency, more than one in five households in the United States depend on septic systems. That's about 25 million septic systems across the country. A rising water table can make it hard for septic systems in coastal areas to properly drain and filter wastewater, leading to backups of waste into homes and contamination of soils

and waterways. In some regions of the country, including the mid-Atlantic states of Maryland and Virginia, the problem is a growing concern.

Maryland is expecting higher-than-average relative sea level rise, in part due to lands that simultaneously are sinking. More than 260,000 homes have septic systems in the 16 Maryland counties (and Baltimore City) that border the Chesapeake Bay, its major tributaries, and the Atlantic Ocean, making up 24 percent of all properties in the region. In some of these counties, 70 to 90 percent of all homes rely on septic systems. More alarmingly, these septic systems are prevalent in areas that have a high risk of coastal flooding.

Working with an interdisciplinary team of researchers from the University of Maryland and George Mason University, and with a community-based partner, the Southeast Rural Community Assistance Project, we are investigating the extent of the septic problem in coastal areas of Maryland and evaluating solutions through the lenses of environmental justice, infrastructure, public health, and economics. Our research so far shows that, under current conditions, properties with septic systems make up 46 percent of all properties in Maryland that are exposed to a 100-year coastal flood event. And by 2050, the number of properties that are exposed to flooding will increase by 30 percent because of sea level rise, even without the building of more homes. As our research partners investigate the flood issues more carefully through more detailed flood modeling, we may find these numbers change slightly; but the results so far clearly highlight the challenge that state and local governments face. The problem is getting worse, and without attention to it now, it will only become harder to solve.

Three potential solutions are available to address failing septic systems in areas that are subject to persistent flooding and sea level rise: (1) replacing and upgrading to more advanced septic systems, (2) connecting homes to public sewers, or (3) relocating households to less flood-prone areas. The first option is likely to be the least expensive of the three but is a short-term fix in the areas that are most susceptible to sea level rise. While advanced

systems do a better job of reducing nitrogen and phosphorous and are less affected by rising waters, the water table will rise enough in some locations so that no septic system there will work properly in the future. Extending sewer lines to new areas is costly, so unless a home is located in an area that's already served by a sewer system, option (2) may be out of reach for many communities. Option (3), relocation, is extremely costly and politically fraught.

One important consideration is for justice, equity, and deep community involvement to be centered in the solutions. Poorer households in marginalized communities are more likely to have older and/or failing septic systems, experience health effects when those systems fail, and have less money to pay for upgrades and sewer connections. These households need help addressing the problems.

In our research, we mapped the location of septic systems that are at risk of coastal flooding in 2050 due to sea level rise, in conjunction with a measure of social vulnerability at the level of census tracts, which are subdivided areas that the US Census Bureau designates for statistical purposes. The Social Vulnerability Index, constructed by the Centers for Disease Control and Prevention, is created from a combination of 16 variables, including household income, poverty rates, education, race and ethnicity, housing types and costs, and English-language proficiency. The index measures a tract's national rank from least vulnerable (numbers near zero) to most vulnerable (numbers near one). In the map at the right (Figure 1), darker colors represent more vulnerable tracts, and the dots show the location of flood-exposed septic properties, based on our analysis of data from Maryland's MdProperty View database and information on the location of sewer service areas.

Figure 1 highlights a few notable features about septic systems and flooding in Maryland. First, flood-prone septic properties are located all along the Chesapeake Bay and the Atlantic Ocean, as well as inland along some of Maryland's tidal rivers. Second, the east side of the Chesapeake Bay, Maryland's so-called "Eastern Shore," is home to the most septic-dependent properties that also are subject to flood risks. Many of the lands on the Eastern Shore are low lying and flood
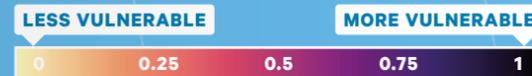
" One important consideration is for justice, equity, and deep community involvement to be centered in the solutions. "

