



Briefing Transcript

Sustainable, Democratic Energy and Public Health

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Daniel Bresette

Good afternoon, everyone, and thanks for joining us today for our third and final installment in our three day online briefing miniseries about coastal resilience and natural disaster recovery in Puerto Rico in the U.S. Virgin Islands. On Tuesday, we convened Margarita Varela-Rosa of the U.S. House Committee on Natural Resources and Ernesto Diaz with the Puerto Rico Department of Natural Resources to learn about Federal Support and Local Action. Yesterday, we continued with Resilient Housing and Communities with Laurie Schoeman of Enterprise Community Partners and Arturo Massol-Deyá, who chairs the board of directors of Casa Pueblo. If you missed any of our online briefing miniseries so far, visit eesi.org and click on “briefings” and you can watch an archived webcast. Over the next few days, written summaries will also become available.

Today our topic is *Sustainable, Democratic Energy and Public Health*, a topic that feels especially relevant given the events of the past several days and our present circumstances. I posted a web article at eesi.org yesterday with some reflections on the need to address the scourges of racism, violence, inequality and injustice in order to meet the challenge of climate change. A major driver of our entire coastal resilience briefing series has been to help make room in policy discussions on Capitol Hill for marginalized voices, whether from Puerto Rico, the U.S. Virgin Islands, Louisiana, Alaska, or any other part of the coastal country. These communities are most at risk, and, in many cases, they're the first among us to be significantly impacted by climate change. We can help them tell their success stories of how they recovered from natural disasters, became more resilient, and met the social, economic, and environmental challenges of a warming world.

When a category 5 hurricane hits part of the United States, it is front page news, and our awareness of these issues become more acute. Unfortunately, big storms like Hurricanes Irma, Maria, Farrell, and Dorian are becoming a more frequent occurrence. The in-between times are absolutely critical and so valuable. The challenge of improving the resilience of coastal communities is made so much harder because of the repeated need to refocus resources on recovery. As resilience gets better, recovery following future severe weather events should

become more manageable. Fortunately, there are people like our panelists today working in Puerto Rico and the U.S. Virgin Islands to facilitate the transition from a fossil fuel-powered energy system to cleaner renewable and distributed energy and help update hazard mitigation plans. They do so justly with community involvement, incorporating the latest modeling and natural systems so improved resilience endures in a strengthened, sustainable way.

If you're joining us today for the first time, this week's online briefing miniseries is the conclusion of an extensive year-long effort to tell the story of regional approaches to coastal resilience. This is the ninth region of focus, along with a week-long online briefing miniseries, about climate adaptation needs. If you'd like to catch up on coastal resilience, you can access briefing summaries and video recordings of all of our briefings at www.eesi.org. When you visit us online, please take a moment to sign up for our Climate Change Solutions newsletter to learn about our other resilience initiatives, clean energy legislation, and of course, our briefing schedule.

One final bit of logistics. Because we're once again online today, I cannot call on you if you have a question. If you have a question for our panelists, please follow EESI on Twitter @eesionline and send in your questions that way. If you'd like, you can also send an email to eesi@eesi.org. We'll draw from your question submissions after we hear from our panelists.

Speaking of panelists, our first is Ruth Santiago. Ruth is a community and environmental lawyer working with groups such as El Puente, Latino Climate Action Network, and Comite Dialogo Ambiental Incorporated, a grassroots environmental advocacy and watchdog organization in Salinas. She is part of a civil society initiative to promote solar communities and energy democracy called We Want Sun. In addition to litigation in courts and administrative agencies, Ruth has co-organized environmental education projects, advised the Jobos Bay National Estuarine Research Reserve on watershed protection and land-use issues, and written extensively about environmental impacts energy generation and environmental justice issues in Puerto Rico. She was a recipient in 2018 of the Sierra Club's Dr. Robert Bullard Environmental Justice Award for environmental advocacy, education and activism work in South East Puerto Rico. She serves on the EarthJustice board of trustees and has degrees from Lehigh University and Columbia University School of Law. Ruth, thank you so much for joining us today. I'm really looking forward to your presentation.

