

PANEL 3 – “LASTING” AND CLOSING REMARKS

*Fall 2018 Symposium: “From Here to There:
Sustainable Urban Development in the Triangle and Beyond”
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Duke University School of Law*

MODERATOR: SUMMER QUINTANA*

PANELISTS: DR. BRIE SHERWIN, KEITH HIROKAWA, SENATOR MIKE
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CLOSING REMARKS: KYLE MEDIN***

Ms. Summer Quintana: I am a Symposium Editor for the Duke Environment Law and Policy Forum. We will be having our final panel right now.¹ They will be discussing some of the lasting effects of sustainable development on urban development, and we will follow with closing remarks from our editor-in-chief, Kyle Medin. From left to right here, we have Dr. Brie Sherwin from Texas Tech University

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1. Editors’ note: this transcript has been lightly edited for clarity. Recordings of this panel and the other two symposium panels are available on the *Duke Environmental Law & Policy Forum*’s website. *Fall 2018 Symposium*, DUKE ENVIRONMENTAL L. & POLICY FORUM, <https://delpf.law.duke.edu/fall-2018-symposium/> (last visited Mar. 17, 2019).

School of Law, then we have Professor Keith Hirokawa from Albany Law School. Then to his right, we have Senator Mike Woodard. He is a Senator for District 22, and then finally, on our right, we have Heather Keefer. She's the associate director from WakeUP Wake County. We will start with Dr. Sherwin and each will have between five and ten minutes to talk about themselves, their titles, and what some of their ideas on lasting impacts of sustainable development are, especially in urban communities.

Dr. Brie Sherwin: I hope no one minds if I stand up. You know it's after lunch, and I was just telling my colleague, Professor Hirokawa, that I think better on my feet. So I'm going to stand up to introduce myself and get the panel started this way. First of all, I'd like to thank DELPF and Duke Law School for inviting me here. I traveled here from Lubbock, Texas today. I'm a Professor of Law at Texas Tech University School of Law in Lubbock, Texas. Again, my name is Brie Sherwin. And, just to give you a little bit of my background, I am a cotton farmer's daughter, so I come from three generations of cotton farming, and where I live in Texas is not really a coastal area. It's kind of up in the Panhandle, so flying out here and seeing these trees is amazing, and I agree with Nicole,² by the way, you should keep the trees! I'm going to talk to you more about why a little bit later.

But, I come from generations of cotton farmers and conservation has always been a really important word in our family, although I honestly come from a very conservative household and so if you asked my father, "are you an environmentalist?" He would say "Well, of course not." But the truth is that he very much is because he cares about water conservation. He cares about soil health. And, of course, we sit on top of the Ogallala Aquifer in Lubbock, Texas, so we care about that water because it's a precious resource and it's running out.

To give you a little bit of my background, I graduated with a dual degree in law and a Master's in environmental toxicology, so I'm also a scientist. I'm an environmental toxicologist, and I moved down and started my practice in toxic tort litigation in Dallas. I spent a good five or six years representing low-income communities and workers in occupational health exposure cases, so much of my time as a young attorney was spent driving around the communities in East Texas in the Houston area, visiting Elks lodges, and signing up clients and learning their stories. I think that the stories from these communities

2. Editors' note: refers to an earlier panel's presentation by Nicole Scott-Harris of the New Jersey Environmental Justice Alliance. Her presentation was in Panel 2, a recording of which is available on the *Duke Environmental Law & Policy Forum's* website. See *id.*

are a very important part of our discussion today as well. I spent about nine years in Dallas practicing law and then I moved back up into academia, finished a PhD in environmental toxicology, and I teach Environmental Health Sciences at the medical school as well. So, I teach doctors, nurses, and people getting their public health degree every spring semester. So my perspective is as a lawyer and a scientist, and I'm going to be talking with you a little bit today about informed decision-making and particularly how scientists can play a role in better informing the community and our decision-makers because sometimes I feel like there really is a disconnect between the two — the science is coming out—yet there is a tension about how that translates into policy and how it can help our environment.

Most of my scholarship and my research recently has focused on environmental justice issues. I've written about trade secret protection and hydraulic fracturing, which is a big deal in Texas because we are from the energy state so that's a continuing issue. I've written about the drinking water crisis in Flint, Michigan, and I've also worked most recently on talking about coal ash waste, which I know is an issue here in North Carolina—coal combustion residuals. These coal ash ponds, or impoundments, and what do we do with them particularly when we have a hurricane like Hurricane Florence hit. How does that affect our community? I'm very much looking forward to talking with you today about climate change, weather events, and the resulting environmental contamination that occurs after an event, and the importance of remembering history and incorporating that into our urban development. Of course, we're not strangers to environmental disasters in Lubbock. We were part of the Dust Bowl in the 1930s, which I think was one of the most major environmental disasters and crises to ever hit this country. Why? Because we chose, as a country, to drastically alter the landscape, to pull up grasslands, and to replace it with short-rooted crops that require a lot of water. The result was that it devastated our ecosystem and drastically changed weather patterns. It affected communities. It had far-reaching consequences. So, what can we learn from history? I think that's another important part of this conversation, so I'm now going to turn over to my colleague.

Professor Keith Hirokawa: I teach law, environmental law, I focus a lot on local governments, community sense of place, and like how environment is regulated from a very locationally dependent place, and we'll probably get into that a little bit today. But, what I want you to think about for right now is what I think is really important for urban resilience, urban sustainability, is the idea of ecosystem services, which

we can talk about, but also specifically in the context of using ecosystem services analysis, is to think about trade-offs. And, one way to get started is—have you heard of the Cuyahoga River before? Not everybody has which I think is kind of amazing. The Cuyahoga River is this fascinating water body, and it does what many rivers do, or at least it did, and it does again, but it flows, right? It goes from one direction. It goes somewhere else. Gravity matters.

And, something worth thinking about is as we settled the world as humans, sometimes we settled near water bodies because moving water courses did stuff, and one of the famous favorite ones is if you throw a little bit of garbage in that water course, and you close your eyes for a minute, and then when you open them up it's gone. So one of the things that rivers do, is it deals with waste, waste disposal, and in a sense this is something we might refer to as an ecosystem service, because ecosystems work very hard in ways that benefit humans. We don't always recognize it or notice it, but they do and we depend on them. Obviously, the particular service we took advantage of in the Cuyahoga may have been to the disadvantage of some other benefits and, by the time it burned for the eighth time, we reported that the water doesn't flow anymore. It oozes, no visible life, and, in fact, it was catching on fire. And this is an example of what we might think about as trade-offs and this is what I want to briefly talk about to get us started.

Ecosystem services include both the way ecosystems produce goods, like bananas and building materials, timber and some such things, but also the way ecosystems regulate the environment, like climate and water quality, and provide what we call regulating services—supporting services by sort of creating this place in which ecosystem functions can occur. And, also as another category, they provide services that we refer to as cultural services—aesthetics, recreation, spiritual attachments. Of those four categories, the only one that we always know how to value is the goods because there's a shelf at some market where that thing is up there and somebody will buy it. So, we can price that stuff because people are paying for it in the market.

The other categories are a little tougher: we don't know how much to pay and, in fact we don't, pay for pollination services, pollution control, and other things that are services that we really depend on but there aren't shelves at the market for that. So, we don't have to pay for them even though they're working hard for us, and because of that they're kind of invisible, right? They don't make their way into

decisions that we make on a very regular basis, so these aspects of ecosystems are always at risk. We're constantly, regularly making decisions, very normal decisions, maybe to take advantage of one service such as producing goods that we're going to use. But, as we make that decision, we may be displacing or disrupting other things that ecosystems do, and this is where the trade-offs analysis comes up. So, the idea of trade-offs is to think very sincerely about the choice that we're making of the service that we want to optimize, such as agricultural choice to produce more goods, and what we're disrupting or replacing by making that choice, such as filling in a wetland to convert more land to ag use. In a sense we're optimizing the production function or service and giving up some of the more water quality or biodiversity functions that wetlands serve. They are, in effect, traded off.