FIGURE 1

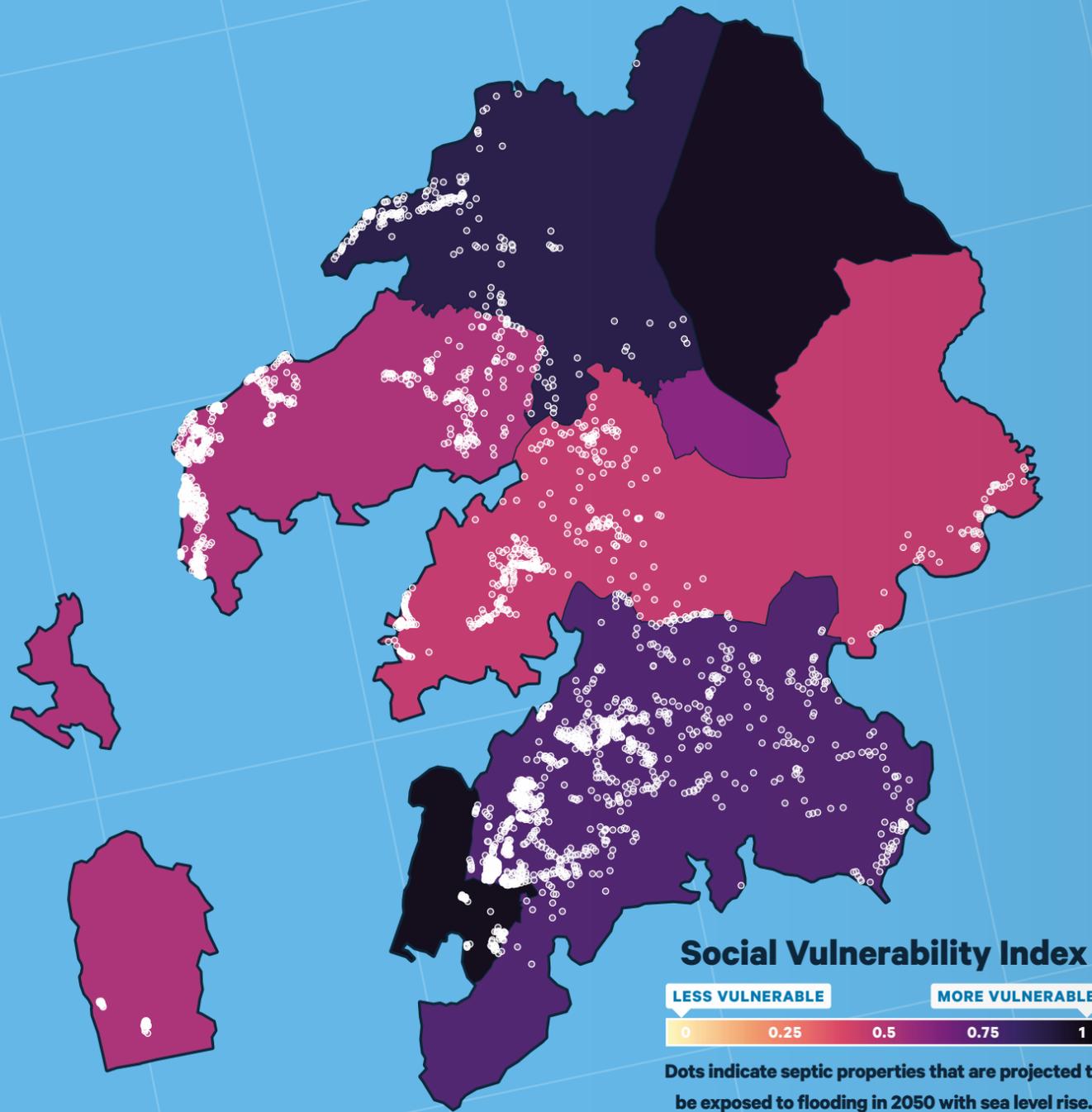## Social Vulnerability and the Location