Ruth Santiago

Thank you also for the invitation, happy to be here. I'd like to talk briefly about what we're doing here in Puerto Rico through the grassroots organizations that I'm especially affiliated with. I work with others as well. I think Dan mentioned the two main ones that are on the screen there. Getting right to it, that is a depiction of the trajectory of the hurricanes that we've had in the past hundred or so years here in Puerto Rico. The brighter the color the more intense. That fuchsia one is Hurricane Maria that came in September 2017.

This is another map of Puerto Rico that indicates what our electric system looks like. The power plants are those numbers in the boxes around the map, and the blue lines are the transmission lines and systems, and there's also distribution lines in there. You can see that it's very elaborate. You'll notice that about 70 percent of the energy generation is on the southern coast. A lot of it is being transmitted to the San Juan metropolitan area, where most of the energy demand is located in Puerto Rico.

I'm sure you are very familiar with the devastation that came about as a result of Hurricane Maria. With the kind of transmission distribution system that we have here, experts like the University of Puerto Rico faculty members and the Army Corps of Engineers estimated widespread devastation to the transmission and distribution systems, which resulted in 100 percent power outage for, in some cases, many months. It was accompanied by a communication failure because a lot of the telecommunications were actually piggybacking on the transmission and distribution system here. What people did to have some minimal energy supply while the system was being repaired was to use diesel powered generators, which were obviously not the solution. Actually, some people were intoxicated by the fumes, there was a shortage of diesel fuel, and all kinds of logistical complications for bringing in the generators, the fuel, parts and repairs and things like that. Ultimately, this all resulted in immense human suffering and death. We can say that at least one lesson learned from Hurricane Maria is that communities need to be involved—need to be active participants—in energy issues here in Puerto Rico, and I'm sure elsewhere.

Giving a little more background on the kind of system that we have—these are photographs of some of the major plants that we saw on the map earlier. As you can see, there's Central Station, a fossil fuel-based plant. The one on the right is especially problematic. That's called the AES coal burning power plant applied energy

systems out of Arlington, Virginia. It generates 17-20 percent of the energy supply here by burning coal that's brought in from Colombia, South America. Islands traditionally have generated energy burning oil, and that's actually less the case nowadays, at least here in Puerto Rico. But those are the oil burning power plants.

This is the energy mix. Most people are not aware that the residual oil and the diesel have now taken a second place to the so-called natural gas, or methane, burning for power generation. As you can see, natural gas has now taken first place: it's the biggest fuel source in Puerto Rico right now. Unfortunately, as you can see, renewables are about 2.3 or 2.5 percent of the energy mix, surprisingly, on this island with so much sun.

This is a close-up of one of the externalities related to the AES coal burning power plant. This is actually a mountain of coal ash waste that AES stored on its plant site. What we've discovered is that coal ash waste is actually leaking the heavy metals into the groundwater into what is known as the South Coast Aquifer. This is documented on the AES web page. They have actually contaminated the South Coast Aquifer with the heavy metals from that coal ash waste because they have no disposal facility for it.

What do we do with this very problematic system we have in Puerto Rico that does not serve the public interest when it comes not just to hurricanes and disasters, but just on a day-to-day basis? We're seeing so many outages and so much unreliability in the system. We're participating with quite a few of the groups on a process for the Puerto Rico Energy Bureau called the Integrated Resource Plan. As most of you probably are aware, that's a process for developing the electric system in Puerto Rico for 20 years. We're very actively participating in that. The major question is: do we rebuild these existing systems especially after the hurricanes, and especially because we're expecting that FEMA will provide some funding for the recovery efforts in Puerto Rico? Our answer and our response to that is absolutely not. We do not rebuild the same system. We have a civil society proposal which, as Dan mentioned, is called We Want Sun, Queremos Sol is the Spanish term for it. The website is available both in English and in Spanish. On the website, and we invite you to take a look, we're proposing a combination of measures that include energy efficiency, demand response programs, battery energy storage systems, and rooftop solar especially as key, and energy literacy so that people can become involved.