This is pretty important for a lot of reasons. One is it may help us think about which needs, which human needs and services we're prioritizing when we interact with the environment. They help us. Doing the trade-offs analysis helps us figure out what the cost of our particular choices are. But probably the most important one is that when we're doing this trade-offs analysis, we're looking at very normal decisions that we make on a regular basis, and we're making those costs of the trade-off less invisible. We have to account for them. That's one of the areas of my research these days.

And what I want to leave you with, so I don't take up too much time and so we get started with the questions, are five things that I think we have to be doing to think very seriously about urban sustainability and urban resiliency in the context of ecosystem services and trade-offs. The first is to recognize that ecosystems work very hard. That we have to recognize the idea of ecosystem services, where they take place, and the fact that we're benefiting only when the ecosystem is functioning. When the ecosystem ceases to function, we don't get the benefits anymore. The second one is pretty important. This is where we start operationalizing some of the obviousness of ecosystem services. We have to start inventorying where these services take place. Where are the wetlands, who's getting the benefit of clean water? As we start to inventory, we can start to think about where those trade-offs are taking place. Whether we want to get rid of the last of our wetlands to convert to ag or whatever the case may be. Important, I think, and actually some of the stuff that we were hearing about in the first panel, was about asset mapping, which is really just a way of figuring out where those cultural ecosystem services are in town. The

third thing that we have to do is think a lot more seriously and functionally about how we communicate ecosystem services. It's a vocabulary that we don't always have access to, which is why these trade-offs and lost services are invisible. But really importantly, communicating with the public about what's going on in the ecosystem gives the public the vocabulary, and, at the end of the day, we start thinking more about government accountability for those trade-off choices we make. The fourth one is to make sure we're integrating these concepts in particular trade-offs of ecosystem services into the way we regulate. You want a building permit? That's fine. Let's figure out which services you're displacing. And finally, is our distributional question. Every time we start thinking about trade-offs we are also talking about the distributional aspects of our decision-making—which needs are being prioritized, which communities and neighborhoods are getting the most benefit, or which ones have to pay the most to secure that public benefit? So, it's an honor to be here. Those are my introductory remarks. Thank you for being patient with me and talk to you soon.

Senator Mike Woodard: Well good afternoon, my name is Mike Woodard, and I serve in the North Carolina State Senate. My colleague, Senator McKissack, was with you on the first panel, I think, this morning, and so. . . I, again, appreciate the invitation, the chance to be with you all. I appreciate Dr. Sherwin sharing a little bit of her family's story because I grew up in Eastern North Carolina and, as we say down there, who are your people? When people want to know about your families they say "who are your people?" So my people came to what is now Eastern North Carolina back in 1697, so we've been farmers down in the eastern part of the state—tobacco, cotton, peanuts—for a few centuries now. So like you, I suspect I feel like the agriculture and the soil is just part of my DNA and those kinds of things as well. So if you were to ask my ancestors if they were environmentalists, they would probably say no, but they clearly were because they cared a lot about the land, the water, the air because that's how they made their living.

I left Eastern North Carolina, came to Duke, and was an undergraduate here. Chose to make my home in Durham and then, thirteen years ago, joined the Durham City Council. So for seven years I served there. We dealt with a lot of the questions you all have talked about. Chaired the Regional Transportation Committee as well as the liaison to the Environmental Affairs Board of Space and Trails and all those kinds of things. I was at all the intersections, if you'll pardon that

bad pun, of where a lot of the issues that you talked about today came together. And then in 2012, left the City Council when I ran for the State Senate. The district I represent is—my English teacher will have to just forgive me—the most unique in, I say, the whole legislature because of both the urban and rural nature of the district. You're in the district right now, right here on the Duke campus. It includes RTP, about half of downtown Durham, both of the Duke campuses as well as the Medical Center. Then from here it goes north to include Person and Caswell counties. That means that it becomes very rural once you get out of the Durham city limits to those places up in the northern part of the district. Caswell County, for instance, is 22,000 people spread out over a fairly sizable area. So there it becomes very rural, very agricultural. In terms of the natural resources, there's an amazing array of things that are going on there. Four of North Carolina's sixteen river basins begin in my district. Their headwaters are right there; there are literally signs that say “this is the beginning of the Neuse River” up in Person County. That makes for interesting challenges. Just Durham alone has probably, among North Carolina's communities, has probably some of the largest number of intermittent streams, urban rivers, urban waterways. We have a couple of lakes nearby, man-made, which bring with them all kinds of interesting issues—Lake Jordan and Falls Lake. And then to the north, some beautiful, natural lakes as well.

Dr. Sherwin also mentioned coal ash ponds, and I remember one of the most interesting days of my life was February 3rd of 2014. My assistant called me. We were not in session at the time, so I was at my office here in Durham and my assistant called me and said we got this urgent call from a farmer up in Caswell County, said he met you and he's very, very concerned about his cows. Okay, he's concerned about his cows, so what am I going to do about that? So I remembered the man, and so I called him and I said, “Hey, what can I do to help you?” And he said, “Well listen, should my cows go down and drink at the Dan River? Should I let them go drink in the water?” And I said, “Well, why not? What's different today?” And I just had not heard the news that—this was a Monday morning—that afternoon before that is when we had the coal ash spill into Dan River at the Eden power plant, the Duke Energy plant in Eden, North Carolina. And so I said, “Has the County Health Department been out there? Had they done anything, you know, posted anything?” He said no. I said, “No, I would not let my cows drink the water today.” So he said, “Well thanks,” and he went and got his cows out of the Dan River.

I worked very carefully ever since then on the coal ash spills. While the Eden plant's not in my district it is upstream from my district, or, my district is downstream from the plant. But additionally though, I do have two of the largest coal ash ponds in the state in my district, so every time a storm comes or we read another study or we continue to test wells in that area, I just hold my breath about what the levels are going to be. Dealing with the coal ash ponds is a very critical and important issue for us.

Some of the things I think a lot about are that intersection that our ancestors wouldn't agree with, but I think, as their heirs today and, I think, the stewards of our future environment, is where the environment and agriculture meet. You touched on it quite a bit, and I think as policymakers we have to have those conversations. They're going to be difficult, very tough conversations. I'm an active member of the rural ag caucus in the General Assembly, and those guys from really rural parts of the state love it when I come walking into all of our meetings and actually participate and know something about it because they say, "What's that guy from Durham doing in here?" But I have been a co-sponsor of the last five farm bills that the General Assembly's passed. We have a lot of important issues around agriculture. Perhaps some of you have studied hog lagoons and they are certainly prevalent in Eastern North Carolina. I can't even begin to think of the myriad environmental issues, but also the myriad legal issues around hog lagoons and that is something we as a state deal with as well.

And then clean energy. My district, again the most unique in the state, we have more solar investment than any other of the fifty Senate districts in the state. Again as you drive north from here, you will find an incredible number of solar farms throughout the district. That is a very big business in my district. How do we balance that with the fact that I have those three Duke Energy plants in my district or just across the county line? So I'll just conclude by saying North Carolina is ground zero for a lot of these questions because of our growing clean energy industry here, we're number two behind California in solar, so that's an important thing to us. Agriculture continues to be our largest industry in North Carolina. You hear so much about the rural-urban divide, I sit right on that fulcrum every day of the issues around urban and rural agricultural environment. Clean energy, dirty energy—well I'm sorry, coal can be clean right? Anyway, coal, solar, I sit on the fulcrum of those issues every day, and it drives a lot of my work. I look forward to the dialogue with you all.