of Flood-Exposed Septic Properties
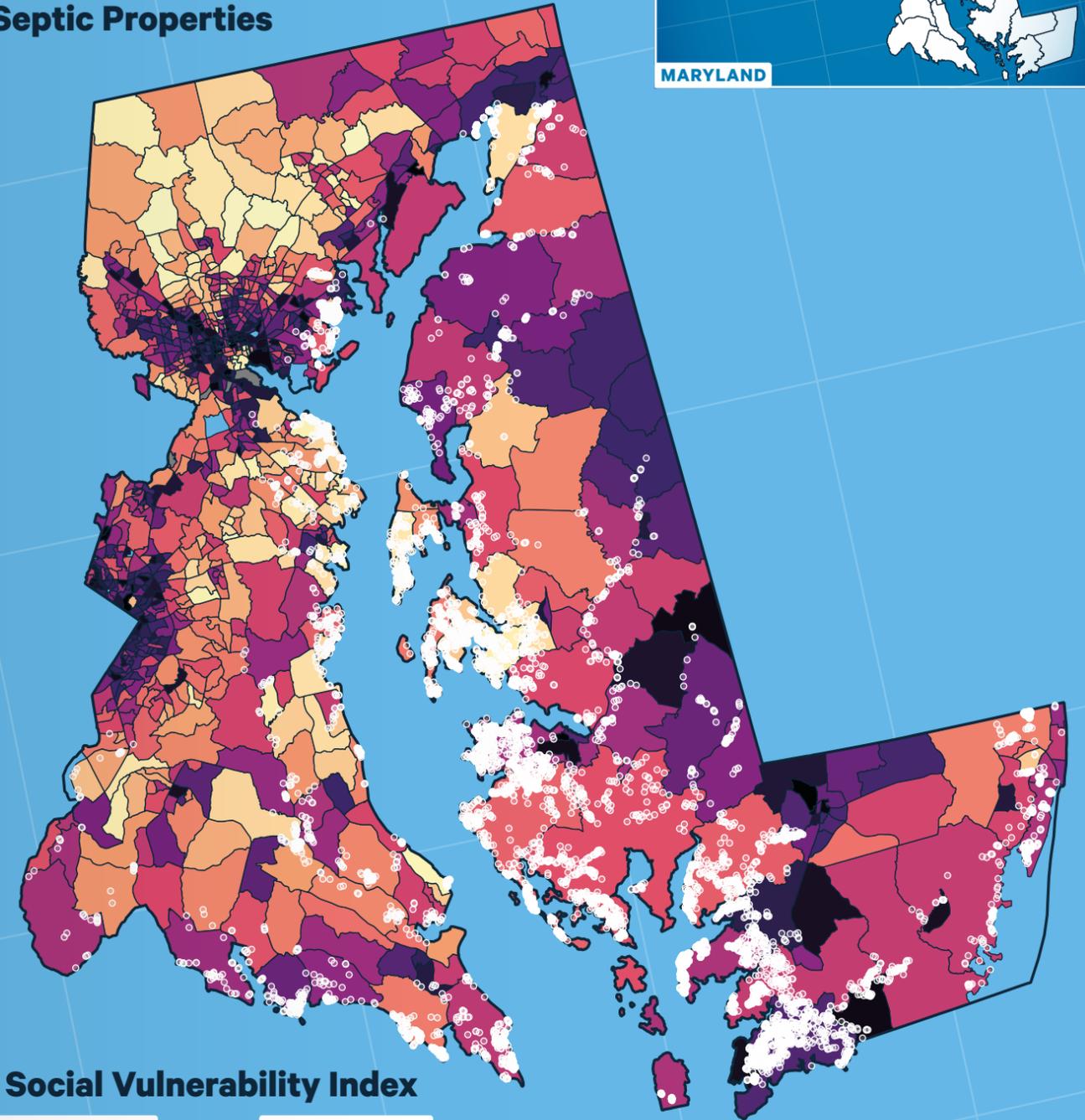
MARYLAND