This is really much more beyond technology—we're talking about sustainable energy through community mutual aid and PREPA transformation. PREPA is the Puerto Rico Electric Power Authority; it's a public corporation that needs to be seriously transformed in terms of its governance to be more representative of the interests on the island of what communities would want to see in terms of the transformation of the electric system. It needs to allow for community participation and what are known as prosumers: producers and consumers of energy, especially at the residential level. We're calling for solar communities, which would have so many benefits in terms of the local economy, in terms of multiplier effects of doing large-scale rooftop renewables that are energy storage systems, energy efficiency—it would be much better than exporting billions of dollars per year for the purchase of fossil fuels or for investments in central station fossil plants. Further, it would provide some measure of environmental justice to communities that are close to these existing power plants. It would also provide a just transition for the workers at the PREPA plants so that they can participate in the transformation of the electric system as well.

We always get the question: is it affordable? In the draft of the Integrated Resource Plan that's currently being considered by the Puerto Rico Energy Bureau, there is a definite statement that rooftop is more cost effective than any of the preferred plans that the current PREPA administration is proposing. It's also technically viable to provide all of the energy needs of Puerto Rico.

Unfortunately, what we're seeing right now is a so-called transition using LNG, or liquefied natural gas, or methane gas. There's been an attempt to flood Puerto Rico with this natural gas, which is likely to be fracked gas from the U.S. There are a number of very powerful forces here trying to influence this transition rather than going to the actual energy democracy proposal that is represented in Queremos Sol and allowing communities to be prosumers, not just passive consumers of energy. One of the main companies involved here is New Fortress energy; they are converting the San Juan power plant to burn gas. We mentioned that natural gas is already the largest source of energy generation in Puerto Rico, so we don't need it for fuel diversity purposes. We don't need to do the transition because we know that rooftop solar is viable both technically and economically.

This was the initial proposal in the Integrated Resource Plan. Again, for natural gas, there is so much infrastructure involved that it would totally displace the possibility of any real advancement of the renewable energy goals and standards here in Puerto Rico. Some of these projects are still being seriously considered by the Puerto Rico Energy Bureau, and they involve onshore LNG operations, three new offshore (or marine-based) LNG

operations, possibly converting the AES coal-burning power plants to burn gas, and various new combined-cycle plants. This is over-doing the construction of new plants and infrastructure to burn gas.

I'll finish up with this photo, which is right after Hurricane Maria in 2017. This was a helicopter placing a transmission tower in the mountainous area. Puerto Rico, like much of the Caribbean, is a mountain range surrounded by a narrow coastal plain. PREPA, on its webpage, boasts that it was a leader in the placing of transmission and distribution systems in these rugged territories and terrain. We believe, now that there are other alternatives, that should be the route rather than redoing this difficult operation. Thank you.

Bresette

Thank you so much Ruth. In one way, it's a very impressive photo because of the flying machine putting a transmission tower in the ground. In another way, it's a bit of an unfortunate photo because it doesn't necessarily look toward the future. Thanks for a wonderful presentation.

If any of you missed any of Ruth's wonderful presentation, just a quick reminder that everything will be archived at eesi.org. If you were late to join us, just a quick reminder about how we're going to deal with questions: my colleague Ellen Vaughan will kick off the Q&A session after our next panelist. If you have any questions from out there in the audience, please follow us on Twitter @eesionline and you can send us some questions that way. You can also send us an email at eesi@eesi.org. We'll do our best to get all of your questions in the mix when we get to Q&A.

Our next panelist is Dr. Greg Guannel. Greg is the director of the Caribbean Green Technology Center at the University of the Virgin Islands, where he is co-leading the update of the Hazard Mitigation Plan for the territory. He is also developing a green infrastructure database to create a series of options for climate adaptation of coastal areas. Greg started his career as a coastal engineer and he has advanced degrees from the École Supérieure des Travaux Public in Paris, Texas A&M University, and Oregon State University. And with that, Greg, I welcome you to our panel today. Thank you so much for joining us, and I'm looking forward to what you have to say. Thanks.

Greg Guannel

Thank you. I'm going to make this presentation on behalf of the entire team, which is composed of a fair amount of people and talent. This is a project that the University of the Virgin Islands (UVI) is doing in coordination and collaboration with the Virgin Regional and Rural Emergency Management Agency.