Ms. Heather Keefer: WakeUP Wake County is a nonpartisan nonprofit that works on growth and land-use issues, so transportation, housing, water and schools. I’ve been with WakeUP for six months and just started working on advocacy issues. What makes me a little different on the panel today is that I’ve worked in state and municipal government my entire career up until recently, so I’ve definitely been the boots on the ground. I went to school at UNC-Wilmington. When I was a freshman, we had Hurricane Fran, and I worked at state parks as an intern and got to clean up. And then, when I was a senior, we had Hurricane Floyd, and I was an intern with the Division of Coastal Management and worked on staking first lines of vegetation and seeing how communities were going to rebuild from Hurricane Floyd. Shortly after working for Coastal Management, I started my role in municipal government, worked in New Hanover County and then soon moved to Holly Springs. I worked in Holly Springs, which was one of the fastest growing towns in North Carolina in 2000. It had very few, if any, environmental regulations at the time, and it was already seeing extreme growth. In 1990, we had roughly 800 citizens, and when I left in 2015, we had 36,000 so it was quite a difference.

I worked on timbering regulations and sedimentation erosion control, stormwater, floodplain management, stream buffers, you name it. We had to really work with the development community as we were figuring out how to grow, how to have development, and how to protect the environment. We also administered something called a secondary and cumulative impacts master mitigation plan. We were one of the first communities in North Carolina to do this, and what this was looking at was all the other things that you’re doing on the federal, state, and local level to protect the environment—when you have your direct impacts and what the other things are that you’re doing to protect the area since you’re already growing. We would look at this for all of our town projects, not just the big projects that would spark the larger environmental review.

I also worked at economic development and tried to help that department identify parcels that the landowners wanted to develop, then look at the environmental features on the property, and then guide the property owners and the people looking to develop the property and what measures needed to be taken for protection with making the development happen. After I left the town of Holly Springs in 2015, it was in the middle of a change—a change in the way that the state was thinking about environmental regulations, and we were looking at why are we doing things, why do we have these rules. We

were kind of rechecking things and seeing if we were overregulating. That is still something where I think there's been some cleanup as far as making regulations more streamlined, but also I think that there's a lot of places where we've taken a step back. And now, when we're really looking at larger storms and talking about resiliency, maybe we need to do another recheck.

After Holly Springs, I worked for North Carolina Emergency Management. I was the National Flood Insurance Planner for Eastern North Carolina, so I helped communities from Lumberton, Fayetteville, all the way over to the Outer Banks manage their floodplain management programs responsibly. For each county and community it looked very different.

You had some areas that were quite urban and in a riverine system where they could protect their floodplain and keep people out of it. Then you had a lot of areas—very rural, flat areas—where their government structure was different and the communities didn't have a lot of staff and depended on the county. There wasn't a lot of communication back and forth; there were a lot of silos. Then you could also find that even in the larger municipalities, like Wilmington, there wasn't a lot of discussion between departments on how they did permitting. We worked with them to try to make sure that each community was coordinating with the right people. We also worked with them after Hurricane Matthew, and we looked at substantial damage assessments and making sure that their permitting was appropriate after the large storm event.

Now that I'm with WakeUP Wake County, I'm working on many regional issues where we're looking at the big picture. A lot of our issues with growth happen on a regional level. A lot of our issues that we have with Falls and Jordan Lake are that they span across municipalities. So, looking at "One Water" concepts where you're looking at the economic vitality of the area, you're looking at equity and also the environment, and making sure that there's water supply for the next fifty years. Then also making sure that there's regional resiliency partnerships that people are building in the right locations. Also looking at the big picture like what WakeUP looks at—transportation, land use, water, housing, and schools—and making sure that they're flowing together, that density is where it needs to be, that land preservation is where it needs to be, and that we can look at all these things together to make strong resilient communities.

Ms. Quintana: Thank you, everyone. We will begin our general discussion. Please feel free to jump in at any time, build on each other's

comments, and have fun with it. As has been discussed earlier today and even briefly in the introductions, there’s obviously an interaction between human health and climate change. So, I wanted to ask you what your opinions were or what your expectations were on this interaction, and do you think that the negative impacts will resolve or intensify in the close future?

Dr. Sherwin: So, let’s talk about the interactions between human health, climate change, and the urban environment. I’d really like to take that in three parts and talk about each of those terms because I think it’s important. Today, we are still continuing to have this political discourse, this idea of scientific certainty sort of underpinning climate change—do we believe that it’s attributed to anthropogenic causes, human activity connected to greenhouse gas emissions? That is very much driving the dialogue, and so I think we really need to start from the same place. As a scientist, I believe there is a consensus that climate change is occurring and that human activity is contributing to that. And, I think if we start from that place of agreement which is really important, then we can get on to the other issues about human health and its connection with the urban environment.

Now certainly with climate change, from a broader perspective, we have seen effects on human health. We see these extreme weather events. It affects crop yields in a lot of different areas. We talk about communicable diseases that are spreading in the aftermath. And, we also see the spread of environmental contaminants, if we have flooding, which is an extreme event that is associated with hurricanes and increased hurricane strength. If we have flooding in these urban areas, then we have to look at that broader connection to human health. In most urban areas, we see industrialized areas located near residential areas, and with those industries we’re going to have more hazardous waste sites.

Houston is a perfect example. It is the petrochemical heartland of the United States, so we have a lot of industrial land use in those areas. Consider that, in combination with the destruction of more grasslands, plowing and dredging through wetlands to transform those areas into residential and commercial plots. To put up a parking lot? Wasn’t there a song lyric “we paved paradise to put up a parking lot,” something like that?³ So when you have these increased incidents of flooding, when you intensify land use, and when you have more concrete, less grass,

3. Editors’ note: Dr. Sherwin refers to JONI MITCHELL, *Big Yellow Taxi*, on LADIES OF THE CANYON (Reprise Records 1970).

you see this spread of environmental contaminants throughout this community and that certainly has an impact on human health.

I think we can look to Houston and Hurricane Harvey, which is fairly recent, as a perfect example. I know we can also talk about Hurricane Florence as a recent example for this region locally. In Houston, we have a city with basically zero zoning ordinances. This presents a challenge with increased urbanization of that area that has continued, since the early 90s, removing many acres of wetland for urban use such as parking lots, commercial development, and apartments. We can arguably see this in the destruction of the Katy grassland which is west of Houston. So here's the result: when we continue to indiscriminately take away these ecosystem sources — and we do have a finite amount of natural resources here — when you take those away and you replace them just indiscriminately with parking lots and concrete, that does have quite a bit of an impact on human health. Because when flooding occurs in and near industrial areas the contaminants spread much more quickly. We're essentially taking out that natural sponge. If we're taking out the trees and taking out the grass, there is no longer that buffer area to absorb that flooding. As a toxicologist, I'm concerned with this aspect of urbanization, and wondering if we are really thinking and planning while considering how are we going to preserve the grass, preserve the trees, and preserve a functioning ecosystem within the community, yet allow for it to grow. Just a couple of thoughts.

Professor Hirokawa: Yeah, that was fantastic.

Dr. Sherwin: Well thank you. Wow, I'll take that compliment.