Social Vulnerability Index

LESS VULNERABLE — MORE VULNERABLE

| 0 | 0.25 | 0.5 | 0.75 | 1 |

Dots indicate septic properties that are projected to be exposed to flooding in 2050 with sea level rise.

FIGURE 2

Social Vulnerability and the Location of Flood-Exposed Septic Properties in Maryland's Somerset County

MARYLAND

Social Vulnerability Index

LESS VULNERABLE   MORE VULNERABLE

| 0 | 0.25 | 0.5 | 0.75 | 1 |

Dots indicate septic properties that are projected to be exposed to flooding in 2050 with sea level rise.

> Who should pay for these connections, however, remains an open question, and many households are reluctant to take on the monthly costs associated with sewer.

Left Aerial view of Annapolis, Maryland, with the Chesapeake Bay visible in the distance

Westend61 / Getty Images

prone, particularly in the southern portion of the region, which is home to Dorchester and Somerset Counties. Third, septic-dependent and flood-exposed properties show up in both low- and high-vulnerability communities, but more than 30 percent of the high-risk properties are in tracts that fall within the 75th percentile or above for social vulnerability.

One area where social vulnerability and flood risks loom large is Somerset County, the southernmost county on Maryland's Eastern Shore. Figure 2 zooms in on the seven census tracts in this county. All the tracts qualify as above the median for social vulnerability, and three are above the 80th percentile. Almost two-thirds of the residential properties in the county rely on septic systems, and of these, 60 percent—more than 2,500 properties, according to our analysis—are at risk of flooding in 2050.

Median household income in Somerset County in 2019 was only $37,800—less than half the median household income for the state as a whole ($84,500). In Somerset County, 22 percent of the population lives below the poverty line. Installation of a new conventional septic system can cost $10,000 or more, depending on its size and the site conditions; advanced systems are significantly more expensive, often twice as much as a conventional system. Connecting homes to the sewer system in Somerset County is difficult because of the limited coverage of existing sewer lines. However, according to our analysis, approximately 20 percent of the flood-exposed septic properties are in areas that already are served by a sewer system. Prioritizing

these homes for sewer connections, to the extent possible, is paramount.

Who should pay for these connections, however, remains an open question, and many households are reluctant to take on the monthly costs associated with sewer. The state of Maryland provides grants for septic-system replacements and sewer connections from its Bay Restoration Fund. Since the program began in 2004, almost 15,000 septic-system upgrades and 1,242 sewer connections have been financed across the state by the fund. Spending priorities are based on a strict set of criteria, set by the state, that revolve around whether a septic system is failing and whether the property with the septic system is located within 1,000 feet of the mean high-water line of tidal waters or the landward edge of tidal wetlands in the Chesapeake Bay and its tributaries. Neither household income, nor any measure of social vulnerability, is on the state's official list of criteria.

By all accounts, the funding from the Bay Restoration Fund is not enough. County governments, which award the grants, carefully manage the money they get from the state over the course of each year, stretching it out to pay for what they can. But additional financial resources are needed, especially in coastal areas that face the growing threat of sea level rise. As our project continues, we and our research partners will investigate these problems more carefully by identifying the factors that lead to septic failure, the links to public health outcomes, and other aspects of this complex problem. All along the way, we'll be looking for creative new approaches that prioritize cost-effectiveness, equity, and community involvement in finding solutions. ∎

Margaret Walls is a senior fellow, director of the Climate Risks and Resilience Program, and director of the Environmental Justice Initiative; **Emma DeAngeli** is a research analyst; and **Yanjun (Penny) Liao** is a fellow at Resources for the Future.

Creating Policy with Good Thinking and Social Stakeholders

Resources magazine recently spoke with Dallas Burtraw, the Darius Gaskins Senior Fellow at Resources for the Future (RFF) and a longtime RFF donor. Burtraw also regularly serves as a government advisor, including as a member of California's Independent Emissions Market Advisory Committee and previously on the US Environmental Protection Agency's Advisory Council on Clean Air Compliance Analysis. Below are excerpts from the conversation, which touched on the importance of global climate coordination, speaking the language of policymakers, the value of flexible funds for researchers, and more.

Supporter Spotlight

In the RFF Supporter Spotlight, our partners and colleagues share their insights about climate, energy, and environmental issues and how they've made a difference by working with Resources for the Future—all in their own words.