As Ruth was just mentioning her in her presentation, the Virgin Islands was impacted by two hurricanes in 2017 that were two weeks apart. It was a bit of a crazy time. The three islands that compose the territories, St. Thomas, St. John and St. Croix, as well as the Water Island, which is a small island, were all impacted by the hurricanes. Following these hurricanes there was also a sense that this is one of many different types of hazards that can really impact us here in the territory. We have earthquakes that can trigger tsunamis, and we have had tsunamis in the past. We also can suffer from landslides during rain and earthquakes. There are the hurricanes that Ruth mentioned. We also have droughts—we are in the middle of a drought right now in the Virgin Islands. And then, with all that, there is climate change that is making the hurricanes stronger and the droughts longer. The sea level is rising, which leads to this picture here on the right of flooding of some of the infrastructure during a sunny day. That is due to wave action that we believe is being amplified by the fact that the seas are higher. This is a historical perspective of minor events, major events, and years when we had more than one event. It is not comprehensive, but I think we did our best to capture some of those events that had made it to the books of history. As you can see, there's been an acceleration since the 70s of multiple events happening in the same year. There are many reasons for that: one is better record-keeping, but there are others such as climate change that are increasing the frequency of those events. There are also land use practices, and I will get back to that in a minute.

The Hazard Mitigation Plan, for those who are not familiar, is a document that is mandated for all states and territories. They need to be updated every five years. We just updated our plan, but we are now working on this new plan. We're taking a bit longer—instead of the usual six months, we're taking two to three years to work on it. This makes states and territories eligible for BRIC, which is pre-disaster funding and post disaster mitigation funding. If something happens, you can have access to some type of funding. The plan is also an opportunity for us

to create big support for existing, but also future, risk reduction initiatives. It's a vision for the development of the territory to bring forth this concept of resilience.

In the past, most HMPs have focused on things: infrastructure, energy, transportation communication, etc. That's important—we need those buildings and we need this infrastructure to have access to those services. However, the hurricanes brought different lessons that made us rethink this sole focus on infrastructure.

We've been suffering from more and more disasters since the 70s. Some of it, like I said, is due to better record-keeping and climate change, but some of it is also due to the fact that we have developed quite a lot. On the left-hand side, you see a picture of the territory: St. Thomas, St. John, St. Croix in 1985. What you see is, right now, we've developed quite a lot of all of the islands. Even St. John, which is mostly a national park, you see encroachment as much as possible. St. Croix has also seen a fair amount of development. People live in more places than before. So, an event that happened in the past now can become a disaster.

If you look at some stats that we started to develop based on the analysis that we do, we see that more than a quarter of the buildings are in a flood zone. More than 45 percent of government buildings (police, firefighters, clinics, hospital and the public safety and health buildings) are also in flood and tsunami zones. We also are seeing that more than 40 percent of all the buildings are in extremely high wind zones. We can suffer the impacts of hurricane windstorms. Some places, because of the topography, suffer from some stronger winds—nearly half of those buildings are in those places. As you can see, a lot of our assets are in hazardous zones. We can't pretend that we're going to move them because we are dealing with a finite amount of land. The question is: how can we rethink our land use practices to not only not encourage more of the same, but also to deal with what we have?

What we have is actually good. We are working with some social scientists to try to understand our community and to try to understand this concept of community resilience. In the past, we tended to focus on things a lot—buying these, installing that, building this—but we tend to forget people. What we are finding is that, we Virgin Islanders, we are accustomed to many disruptions. As you saw in the figure, there have been a lot of events in the past 40 to 50 years, so we know how to live with disruption. Outside of those events, we also experience disruption in just normal service delivery, so we have built ways to deal with this. We are also compassionate and we help each other during times of hardships. The picture shows the help that St. Croix provided to St. Thomas. Islands help each other because we know that we only have us—we cannot really wait for somebody else to come within 24 hours.

We are also finding, beside all those very positive traits, that there are people who are suffering and there are communities that are very vulnerable. Sometimes it's not very visible because we have a culture of positivity and can-do. Sometimes we tend to hide our difficulties and hardships, which makes it difficult to understand the depth of the issues. We are also finding that social networks can sometimes be exclusive. Sometimes it's a who-you-know type of social network to get access to help. Some of the organizations have blind spots because there is not a very thorough accounting of all the different communities. We have people from pretty much every single island in the Caribbean, different types of languages, and people from the states. It's a very diverse community and sometimes it's hard to think about who really needs help.