Professor Hirokawa: So I've got a couple responses as well. I think this idea of where it is that human health, ecosystem health, and climate change. . . What kind of things should we be thinking about? One is the public services that we provide to maintain our public health—our water infrastructure, water, sewer, among others. That's one of our primary vulnerabilities. One hundred and twenty-five years ago we're laying pipe that should have lasted 125 years. Seventy-five years ago, we changed to seventy-five year pipe, and fifty years ago, we said we can lay this pipe to last about fifty years. It's time that we got to think about taking an inventory of whether we have any working systems left. In the meantime, we've got a variety of different kinds of sewer and water-type systems—separate storm systems versus the CSO kind of systems—and they have their own vulnerabilities, not the least of which is location. Are we going to have to move them? Figuring out changing storm patterns and coastal vulnerabilities, and soil

movement. And, on top of all these critical issues, one of the things that we know without regard for who's causing the changes in the climate is that we've got human migration along with climate migration and wildlife migration. You're seeing it right now in this location. Maybe it's going to keep moving north, who knows? We know, but the human migration is going to demand extra capacity in our already problematic infrastructure systems. Do we have water, do we have sewer capacity for the influx of new people we didn't expect to come when we built the system? This is one thing we need to think about, and a lot of that infrastructure is within our control. We just need to plan and fund and do it.

As part of that, the ecosystem services component is asking us to consider the cheaper, more lasting ways that we provide for these public services through ecosystem services. The idea of green infrastructure that Dr. Sherwin was talking about is that we leave some unpaved spaces, have some plants, but more than that, figure out how to integrate working ecosystems into the way we manage our public infrastructure needs. We can build a better, more resilient, longer-lasting, cheaper system to maintain that can provide when we need it. It's thought to be more resilient because the ecosystem can recover without our intervention a lot easier than if we have to build a new pipe system. The first issue was sort of thinking about migration and capacity with the physical aspects. Planning to integrate green infrastructure is a little bit of planning for the next emergency, right? If we get rid of all of our ecosystem function of the ones that were contributing to our infrastructure—like how we're delivering clean water—we're not ready anyway you look at it because we're going to have to build another system in response to the next emergency.

I think a really important thing that we need to think about too is since 1969 or 1970, when we started thinking about the modern era of environmental law, local governments really have been left out of that equation. Sort of left to do what they're supposed to do. And every once in a while you hear the critique that local governments aren't carrying their weight because they're not doing stormwater control very effectively, or some such things. As a result, local governments don't get to participate in how we formulate federal environmental policy. And I think that's a crock, a little bit, right? Because when you think about who's at the center of providing clean water—we may adopt uniform standards at the federal level—but it's the Public Works folks that are making sure we're implementing technologies to make sure that water gets clean. That's where the work is happening.

In fact, the big critique of, “we don’t have the sophistication in local governments to get some of that stuff done” is clearly not true, and I just want to point this out because I think it’s hilarious. Two weeks ago I was at this meeting of water folks—Public Works, water engineers, water practitioners—and they were showing off the systems that they were developing for going way beyond sewage treatment. Usually it’s a primary and secondary cleaning system while the tertiary would fry everything up, and the water comes out of sewer systems pretty clean. There they are figuring out other mechanisms to clean it up so much that it’s not just drinkable, but it also removes the stigma of having been in the sewer system. And, they’re shipping it off to brewers and making beer out of it. It’s a bunch of water folks out there having a blast, but doing the heavy lifting of making sure that we’re providing for these basic systems. I think local capacity is exactly where it’s supposed to be. We’ve been training for this for a really long time.

And, the last thing. I do think something we need to think about from the legal perspective is how we regulate our emergency responses. This is no real mystery but, generally speaking, we have emergency responses. If it’s between getting a permit and going through the process, or digging a ditch to get rid of the water, we dig the ditch to get the water out of town and move it somewhere else and save people’s lives. And, it’s okay to have special procedures during emergency responses. We’re sort of trained to say “here’s what our problem is, focus on that.” There’s a direct cause and effect of what we’re going to do to prepare, but we have to remember that there’s this very built environment, gray infrastructure sort of training to those responses, and we don’t have to have that normalized in the way we do emergency response. Every time we dig that ditch, we separate the water course more from the floodplains, and that’s the ecosystem service that helps us deal with the flood. I don’t have a problem with having special emergency procedures, but if our emergency procedures are a little more planted in best practices then it justifies having emergency exemptions because it normalizes better practices for how we respond.

Senator Woodard: You didn’t leave me a lot to say. Joni Mitchell “Big Yellow Taxi,” 1969. As the oldest person in the room, I actually remember when that was a hit song. The challenge in talking about any of these kinds of things though is that, ultimately, you’ve got to convince the politicians to do this, and if the politicians aren’t going to believe in the science then it ain’t going to ever happen. Again, North Carolina is the prime example of this because in 2012 we actually

passed a law that told our Department of Environmental Quality that you don't rely on scientific data to make your decisions. We weren't the only state to do that but we were probably the largest state to do it and passed the most egregious of the laws. Now, when a scientist goes out and tests something do they follow the letter of that law? Probably not, but it put North Carolina right up front as saying, “Hey you know what, we're the policy makers, and we just don't believe in the science here.” If I can get back in the majority, one of the first things I'm going to do is repeal that damn law. [Applause].

We've got to let the science drive the work that we do. If not, when it comes to not just environmental policy, but the related health policy around that and then all the urban planning that's connected what we tend to do—and I've seen it in my six years in the General Assembly—is that we play whack-a-mole with every environmental disaster that comes along. Instead, we should be playing Moneyball, if y'all know that movie or book. We need to be playing Moneyball; we need to let the science, the data, the research drive the decisions. Or every time another hurricane comes—Michael, Florence, Floyd, Fran—we're going to be just spending lots of money when we could have planned a lot better.

I appreciate Professor Hirokawa talking about cities because I honestly think that the most interesting work that's going on in protecting our environment, our water, our sewer and thinking about this is going on in cities now. It's not going on at the state level. Even progressive states that are doing some good work on this, like California or Oregon, you're finding a lot more interesting things going on in cities. I'm a big local government guy even though I work at the state now, so thank God we've got progressive cities like Durham, like Raleigh, like Cary, like Chapel Hill who are—just in this region—thinking about this and doing that in spite of what's happening with state government. Hamilton and Madison I think would love to come back (well, Hamilton is back, what am I saying? He's here next week in Durham). The whole tension between federal, state, and local government now in these issues is fascinating to watch the whole marble cake of this democratic republic that those guys helped create is really challenging, particularly when it comes to the environmental public health issues that we face. So thank God for cities and counties who are stepping up and pushing state and local government, even to the extent of ending up in lawsuits either suing those other two levels of government or getting sued from the top down, to come up with creative solutions to these challenges that we all face.

Ms. Keefer: Well I agree with everything that's gone through here. What I can say about our area is that the Triangle⁴ has been pretty progressive as far as protecting the environment, and it's interesting, there's been some reports out recently that there is an increase in development in the floodplain in Durham and Wake County. It's looking back from 1992 to now, and it surprised me because since 1998, Holly Springs—the town I worked in—we didn't allow development in the special flood hazard area, the 100-year floodplain. Since 2006, we were regulating the 500-year floodplain and future conditions. So for quite some time we've been trying to keep development out of the floodplain. One thing that they did look at in the study was the 500-year floodplain, which is more restrictive, and it's something that that the NFIP doesn't regulate so communities that would be doing a higher standard. Floodplain management is one of the places where you can have those higher standards—they haven't been taken away from us—but it's a little weird too because a couple years ago we walked into a set of meetings and we were told that we couldn't say the phrase "climate change" anymore. It didn't exist in our vocabulary; it just was wiped out. So you have the science and then the reality that we're having these bigger storms and that people are flooding and that there's complaints and concerns, and you're trying to figure out how to convey that to the population.

You're also trying to figure out how to keep the tools you have—those higher standards—that we were lucky to have when we had all this development, and tell them that it's still worth having. A lot of them went away; now, having stream buffers is very hard in a lot of communities. Some communities, like the town of Cary, have figured out that resiliency is good and that keeping people out of the floodplain also protects your stream corridors, keeps temperature down, and does a lot of good as far as filtering pollutants while being under the guise of floodplain management and keeping people safe. You know you get the biggest bang for your buck. I think that's a strategy.