R *esources* magazine: What got you interested in environmental policymaking?

Dallas Burtraw: My first experience with environmental policymaking was as an undergraduate, when I became involved in a campaign to stop the construction of a coal-fired power plant in California's Central Valley. Opposition to the plant extended widely, from liberal students to conservative members of California's agricultural industry. I was interested to see that sort of bipartisan, broad social engagement around an issue, which is the kind of thing that RFF does in terms of bringing good thinking to policymaking.

You've worked closely with policymakers while at RFF. How would you describe the role that RFF plays in helping leaders solve the climate crisis?

First and most importantly, RFF is a source of reliable information. I think that reputation is hard earned and very solid. Second, RFF researchers commit to learning how to communicate ideas. RFF researchers distinguish themselves from many academics in that ability to speak in a vocabulary that makes sense to policymakers. In my own work, I've always tried to have empathy for the challenging situations that policymakers are in and anticipate their needs.

> " RFF has made a major investment in learning about how to engage, up front, those who are affected by decisions in the analysis. "

Above Burtraw speaking at an event held in 2019 to launch a book he coauthored, called *Lessons from the Clean Air Act.*

What excites you about the work you do at RFF and the work you make possible with your financial support?

I view the climate policy challenge as the biggest coordination problem in human history. Jurisdictions all over the globe need to align their efforts and develop trust in each other; no single jurisdiction can solve the climate crisis by itself. The question is, How can you maintain a coalition while having some jurisdictions that, for political or other reasons, may race ahead with more ambitious climate policies? RFF works to find ways to maintain coalitions when the members display different levels of ambition. I think that's fascinating.

This issue of *Resources* explores a variety of issues related to environmental justice. Why do you think RFF should be involved in helping to achieve environmental justice?

I view environmental justice as a subset of a larger set of questions around economic and social justice. RFF research can inform environmental policymaking in terms of distributional impacts, recognizing that, in environmental policymaking, we'll have winners and losers. When studying economics in graduate school, one learns that the

most important thing is the benefits being greater than the costs. In practice, though, two policies may have good outcomes in terms of overall benefits and costs, but they might have very different distributional effects—in other words, we'll see variation in how different stakeholders are affected. RFF is finding ways to frame policy options that reflect both the overall cost-benefit outcomes and the distributional outcomes, so that our research can be more relevant on a broad social basis. Equally important, RFF has made a major investment in learning about how to engage, up front, those who are affected by decisions in the analysis.

In addition to serving as a research leader and mentor at RFF, you're also a financial supporter. Why do you donate to RFF?

Because RFF has supported me so strongly over the years. I don't just mean by giving me a job; I mean that RFF provides a platform upon which to do really meaningful research. The thing that differentiates RFF is its ability to support researchers with flexible funds. That's so important to RFF's mission, because it gives researchers a chance to take risks. It's with that flexible funding that RFF researchers can get out in front of issues, ask questions, and then bring that information into the policy context. I think doing that throughout its whole history has made RFF such an important organization. That's why I support RFF. ∎

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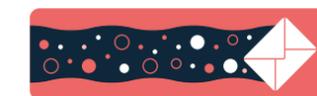
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Discover other ways to give at **rff.org/waystogive** or contact Ryan Sabot at **rsabot@rff.org**

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Although sometimes at odds, economic efficiency and environmental justice can coexist in effective, viable climate policy. Thoughtful policy design can help ensure that environmental benefits accrue in communities that need them the most.

by Nicholas Roy and Dallas Burtraw

California's Cap-and-Trade Program and Improvements in Local Air Quality

C limate policy has begun recognizing and prioritizing environmental justice as a central element. Whereas climate can be a core issue for environmental justice advocates, climate policy experts historically have struggled to integrate the core tenets of environmental justice into their decisionmaking processes, in part given the global nature of their objectives. Greenhouse gas emissions that accelerate global warming have an impact on everyone, but declines in air quality caused by conventional pollutants affect only those communities that are proximate to or downwind of emitters. Consequently, a potential imbalance exists in which climate policymakers share goals with environmental justice advocates, but environmental justice concerns still can be marginalized in favor of utilitarian arguments for the greater good in climate policy decisions.