The other piece is that nonprofits and non-governmental organizations sometimes are not brought to the table in pre-disaster periods when we put in place the preparedness. The government, for good reason, is leading the charge, but we're also finding that the social infrastructure is vital for this production. We need to think about how to best empower social infrastructure as we start to think about mitigation.

The other piece is that natural infrastructure has a role to play during disasters. They are the foundation of our economy because most of our economy is based on tourism. The natural beauty and the quality of the environment is really important for our economy. With the economy going quickly after a major disruption there can be some very long and negative consequences. Our natural systems are the foundation for the economy but also, they can be lifesaving. As you can see in this picture, you get water from the aquifers, we get water from things that don't require technologies that can break. The issue, and you saw that in the history of development of the VI, is that the development is degrading the health of our natural system and the benefits that we are deriving from this are being lost as we are paving over our sources of water, fresh air, etc. We are also losing the cultural attachment to this natural system. The loss of cultural identity can sometimes lead to a longer recovery than could have been achieved with a society that can relate to different facets of its identity. The natural infrastructure that we have is degrading in the VI so we are thinking about how to integrate it in the HMP and how to qualify all those

benefits beyond the well-known storm surge reduction. We are talking about food, water, and all these provisions of very important services so that we can integrate those into the long-term mitigation strategies.

This figure, which is from the National Institute of Standards and Technology (NIST), is what we gravitated toward. We are really thinking about critical infrastructure: things as a way to support our way of living and what matters to us (education, family, health etc.). It's not an end of itself, but it's a means for society to function. Ultimately, what we want to do is make clear that resilience, building resilience practices, and having resilience is really about what we do with what we have and what we do outside of what we have; but it's definitely not what we have. In this example, we have a house with solar power. This is great: they have a redundant system for access to energy, but at the same time, they have developed practices so that, when they tap into this external source of power, they don't overload it and they also realize that, when they turn the button for this or that, things are actually working, or that this system is well maintained, well installed etc. What we saw after the storm is other people who had solar power could not rely on it because they weren't familiar with the system, because of the way the system was designed, and because of practices that didn't develop as they were installing the system.

The other picture is a picture of a recovery effort to fix one of the areas that suffered from a landslide post-hurricane. The question that we are asking is: now that you have this infrastructure, what are you going to do to maintain it? What are you going to do to ensure that it doesn't degrade? That it becomes part of your day-to-day operation? That you really integrate it into what you have and make sure that, moving forward, it doesn't degrade and you can rely on it as an asset? That goes for all types of infrastructure. The dialogue that we have is really integrating some of the concepts that I mentioned earlier. How are we working as a society? How are working as an agency to ensure that things are going smoothly?

The questions that we are asking moving forward, when we start to talk about resilience, are where is the risk, what is the risk, and what is at risk? We are trying to figure out a solution that really increases resilience in a strategic way rather than just massive purchases of things that, at the end, might put us more in danger or not really change our situation.

The last question is really a question that we are asking ourselves constantly: as we are moving forward, is our economy resilient? Are we ensuring that we have the means to pay for it and that what we do really increases our ability to have a strong economy? Without a strong economy we cannot do any of those risk reduction strategies that we really want to put in place.

This figure here summarizes our philosophy for the work that we are currently doing, which is really investing in social systems because of the strengths that they have and the role that they play for disaster reduction. How do we operate? How do people work with what they have? How can we increase that, because of the importance of maintaining and working among agents and across different networks to ensure that those investments will go a long way? We're also thinking about the natural systems, like I mentioned, and also thinking about if our environment is strong. Is the building strong enough? Are the buildings well placed? What does that mean if they are placed in the flood zone? We are really looking at the intersection between all those different systems to try to find as many win-win solutions and strategies that really maximize the benefits and the strengths of all those different networks.