Also, when we were talking about infrastructure and in larger rain events, we have had some pretty significant droughts. We don't have a 100% reliable surface water source and sometimes we have too much rain and then other years we're in the opposite boat. And, we're talking about having to conserve and have people shower differently, and water their lawns differently and really kind of get that mindset in play.

4. Editors' note: "Triangle" refers to North Carolina's "Research Triangle:" the area between the academic research hubs of Raleigh (N.C. State University), Durham (Duke University), and Chapel Hill (U.N.C.).

It's very interesting that we have to bobble back and forth. Then not even getting into infrastructure and local government . . . conveying that fixing those pipes and, if they're in the older areas, that it's worth it. New development and the people coming in might be paying for it, but it's needed for the community to remain vibrant and to stay as a desirable place. There's lots of pieces and parts to it.

Dr. Sherwin: I did want to comment on two things you said which I think are really interesting. First, the fact that there exists a restriction where you couldn't use the term “climate change” in the meeting that you went into. You know, I become increasingly concerned when I see this censoring of scientific terms, particularly when we are not allowed to use these terms when we're talking about public health, when we're talking about environmental health. We are also seeing this type of censoring with the alleged scrubbing of data from websites—key environmental health studies and climate change studies that we can't find any more. When we continue to do that, it makes it that much more difficult to have an informed discussion that turns into something productive. If we can't even have access to the science, if we can't even use the correct terms, then how do we have an informed discussion? And, so I agree with you. I think that's an issue. And, then we see these extreme weather patterns.

For example, when we go back and forth between the drought—which certainly we experience in West Texas—and then the past week, we have just experienced torrential flooding and rain in Texas. We can't really have a short-sighted vision with, “Well, it's raining again so we're good, so climate change, that that's not really a thing, right? We had drought, but now we're good again.” I think we have to look at it long-term. I agree with you, I think that's an issue and the long-term vision of the connection between the drought and the flooding should inform how we farm and how we plan. I mentioned my dad's a farmer, and certainly people say that a warmer climate is better. I hear that a lot in Texas—“well, we're not getting the freezes anymore. It's warmer, this is a good thing.” For my father, it's devastating because if he doesn't get a hard freeze in the winter then he has to spray that much more to kill the boll weevils and every type of pest that comes in and devastates the crops. I think looking at climate change with an expansive view like that and being able to use the key terminology is really key.

Ms. Keefer: Well on the news this morning they said that the reason why our leaves haven't changed is because we have warmer evenings. My husband was really upset because he has the map in mid-

October and he was waiting for orange leaves in Asheville and they were still green. So, this morning he was like, “I told you we have problems.”

Senator Woodard: I think the challenge for those of us who think about these things, particularly those of us that believe in the science, is we’ve got to start making the economic case for this. Because that vey thing your husband’s complaining about is mountains—those who lived in North Carolina awhile and perhaps you law students had the chance to go to the Western North Carolina Mountains this time of the year to see the changing leaves—that’s a big deal to the economy in Asheville and those western counties. But, if that tourist draw isn’t there because the leaves aren’t changing, we’ve got to make that argument. Apples won’t grow as well and that’s a big part of the economy up there as well.

Listening to your conversation about boll weevils and spraying, an issue that’s been a particular concern to me is protecting our pollinators. I wrote the Pollinator Protection Act of 2017, which is a great bill and y’all should go check it out sometime—award-winning legislation. I love telling people I wrote the Pollinator Protection Act, but we’ve got to make the case when we have to spray more to take care of boll weevils, what is that doing to all of the ecosystems? And, we’ve got to make the economic argument. You know what I hear from the farmers—“Well you’re going to make it so I can’t spray.” And they start listing all of the pesticides that I want to get rid of because they’re killing pollinators, and I say, “Yeah but you know, you keep killing the pollinators because we’ve lost half of our pollinator population in the last 30 years. You keep killing the pollinators then you’re not going to have any of your crops in the next 30 years.” We’ve got to make the economic argument.

Ms. Quintana: I’m going to ask one final question, and then we’re going open up to audience Q&A. So it seems like one of the big themes that we were discussing is to make sure we don’t develop in areas that we need to maintain its natural presence, like the marsh lands and all those other things. However, as Keith was saying, there are some areas I do need development, like pipes replaced and better infrastructure that’s more sustainable. My question is, so we’ve discussed throughout the day that it’s going to take finance and money to be able to get us to a point where we can start acting sustainably, but then we need to maintain sustainability. We need to have people that are able to take care of the green belts. We need to have drivers for the buses and the trains. So my question to you is: how would you foresee or advise the

Research Triangle, or really anywhere in the country, as to how they can maintain that sustainability in these urban environments?

Senator Woodard: Well, you’ve got to invest. Number one, those of you registered who are registered in North Carolina, vote no on all six amendments, but particularly the one that caps the income tax at seven percent. That’s a bad financial policy anyway. But these governments, as I said earlier to my environmental policy but it’s true for municipal economic policy as well, don’t play whack-a-mole, play Moneyball. You’ve got to plan for these investments.

We’re running through a situation now, not so much on the streets right here in the Duke campus because these were developed later, but you can go just off East Campus and just off the West Campus here. Durham has gone through a situation where most of the urban streets in Durham were paved 100 years ago, so the water and sewer pipes that came in were terracotta pipes, which were common at the time, and they’re starting to crack. So, you’re seeing a lot over the last decade, you’ve seen incredible amount of replacement of those pipes and the infrastructure here. It’s been a real challenge. I was on the City Council when we started to address some of this, and we developed a long-term plan so we weren’t just having to do emergency funding. We actually passed a bond. I chaired the bond committee to go sell this, so I remember very well in 2007, of convincing people that what we’re asking for with the bond is not something you see right away. It’s a fund that’s going to go for the stuff in the ground that you’ll never see. And that was a hard sell.

Fortunately, we can make the business case for that, but your elected officials have to bite the bullet on some of these things. It’s not politically popular to talk about the funding, the financing of this kind of infrastructure because you don’t get to cut a ribbon and have lots of applause when you lay six blocks of new pipe through a neighborhood. Nobody gets a warm-and-fuzzy from that, but when that damn pipe breaks and it’s running through your yard and you’re the city council member who represents that ward and you get that phone call, it’s a real pain to deal with. We’ve got to bite the bullet, and, as elected officials, I think we have the responsibility to explain this to our taxpayers.

Ms. Keefer: As far as this area is concerned in urban environments, one of the things that we’re all subject to are the NPDES Phase One or Phase Two stormwater rules. When you’re looking at stormwater management devices, whenever I talk about it, I always talk about the need to put them in, the need for them to be aesthetically

pleasing, and to be amenities to a site and not the big hole in the back of the Walmart. But also, I really focus on, when you're planning, to also take into account operation and maintenance because that's often overlooked, and it's very hard to enforce if you don't think about it in the beginning. Many communities, but not all, in Wake County, have a stormwater enterprise fund that runs their stormwater management programs and it does some operation and maintenance of municipal stormwater devices. It does not maintain private property in most municipalities, and in some municipalities, their enterprise fund is only paying for maybe half of their stormwater management costs. The rest is being paid by either the taxpayers or by development. So, they really don't have enough money to maintain things in the fifteen, twenty, thirty years when the stormwater devices are starting to see wear and tear.

The city of Raleigh probably has been the most focused on looking at changing their unified development ordinance to incentivize and break down barriers to pick out better green infrastructure alternatives when you're looking at stormwater management—more low impact development, making the review process easier, even taking on some of the operation and maintenance of stormwater devices in the right away, possibly treating areas that were already impervious that are going next to redevelopment. They have the green review, they have the Raleigh rain water rewards, which is putting stormwater devices in people's existing homes, and they have a watershed protection fee, which sets land in different areas. They've got a lot of different things that they're using their funds for.