This disconnect not only may undermine a potential alliance between climate policymakers and environmental justice advocates but also may hamper the effectiveness of climate policy. To be comprehensive and maximize the likelihood of reaching the stated goals, climate policy should aim to empower participants at all levels. Let's look at how these tensions manifest in California as an example of a potential path forward.

California's Cap-and-Trade Program

A longside the state's other climate initiatives, California's cap-and-trade program, the largest carbon market in the United States, has earned California recognition as a national and global climate leader. But the program has been a point of contention for environmental justice concerns over the past decade. Initiated in 2013 for electricity and industry and expanded economy-wide in 2015, the cap-and-trade program in California focuses on reducing the state's overall greenhouse gas emissions by employing an emissions allowance trading market.

Emissions allowance trading is a system in which emitters buy or are allocated allowances to emit greenhouse gases and can trade those allowances with each other to encourage cost-effective emissions reductions. The number of allowances that are issued is set by the state's annual climate goals. This determination of the number sets the total emissions cap and the rate of emissions reductions across the state; this strategy does not require that any one facility reduce its emissions by a set amount. Traditionally, the geographic distribution of emissions reductions is a function of where those reductions are most cost-effective— rather than where air-quality concerns or emissions are the highest.

Environmental justice groups share the state's ambition to reduce greenhouse gas emissions; however, they may contend that market-based mechanisms emphasize efficiency, which potentially conflicts with equity. This conflict can manifest in several ways. For instance, an inefficient and costly power plant or refinery might decrease production due to the financial influence of the carbon price, resulting in improved local air quality for nearby communities. But demand for the facility's product could persist, potentially leading to increased utilization of another facility that might be located in a disadvantaged community. Moreover, even if a closure occurs in a disadvantaged community, facilities located upwind of those communities may increase emissions subsequently for similar reasons.

Studies that have been conducted by several institutions have explored whether disadvantaged communities have experienced net benefits from California's cap-and-trade program (e.g., the University of Southern California, Arizona State University, the University of California, and the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment). The results have been mixed. While some studies indicate that disparities persisted in the early years of the program, others suggest that these disparities were reduced when considering the impacts on a longer timescale.