This last slide here summarizes the different types of work that we're doing. Like I said, I'm talking for a larger team of colleagues and contractors. We are engaging with the public and with different stakeholders to understand what's going on and the strengths and weaknesses of different types of sectors. We are also doing the hard analysis of understanding the hazards, their impact, the natural environment around us to do a strong risk assessment. We are also doing a sustainability analysis to ensure that, moving forward, we are keeping our assets in check so that we can rely on them when things go wrong.

We are still in this process. We're probably going to spend the next six months analyzing this first section of our work, and then we're going to start to move into those mitigation strategies that I mentioned. We are really thinking about this question of resilience, this question of duration, and this question of ensuring that what we do is part of resilience as much as what we have. All of those components will end up in the Hazard Mitigation and Resilience Plan. We expect to have this plan by the end of next year. I am hoping I can give you an update on all the different components that the strategies that this plan will have. We are really hoping that it will be a comprehensive view of how to tackle risk reduction in a place that has a lot of strength that I think in the past we didn't rely on as much as we should have.

Bresette

Thank you so much thanks Greg. That was a great presentation. I really appreciated all of your commentary on what resilience means looking beyond the obvious.

Now is the time we're going to move to Q&A. If you have questions out there in our audience, you can send them to us using Twitter. Follow us online @eesionline. If you would prefer to just send us an email, you can do that too. The email address to use is eesi@eesi.org.

My colleague Ellen Vaughan is joining us. She is going to kick off and lead the Q&A, so I'll turn it over to her. Thanks Ellen.

Ellen Vaughan

Great, thanks Dan. Thank you, Greg and Ruth, so much for your very insightful presentations. Greg, thank you. I'm going to go back to Ruth first for a couple of questions.

Ruth, it was fascinating learning more about the energy infrastructure and the energy sources and where we go. First of all, thank you for all the work that you're doing on behalf of communities and health. I wonder if you could talk about federal energy policies and how Congress could help the islands utilize more of the indigenous energy resources that you talked about?

Santiago

Here in Puerto Rico, as in most of the Caribbean islands, we don't have any fossil fuels that we know of and certainly nothing that's developed. What we do have is an abundance of sun. Over ten years ago, the Department of Energy commissioned this study to some of the faculty at the University of Puerto Rico, and they developed a study called the Achievable Renewable Energy Targets (ARET) in which they recommend that the Puerto Rico electric system be developed using primarily rooftop solar installations. This is because we happen to have, in addition to all of that solar resource, lots of sprawling, built-up development in Puerto Rico. They actually call it the "rooftop resource" and recommend that it be used as opposed to using very scarce land areas. As we mentioned, we have a very narrow coastal plain and a lot of it has already been built up. In order to have some food security we need to preserve certain areas for agriculture and ecologically sensitive areas so that we don't see the disaster situations that Greg was indicating in his slides. We would hope that Congress would implement policies and programs that would allow Puerto Rico to implement the recommendations in that ARET study which are incorporated in the Queremos Sol proposal. Of course, that would be coupled with battery energy storage systems, because, as Greg mentioned, many of the systems after the hurricanes here in Puerto Rico did not have the battery energy storage systems; there was no way to store the energy that was taken up by the panels. We need energy efficiency programs, we need demand response—all kinds of alternatives. We need energy education so that people know how they can make the best use of the energy that would be available.

Vaughan

Thank you, that's very interesting. I'm so glad you mentioned energy efficiency—took the words right out of my mouth. That's also interesting with geography, with topography. That's a very important point about conserving land for food and also the natural infrastructure that Greg talked about. I was going to ask about wind. I know that you have trade winds and I know there has been wind energy development. Maybe just kind of follow up on that a little bit? Maybe people are curious about the potential there and the barriers to wind energy technology?

Santiago

So far what we've seen in terms of the studies that have been done about wind potential show that wind in Puerto Rico is nowhere near the abundance of solar. We have seen that on the eastern coast there is some potential for wind farms. In fact, there was a wind farm on the eastern coast of Puerto Rico that was actually taken out by Hurricane Maria and it has not been rebuilt. For reasons of transmission and distribution infrastructure, on-site solar seems to be a better option. The utility-scale projects require lots of investments with substations and a transmission distribution, and why do that when we can do direct power generation using the rooftops?