The other thing that we're looking at Wake County is the school systems because they're required to do stormwater management, and they have the large, big ponds that they can't keep up with. One of the things that we have a problem with in Wake County is we have a lot of people moving in. We have a lot of regulations that are requiring more classrooms, so we're building a lot of new schools. They have the opportunity to put in really innovative green stormwater, but they don't know how to maintain it. That comes from the operating budget, and the operating budget is always falling short. You have your teachers that are complaining that they don't have the resources and they can't vacuum the schools enough, so how are you going to ask them to maintain their stormwater devices? These need to function to keep our watershed clean so we can have clean drinking water and so we can have a supply that's going to last for the long haul.

Professor Hirokawa: All these fantastic points. I think we're hearing a lot of sort of “nailed it” moments and what we're getting at . . . There's a pragmatic issue here about whether we are fighting over whether we call it “climate change” or something else at the end of the day doesn't matter because we're seeing migration of climates and temperatures and weather patterns and some such things. We keep going on the fight about trying to figure out the sources and the causes and predict into the future and figure out what the science is so we can have an agreement to it, and in the meantime, we need to be thinking about education. We need to get out there and have the conversation so people understand that they're going to have to adapt their farming practices or their driving practices—or whatever the practices are—to a new set of circumstances. We need to think about flexibility. We need to think a little bit about how we finance it but largely continue to finance living, but shift what living means a little bit. The idea of being adaptive into how we do things this is a pretty important thing. Dr. Sherwin's going to have to talk to her dad about how frost may be gone.

Dr. Sherwin: I agree. I think he's quickly realizing that, and he's now employing water conservation practices with the way that they irrigate. Back in the seventies, it was just pure ditch irrigation. The farmers would open up a ditch and just let it flow, and now we're talking about a subsurface irrigation which they even run their chemicals through and that's amazing. But I agree with you, part of this is education and so it may be considering changing some of our terminology. One of my colleagues, Dr. Katharine Hayhoe, has been at the forefront of doing this.

You've got to figure out the audience and communicate in a way that puts us all on the same page. So, when I'm talking to my father who's not the environmentalist, but the *farmer*, I'm not going to say, “Hey Dad, you're a tree hugger, right?” No, but he's proud of the fact that he put up his own personal wind turbine in his backyard, and he funds most of his own electricity. He's proud of his water conservation practices. If we can find mutually agreeable terms to communicate these concepts of conservation, like the fact that the weather is changing, the better we're all going to be for it.

As far as the economics are concerned, I had the Lyft driver taking me from Raleigh-Durham airport to the hotel, and she told me, “You know, we've had a lot of these high-tech industries move recently into the Research Triangle, and it kind of feels like San Francisco where all of the prices are going up.” I was thinking last night, let's see. . . those companies have money and they have technology and certainly they do

satellite imagery. You can translate in that into geospatial analysis and if we combine that with epidemiological studies, we can then start identifying vulnerable groups and populations and adjust our plan accordingly. You can go out and talk to communities and say, “Here’s what’s going on in the area.” Perhaps identify those increased cancer rates that, if they’re situated close to industry, whether it’s a petrochemical refinery or coal ash waste impoundment. It does begin with education and identifying populations at risk, and starting to spread the word.

Ms. Quintana: We will now open this up to audience Q&A. Kyle and Emma will come up and down the aisles with microphones.

Audience Question:⁵ I’m from the Nicholas School of Environment here at Duke. So, I hear a lot of you talking about ecosystem services. I think it’s a very good tool to quantify the environmental benefits into economic terms, but then I think there is a potential problem about ecosystem services that it’s not very precise and not very accurate. Every organization when they calculate the same ecosystem services for the same system, they got different values and sometimes they differentiate a lot, so how is ecosystem services used in practice nowadays because it’s not very precise? How is it used by decision makers?

Professor Hirokawa: Fantastic question. Since, I think, 1997 when the first big studies on ecosystem services came out, we were talking about in the tens of trillions of dollars of just wetland services alone, and it wasn’t supposed to be exactly precise. Some of the math does have to be worked out, but a couple things to contextualize. If you’ve ever tried to figure out how much a house is worth, you understand that precision is not exactly the name of the game. You get an appraisal that says \$100,000 and an appraisal that says \$300,000 and then you start negotiating. It’s because market values can be really complicated. When it comes to ecosystem services, what we’re doing with that valuation is trying to figure out the measurable quantity of services, and usually we’re picking one service instead of the one plus the co-benefits and the eighteen other services are provided. Some are very difficult to measure, such as biodiversity. Others are easier. If we lose this wetland that can filter out however many gallons of water per minute, then we need a filtration system that can do that. We have to build it; we have to maintain it so we can figure out how much it costs to replace those services. In one sense, the idea of getting to valuation

5. Editors’ note: this audience member’s name was omitted for privacy reasons.

is this belief that it's as close as possible to precise, recognizing that hopefully we won't lose that service and we won't need to build that filtration service and that the cost of replacing the service also has some value. We might estimate how much it costs to build that facility, and we could be off by a \$100,000, so the lack of precision is just the way we do markets.

Now, that said, it's one of the ways we use it. In fact, in payment for ecosystem services programs, we try to figure out as close as possible how much that's worth so that we can understand valuations of replacements and substitutes and how much to pay somebody to preserve it. All those things that we're sort of creating these market forces that will determine prices. But it's not the only use for ecosystem services either. In some situations, we do valuations just to make sure we're not ignoring the cost of loss. Urban forests are a fantastic example. We do some measurement of how much water capture and carbon capture and water filtration and biodiversity and all kinds of things that we get out of trees in the urban area. We can do this by a bunch of different measurements—canopy cover and tree type and placement—so that we can figure out this is how much value or how much of a benefit to this area the one tree and the group of trees do. We decide that we're just going to cut some trees, not because we're doing a stormwater project, but because we want to build a house there. That's the loss. We've measured the loss we get out of the service that was being provided, and we need to recognize that we're losing that service so that we're cognizant of the fact that we just may have caused the flood or at least of that amount of stormwater control we just lost.

It gives us an estimation of what those functions are we're losing, so we know what services we're going to be short of later. It may give us some idea of, say, how to account for property rights. If all of the services are provided on one person's property, maybe we want to pay the person to not touch those and do a non-use practice of property. But, the other thing that I think is really important is when we start thinking about ecosystem services, we start measuring the benefits, recognizing all the different benefits, and trying to measure them. We have to remember that what we're doing is very locationally dependent. These are services that are provided here, that have beneficiaries here. When you start thinking about how communities identify with their environment and, by the way, communities only identify by identifying with their environment because they're always placed, all of those benefits are relevant to everything that happens

there. You trip over a rock, it's not a rock in some book. It's a rock that's right here. You go fishing in the pond down the street or swimming there or your route to go to work, these are the locations of here. Ecosystem services is a way of really taking into account how the ecosystem functions relate to where you think you are. In a sense, that sense of place benefit we get out of a really rigorous ecosystem service analysis isn't precise, but it gives us an awful lot of the values we may have been missing.

Audience Question:⁶ Thank you, I'm Arthur. I work at the agroecology education farming for NC State. You touched base on the long-term view and infrastructures, and I want you to follow on that. On a more political point of view, how is it possible to get a long-term view of sustainability by investing in infrastructure and conserving our ecosystems, and to have this fit with the short-term growth of our cities where we have to build houses as fast as we can because we cannot cope with amount of people coming in? Also with the short-term of the political terms, like you have four, three, two year mandates, and you have to cope with that and it doesn't really fit with the long-term views that you we have to get for sustainability.