A lively debate has ensued around program evaluation and study methodologies, but where researchers agree is that no safeguards currently are in place to prevent future potential instances of the cap-and-trade program exacerbating
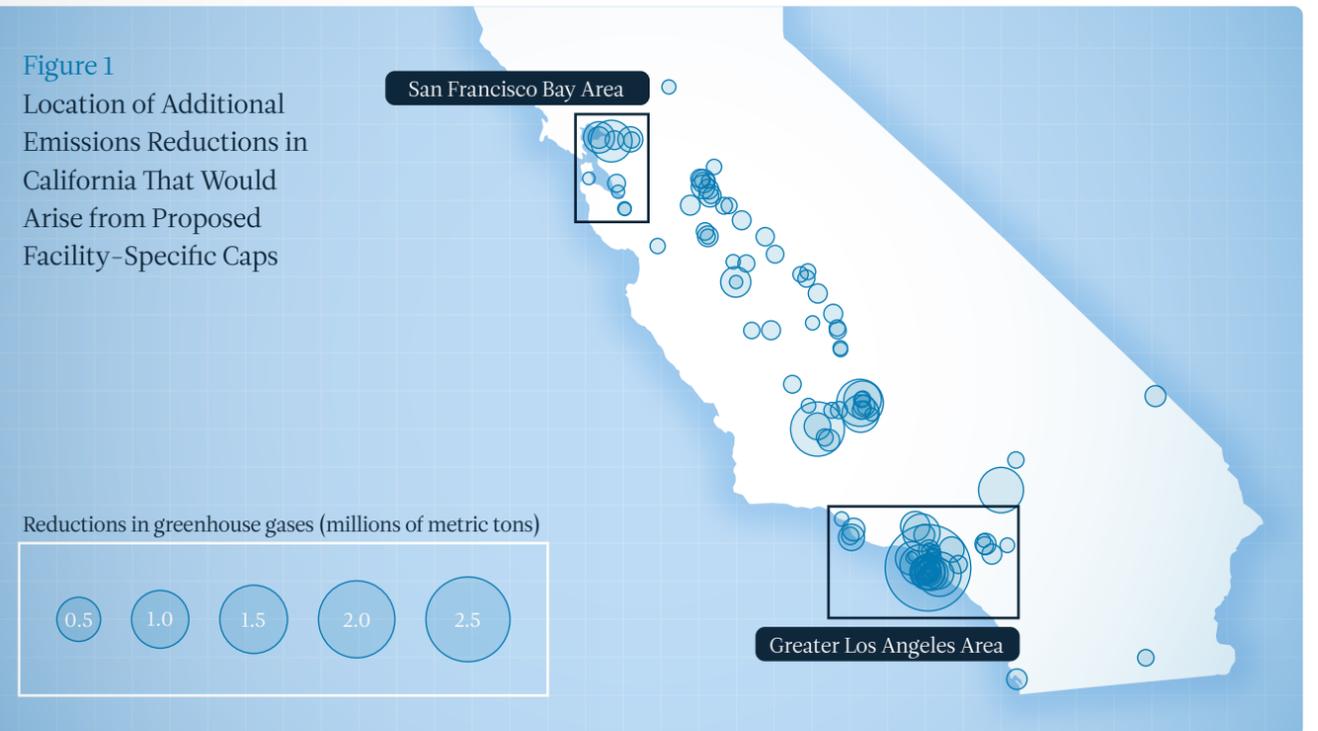
> To be comprehensive and maximize the likelihood of reaching the stated goals, climate policy should aim to empower participants at all levels.

> Emissions reductions from the program clearly are not *guaranteed* to occur at an equal pace in all communities, which leaves room for possible disparities.

Figure 1
Location of Additional Emissions Reductions in California That Would Arise from Proposed Facility-Specific Caps

Reductions in greenhouse gases (millions of metric tons)

0.5   1.0   1.5   2.0   2.5

San Francisco Bay Area

Greater Los Angeles Area

environmental injustice. Emissions reductions from the program clearly are not *guaranteed* to occur at an equal pace in all communities, which leaves room for possible disparities.

Facility-Specific Caps on Emissions

To address the concern over the lack of safeguards, the California Environmental Justice Advisory Committee has proposed facility-specific caps on emissions. We interpret this proposal to require facilities that are located in, near, or upwind of disadvantaged communities to meet or exceed the rate of emissions reductions that occur on average throughout the state.

We recently published a report that evaluates the change in greenhouse gas emissions and other air pollutants in the program thus far; the report also estimates the potential impacts of the proposed facility-specific caps. To date, we find that, as a group, facilities in disadvantaged communities have reduced their emissions at a rate that exceeds the state average; however, these reductions have not occurred at *all* facilities. Where reductions most often lag is in

densely populated areas of California (Figure 1), where communities would have benefited from the existence of facility-specific emissions caps in their vicinity.

We estimate that the proposed facility-specific caps would have a minor effect on the state's emissions allowance trading system overall, but potentially an important effect on the small number of local communities that would experience additional emissions reductions.

California would need to adjust the supply of emissions allowances strategically to both achieve large emissions reductions in disadvantaged communities and maintain an effective emissions allowance market. We calculated this decrease in the number of allowances that California would need to impose, estimating that the change in total supply would be small (0.7 percent) and would lead to negligible price effects in the emissions allowance market.

If California regulates emissions in disadvantaged communities with facility-specific caps, the effect of the above adjustment on the market depends on whether allowance prices

are off the price floor. If the price of emissions allowances is on the price floor, we would estimate that government revenues from the program would fall by 0.6 percent. But if the demand for emissions allowances is enough to keep the price of allowances above the floor, then we forecast a 3.3 percent increase in the allowance price, which would lead to a 2.5 percent increase in government revenues.