Vaughan

Yes, thank you. I appreciate that. I'm going to give you a break and I'm going to bounce over to Greg for a minute. Greg, thank you so much for your presentation and letting us know more about the Hazard Mitigation Plan, why that's valuable, and how that can also free up some of this funding that's so important.

You had talked about the value of natural infrastructure. I think we all know that at some level, but in terms of the foundation of the island economy and how natural systems are under threat, are there projects to restore natural systems that can be eligible for FEMA funding, for BRIC funding, to build resilient and infrastructure in communities?

Guannel

Yeah, there are a few. I'm not familiar with all the projects that have been submitted. I know that there have been a few projects that were submitted related to restoring some of the mangroves and restoring some of the reefs. I've also heard some projects related to replenishing some of the aquifers and restoring some green spaces for aquifer recharge. I think what we are trying to look at with the Hazard Mitigation Plan is going back to this question of what is that risk and where is the risk to be able to better articulate why we are doing some of those restoration. I'm a coastal engineer, for example, and a lot of the discussion about mangroves and coral has to do with coastal risk reduction in terms of wave attenuation and storm surge reduction. We don't really have the amount that really would make a difference in a category 5 hurricane. We don't have the Everglades, we don't have the Great Barrier Reef. The quality of the environment and the degradation of the system is such that it could take a very long time to get there. However, there are other types of benefits that can be looked at, from storm water filtration, storm water retention and fisheries. Access to food after disasters is critical, so if you have strong fisheries and fishery practices, you can, a few months after a storm, start to resume some of those activities. It is the same thing with farming. We are still looking at this. We have a colleague who is coming on board to spend time on the fish and agriculture sector to be able to articulate different types of restoration activities and the benefits on different angles so that we can really have a comprehensive view of what we are getting with those. Then we can start the education and the outreach about why it's so important to look at it in a varied way.

My fear sometimes is if we just focus on one thing, such a storm surge reduction or wave attenuation, when it fails people will just look for the next thing. What we're making an argument for is that there's more than one way to protect ecosystem services.

Vaughan

Great, thank you. That makes me think that there are multiple benefits from these systems. Do you find that we have the right tools for benefit-cost analysis to take those things into account, not to mention the effects of climate change?

Guannel

I think that there's two ways I've been saying this question. There is a question of tools but there is also a question of policy and the ways that you use those tools. In terms of tools, I think that it depends. When it comes to wave and storm surge reduction, I think that we still have a bit of a ways to go. There are still a fair amount of scientific basic questions that need to be answered when it comes to the ability of the system to reduce storm surge, for example. I think that, when it comes to groundwater recharge or maybe some AG or other type of benefits, or even temperature reduction, I believe that there are more tools available to make some of those modifications. I think, in general, we're getting there. I'm not an expert on everything related to ecosystem services, but at least I would say that in the last 20 years, there's been this massive investment. Compared to other tools, it's relatively young, but at the same time, we've known a lot of things for a long time. There are tools that give some level of answers for different questions.

I think the other barrier is the way that you look at what is important for your society. What we're finding is that there is a lot of emphasis on built infrastructure. The reason why I make the point that natural resources are important for our economy is because, when we look at the type of funding post-disaster, it's all about building infrastructure, which is extremely important—we need the road, we need the phones, we need the power. But at the same time, if we don't have the beaches, if we don't have a place for people to go and have a vacation, because it is so dependent on tourism, then we are not about to rebound. If we don't make those investments, we are about to rebound. If we continue to build the way that we have in the past and lose all of

those natural systems, we start to lose our freshwater and we start to lose our temperature moderation. Then we turn to things and infrastructure that make us more dependent on that infrastructure, so we have to invest more and more infrastructure, we have to maintain more infrastructure and not be afraid of infrastructure being broken if a hurricane or something like that happens.

I think that there is a question of science and tools in terms of modeling and coming with answer that make you comfortable to make a decision, but I think there's also a question of how do we look at development, how do we do growth, and how do we place natural infrastructure in this discussion about growth and economic development.

Vaughan

Absolutely. So really looking holistically at all the systems together. Thank you. I'm going to bounce it to Dan, I think there might be audience questions.