Senator Woodard: You've asked sort of slightly rhetorical, but a very critical question that I don't know that there's an answer to. That's what I think all of us are going to have to wrestle with is that balance that we find because I know having sat for seven years on just rezoning cases or development questions. A developer comes in and lays out the tax benefit, so we're providing room for people moving in, this is how much revenue your city or county's going to get from developing this land. And to stand there and say, "No, I need to protect that land for one hundred years, not for the thirty years of this project or whatever." How do we do it? We just have to wrestle with it.

I like the professor's thoughts about talking about education and the political will to put in office the people who are willing to stand up for those long-term decisions. It's easy to say, "Yeah we'll rezone. We'll build in that watershed. We'll let this coal-fired plant continue to run. We won't develop solar or wind." Those are easy short-term answers. It's just political will on the part of voters and on the part of the people they elect.

Dr. Sherwin: I think part of it, too, is just looking back to our history. Now, more than ever, I think we operate with short-term memory. We have a hurricane come in or we have some sort of natural

6. Editors' note: this question was edited for clarity.

disaster or environmental disaster and a month later, three months later, six months later we're talking about a different topic because there's something more pressing. The formation of environmental law has always been very reactionary; it has typically been in response to some sort of major environmental disaster or consequence. I don't even know if that's really happening now, but I think again we can look to Houston and take Houston's rebuilding after Hurricane Harvey as an example. Are they going to go back and rebuild in the exact same way even considering some of the problems that they've had with flood control? Are they taking out a lot of those natural resources to do it? Will they choose to put green space back in? Are they going to plant more trees or are they just going to repave and rebuild? Do we have really an accurate picture of what those flood zones look like? Maybe some of that data needs to be updated as well.

I think part of the solution is to not have that short-term memory, but to look to past lessons of what's happened and even some of these more recent environmental disasters and remember them and where we failed. We can go back and say well, “Maybe we shouldn't do that again, maybe we should rethink this and do it in a different way.” I loved one thing that Patrick said on a panel earlier today.⁷ He said, “We need to try and not be afraid to fail.” We need to be willing to experiment and try some new things. Of course, I think that takes courage and we have to talk about it as far as politics too, right? But, part of it is just remembering and learning from what's happened.

Ms. Keefer: I think that one of the things too is that we have better mapping and better analysis when it comes to figuring out where the floodplains are in North Carolina. Areas like Cary are working to take it to a much smaller watershed, so instead of one square mile you're looking at, almost at, the start point. They're starting to look at what is the risk to infrastructure, what is the risk to their existing facilities, what is the risk to their new facilities, and what is the risk to their citizens. And then, hopefully, when you find out that those areas shouldn't be where our people are, maybe that's where they protect our natural resources and then that also can help us with our water temperature issues and our habitat connection issues and we can start seeing some benefits in our streams and our lakes.

Professor Hirokawa: I think the framework for thinking about this is natural capital, which gives us some dividends. If we start spending

7. Editors' note: refers to remarks by Patrick McDonough of GoTriangle. He sat on the Symposium's second panel, a recording of which is available on the *Duke Environmental Law & Policy Forum's* website. See *Fall 2018 Symposium*, *supra* note 1.

the principal right off of this account, at some point we're not going to get any interest off of it and the principal will be gone too. I think that's the difference between what you're saying is short-term decision-making and long-term. I think you have to remember that crisis decision-making has always been bad since the beginning of time. I mean relationship crisis decision-making, political crisis decision-making, flood . . . It's just something we do, and we have to figure out how to do it, there's no doubt about it.

I think one of the things that we are all struggling with on every panel here and probably all of you as you go through school is: what's a better framework to do crisis decision-making than, "Oh crap, I'm in a crisis"? So here's the problem, I'm going to solve that problem. Or, non-crisis decision-making is, "Let's not have a problem." The long-term view is set yourself up so that the thing never becomes a problem. But, it's not how we do things. That framework is tough, right? That's why we have sustainability and equilibrium and capital and social—these are all frameworks to try to figure out what that best long-term goal might be. Ecosystem services is another one. Some of them are better than others, maybe, for crisis decision-making in terms of trying to get us to a better outcome. Some of them prepare us better for the next emergency. Sustainability itself is tough because we don't know what we're sustaining exactly over time—we have shifting baselines in the environment, we have changes that are happening, and we're not exactly sure. It doesn't matter who caused it. We're not exactly sure what's going to happen to the environment tomorrow—what population migration is going to do to the services that we're trying to provide even if we're thinking about providing the same service anymore. Some of this has to be iterative, it has to be adaptive. That framework seems pretty good. Some of the "preserving natural capital so that it can keep working at a low cost" seems like a pretty good framework too. But I'm not sure we're going to get over crisis decision-making, we just have to try to have a temper it a little bit.

Audience Question: I'm Sean. I'm an MEM at the Nicholas school, and I had a quick question on you guys' thoughts on regulating and planning under areas of uncertainty. I think more specifically, I was thinking about this summer how in over the past year in North Carolina how Gen X and PFOAs chemicals in the water was a really hot buzz topic and how there was a lot of uncertainty on what is a safe level. So how do you go about making decisions when we don't necessarily have all the information?

Dr. Sherwin: Just to clarify, Sean, did you say PFOAs? Okay, that’s a tough question and with what we’re seeing with some of the policy decisions coming out of the EPA at this point; maybe we don’t need as much science to inform how we’re going to regulate PFOAs. I think that scientific uncertainty can be used in a way that’s unfortunate to risk assessment because if we don’t let science inform those decisions, if we just say “Well, we’re going to guess at this risk. We think this is okay if we have a new use for a chemical.” Or, “We’re cool with that because it’s kind of about the same. We don’t need the scientists weighing in on that.” Then we then we have a problem. Of course I’m going to advocate for more science versus less science, but I think a lot of that just depends on, when we’re talking about risk assessment, how informed our decision-making is going to be particularly with PFOAs.

Senator Woodard: There are points where you have to draw the line to make the decision. What are safe levels? Do I believe that? Let’s take Gen X. Our scientists say it’s this level, but I hear other folks say, “Nah, it ought to be a level here” [indicating lower]. I don’t really have an answer for you, but you’ve got to rely on the science a lot more. And we’ve got to take the risks, take the gamble when setting those levels in there. I think we’ve got to be constantly . . . You mentioned technology’s always changing and improving, and I just think we have to commit resources to always do evaluations of those things. Do we believe that the level we set for Gen X, for instance, in the Cape Fear is still a good level? I don’t know. I hear from people all the times that the level needs to be much lower than where we are. So I don’t have an answer for you, but we struggle with that all the time.

Ms. Keefer: I think industry and the regulators are going to have to figure out a way to work together and to make sure that when it’s leaving the site is when you’re thinking about what level it needs to be at. And, you’re not trying to figure out how you’re going to treat it as it gets diluted and works its way into the ecosystem. I think it’s very, very hard at that point.

Audience Question: I just wanted to end on a positive note. Everybody seems to love solar power, and I’ve actually read that Texas is huge on solar power. There’s a component of education. If you gave every kid an iPad that was solar-powered, that would be a learning, teaching moment that would do that in a few . . . If you walk around Durham, you see these lending bicycles that are not attached to any particular station and all of them have solar panels. If you can afford to put them in a basket of the bicycle you can almost give this out and

make people aware that they can capture energy in a different way. Even if the only thing that they do is power their iPad and it becomes a hobby for kids, I think that it can increase the awareness.

Professor Hirokawa: Keeping in mind that some of us grew up with calculators in fifth and sixth grade and they were all solar powered, but then we got rid of those calculators in favor of iPhones and smartphones and stuff. Now we have to plug in our calculators for school. So, it was a great idea, but maybe we need to get back to that.

Dr. Sherwin: Well I'm encouraged as well. Again, I'm in West Texas, and one of our biggest resources is just wind. Wow, we have a lot of wind out there. So, a lot of our farmers have started leasing out their land to wind turbines and wind farms, and, of course, those come with some of their own environmental challenges. But it's interesting in Texas, in certain areas and pockets, different forms of alternative energy are popping up, and it's working.