In other words, the proposed facility-specific caps would not affect the allowance market dramatically, and California's market-based climate policy likely is robust. Where the proposal would produce a change is in disadvantaged communities where facilities have not achieved emissions reductions at a pace that matches the state average but have the potential to do so moving forward (Figure 1). Air quality would be improved by the reduction of local concentrations of criteria pollutants that are related to greenhouse gas emissions.

Fundamentally, the cap-and-trade program is not the primary regulatory mechanism that's employed to reduce air pollution. The permitting authority of the California Air Resources Board is the primary mechanism and

> " If California reaches its climate goals during the next decade, but with delayed air-quality improvements in disadvantaged communities, would the program be considered a success? "

Nicholas Roy is a senior research analyst and **Dallas Burtraw** is the Darius Gaskins Senior Fellow at Resources for the Future.

deserves most of the credit for improvements in air quality; comprehensive improvements need to come from this permitting authority.

Further, a high-level policy decision needs to be made about how best to balance the enforcement of facility-specific caps with efforts to maintain jobs and economic activity at facilities that are energy intensive and trade exposed, i.e., sensitive to competition. Policymakers will have to balance various factors when implementing the details, so as to prevent perverse outcomes, some of which we discuss in our report.

Integrating Environmental Justice

Ever since making progress on its problems with smog in 1970s Los Angeles, California has led the country in environmental policy. Recent legislation in the state continues to address air quality and investment in disadvantaged communities. For example, Assembly Bill 617 in 2017 established the Community Air Protection Program to monitor and improve air quality in communities throughout the state. Senate Bill 585, passed in 2012, both identifies disadvantaged communities and designates funding for disadvantaged communities through the revenues of the cap-and-trade program. The latter bill has served as a model for federal efforts, like the Justice40 Initiative from the Biden administration and the environmental justice screening and mapping tool produced by the US Environmental Protection Agency, both of which have been adopted by other states that are looking to replicate this investment strategy.

It would not be unusual for California to include stakeholder interests that constrain economic efficiency in its ongoing decisions about policy design. When the state initiated the cap-and-trade program, a fundamental aspect of the market design was the free allocation of emissions allowances to trade-exposed industries and utilities. Motivating this approach to the design of the market were concerns that industries may leave the state and a desire to shield households from the higher costs of utility services. Giving the relevant stakeholders a say in the program design was seen as important for ensuring

the legitimacy, ambition, and durability of the cap-and-trade program. The same now applies to environmental justice communities, their concerns, and their recommendations for policy design.

Market-based climate policy starts with the assumption that cost-effectiveness can address the urgency of the climate crisis. The implementation process brings in other objectives that can affect and potentially constrain this cost-effectiveness. Proposals like facility-specific caps chart a path of compatibility between the objectives of climate change mitigation and environmental justice that may resemble other effective paths that have been charted with other stakeholders.

Nobel prize–winning economist Elinor Ostrom once stated that, to effectively govern the commons, all stakeholders must have a say in the process. Emissions of greenhouse gases and conventional air pollutants into the atmosphere are some of the most notorious tragedies of the commons, and all communities are stakeholders in the governance of these environmental inputs.

If California reaches its climate goals during the next decade, but with delayed air-quality improvements in disadvantaged communities, would the program be considered a success? And would the program then serve as a model for other jurisdictions, as the original legislation intended? Would the inclusion of provisions that prevent potential perverse outcomes in disadvantaged communities expand or reduce the state's capacity to meet its climate goals?

We find that implementing the proposed policy to address environmental justice does not appear to drastically affect the allowance market. Furthermore, facility-specific caps could be a more generic way to link carbon markets without harming air quality in disadvantaged areas. By alleviating such concerns, facility-specific caps may enable or accelerate the merging of carbon markets into larger, more efficient systems. Thinking through and implementing a policy framework that can address both carbon emissions and environmental justice concerns may help California's cap-and-trade program serve as a good model for climate policy beyond the Golden State. ∎

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