Bresette

We do. This is more of a clarification question for you, Greg. The question is about your Hazard Mitigation plan and your plan for BRIC funding. One of our audience members understood you to say that the plan was required for BRIC funding but the plan would then not be ready until next year. The clarifying question is does that mean that the Virgin Islands will not be able to apply to BRIC until the report is done?

Guannel

No, so HMPs in general make states and territories available for funding. We do have an HMP in place, so we are updating that plan.

Bresette

Great, thanks for that. We're getting close to four o'clock. Yesterday we had two wonderful speakers, and they mentioned that yesterday was the third day of this year's Atlantic hurricane season. Today's the fourth of June, the fourth day of the season. I'm wondering, obviously I hope that there aren't any nasty storms that come your way this year, as you're on the fourth day of this year's hurricane season, I'm wondering if you could each share a few thoughts about how your work, or the work of the islands in general, has better prepared your communities to make it through this hurricane season so that they can hopefully avoid the kinds of disruptions and the kinds of devastation that you've seen before? How have your resilience efforts, since Hurricane Irma and Hurricane Maria, better prepared you for this year's hurricane season? Ruth, we'll start with you for a couple concluding thoughts and then we'll wrap with you Greg.

Santiago

A lot of the organizations that I work with have done community-level resiliency centers. In every essential aspect of life, they're working on projects which would make their respective communities better able to withstand, recover, and do well after another natural event. That means some reconstruction work to housing units on a community mutual aid basis, rooftop solar at the community centers, water filtering, communications improvements—things like that. Throughout Puerto Rico there have been quite a few projects, mostly at community centers, hospitals, and schools that have started to prepare in that way and created community hubs for resilience.

Bresette

Thanks. Greg, from your perspective in the Virgin Islands, how are you feeling the Island has prepared itself over the last couple of years since those horrible storms?

Guannel

I would like to first see that there is a still amount of anxiety; it was very traumatic. That being said, I think we have some sense of confidence. Like I said, the government is doing great work in terms of moving forward projects, so I think some of our infrastructure is stronger, we have better building, better electrical pools etc. That's a good thing that makes us in a better position. I also think that there are stronger ties within the

community. That goes back to what I was saying in my presentation, which is really spending time understanding the strengths in communities and more investment in communities would help. I think that they are so attached in the communities. They've done it before and it's not fun at all, but we know we can rely on each other. I think that is extremely important; sometimes I think it's more important than having power on a 24-hour basis. I think, from my point of view, a better appreciation for the services and the benefits that nature provides us. We think about planting gardens and really understanding ways that we can build resilience at the household level with what is around us, from solar power, to food to, water security etc.

Bresette

That's great. A stronger community and more resilient community: I can't think of two better notes to end today's panel on, as well as the entire briefing miniseries of the week.

Ruth and Greg, thank you so much for joining us and being part of our briefing miniseries this week. Thanks to everyone on the EESI team: Ellen, Amaury, Dan, Anna, Amber Sydney, our summer intern class, Bridget, Abby, Maeve and Maia, thank you so much for all of your efforts this week.

All of our materials will be available online at www.eesi.org. If you have a few moments to take our survey, it would be great to hear what you thought about today and great to hear what you thought about the week in general. We've been doing more of these miniseries of multiple, shorter online briefings. At some point we'll go back to doing them in person but, for right now, we'd love to hear how you think we're doing with respect to our online briefing offering. If you have a moment it means a lot to us. Thanks so much.

We'll go ahead and end it there. I hope everyone has a great rest of the week and I hope everyone is getting ready for the weekend and reflecting on the events of the last couple days and thinking about ways that we can do better and hopefully move past some of the difficulties in our societies that are creating these awful instances of injustice and inequality. We'll go ahead and end it there. Thanks so much and take care.

The Environmental and Energy Study Institute (EESI) is a non-profit organization founded in 1984 by a bipartisan Congressional caucus dedicated to finding innovative environmental and energy solutions. EESI works to protect the climate and ensure a healthy, secure, and sustainable future for America through policymaker education, coalition building, and policy development in the areas of energy efficiency, renewable energy, agriculture, forestry, transportation, buildings, and urban planning.