Senator Woodard: The solar farms in this area are because the farms don't grow tobacco anymore so the family would love to stay on the farm. I talked to two constituents, a husband and wife. He's 76, she's 74, and they live on their farm that's been in their family for over 150 years. Their kids don't live in the community anymore, but they don't want to sell the farm. They want to give it up. They want to stay on their farm, but they're not able to farm it anymore. They don't grow tobacco. They can't get out there and harvest tobacco or cotton or peanuts, so how do they stay on their land? As soon as the solar folks came knocking at their door, they signed that twenty-year lease, and they're coming up for another renewal here in about six or seven years. I asked them, if you're still around are you going to re-up? They said, "oh yeah," or their heirs will. So same thing as your wind farmers.

Audience Question:⁸ To jump in on farming, how do you see growing cities and urban areas fitting with agricultural areas, like with urban farming or around education and more local food systems and getting people to know more about their land and their where their food comes from. How do you see that growing in a sustainable way?

Senator Woodard: I am a huge proponent of urban farming and supported a lot of work on that. It also helps us address food deserts, which are not just in rural parts, but in urban areas as well. Again, I think it takes local policymakers who are willing to allow chickens in an urban environment. Heather will appreciate this—trying to allow chickens in Cary.

8. Editors' note: this question was edited for clarity.

Ms. Keefer: I had them in Holly Springs.

Senator Woodard: Holly Springs is one thing, Cary is something else. I think you're starting to see more and more urban farming. You're seeing cities who are really taking the lead on doing that. As I said earlier, God bless cities for allowing chickens in every patch of land that can be a farm and beehives on the top of hotels and those kinds of things that we're seeing. It's a great move, and I do everything I can. I had to fight in the farm bill three or four years ago for what the definition of poultry was—you think that would be fairly easy, the definition of poultry—so we could continue raising poultry in urban communities like Durham, Raleigh, Cary, Chapel Hill. I was successful in fighting that and the poultry industry loves me because they now see that an area where they have real growth.

Ms. Quintana: Law students here would say that there's actually a lot of fight over what is considered poultry and chicken, citing *Frigaliment*.

Senator Woodard: How about milk? Have y'all fought on that one yet?

Ms. Quintana: I don't know, but everyone's heard about the chicken case.

Senator Woodard: We had the debate about milk this summer. Almond milk?

Professor Hirokawa: Just real quick, I just wanted to mention something. The evolution of urban areas towards more acceptance of ag type practices starts from the beginning of zoning when ag areas were zoned out of urban areas as fundamentally incompatible with the kinds of residential values that urban areas were supposed to portray. We're sort of in the middle right now of the wave away from that. Some local codes simply say, “agricultural practices of all these different types are *per se* nuisances within city centers.” And what you're seeing is lifting of those nuisance declarations gradually, but speeding up as it goes across the country. It's not the only thing, but certainly that's one of the structural limitations on integrating ag in cities and urban lifestyles. I think what's sort of interesting about it is as that's lifted from property rights as a prohibition on ways you can use your land, that doesn't answer what urban ag looks like. So the jury's sort of still out.

I think a lot of the constructive and creation kind of issues with what urban ag will do haven't even really hit the table yet on a lot of these local governments because they're still struggling with whether they will allow it, which I guess is maybe part of your question. It's

going to be important, so it's worthwhile trying to figure out. What does really successful urban ag look like? And, it won't be one thing. It will be many things. It will be very contextual and locational. It will involve different kinds of materials and different kinds of products and whether it's market and all kinds of stuff, but now it's the time to have that conversation because it will help get to that place where urban ag is a little more comfortable.

Dr. Sherwin: I'll give one quick example just from my community of Lubbock. We're a community of about 250,000 people, a university-based community, but largely ag-based community in rural areas all around us. I guess we're kind of urban/rural in a way, but what I see is a wonderful collaboration between our farmers and our city officials. We have a wonderful group called the South Plains Food Bank, and they collect canned goods and foods and redistribute it. But, they've also started farming practices and so a lot of our at-risk children are learning farming practices, what fresh food and harvesting fresh food looks like, and how to cook it. A lot of our farmers are coming in to help with those practices and teaching those practices, so we're seeing some really interesting collaboration there between our rural farmers and what's going on within the city.

Mr. Kyle Medin: Before I begin my closing remarks, if y'all could go down the line and in a minute or less just give us one action item, one thing that you think those sitting in this room can do to go out and start to engage with these issues.

Dr. Sherwin: One action item is to stay informed, not just through listening to stories via media, but to search for the truth through science and then use that and communicate that with other people. Again, like I mentioned at the beginning, I think there is a disconnect between what scientists are finding and what ultimately happens as far as policymaking. I think science can be very empowering, and I think the more that we look into that, understand that, and then communicate that with each other and educate based on that, the better decisions we're going to have.

Professor Hirokawa: Education seems to be the key, educating ourselves. Everybody knows you ask the kid where milk comes from and they say the grocery store. But, that's the state of knowledge in many places. A lot of thinking through what we have to do involves a baseline vocabulary and set of concepts that a lot of folks don't have, including folks that are making some pretty important decisions. So, the fact that this tree does these things is important. It's just a basic concept. Education I think is the best way to get to that base.

Senator Woodard: Vote and vote locally.

Ms. Keefer: Think about the big picture and embrace regional thoughts on planning. There’s areas where density is okay—bikable, walkable communities with transit—and then there’s areas where there can be good farming practices that are good for a healthy watershed.

Ms. Quintana: I want to thank our speakers for coming today. [Applause]. And now we’re going to wrap things up with closing remarks from the *Duke Environmental Law & Policy Forum’s* Editor-in-Chief, Kyle Medin.

Mr. Medin: Thank you all so much for coming. I’m going to be mercifully brief, because I know I am the last thing standing between you and your weekend. I just want to say that it’s become increasingly clear through all these great talks throughout the day that where we live, how we live, and who we are, are much more closely intertwined than many of us realize. We’re surrounded by highways, busy streets without sidewalks, we can get cut off from our community and from those around us, and we’ve seen examples of that in talks throughout the day today.

Personally, I thought that this symposium was going to be a great topic to explore because I’ve been fascinated with the interaction between humans and our built environment and how we grow, how we spread across the landscape for several years, and this was a great chance to explore that in a local context and a regional context. It’s really a crucial discussion—crucial for Durham, crucial for the Triangle, crucial for North Carolina, but crucial anywhere that urban spaces exist. As we keep going further and further into the 21st century when there’s more and more of a flock to the cities by our populations, it’s going to get more and more important to find workable, equitable, and sustainable solutions to all the problems we’ve discussed today. I think that it’s a very important discussion to have.

But, the reason we asked you all here today wasn’t to give you a fire hose of information and just send you off into the world. We hoped that this symposium was going to be the beginning of a conversation that continues once you leave the room. We hope that at some point today you struck up a conversation with one of the folks on these panels, and you asked them how you can get involved or you traded emails, traded cards to see if you can send them a question, send them your thoughts. We hope that you’ll now know a face in the bureaucracy that can sometimes seem cold and faceless, and know where you need to go to get involved in these issues. Above all, you have a voice, but it only works when you use it. In a very salient issue right now, the most

important way that you can actually exercise that voice in the next week is to turn out in the Midterm, which is November 6th. Voting happens all day. Early voting is underway. We have an early voting site just up the street at the Brodhead Center, so I urge you all to—if you're interested in these issues—make sure you make your voices heard because that's the only way that we can keep pushing these issues forward.

Again, I want to thank all of our symposium editors for all their amazing work, their really hard work on making this a success; all the staff editors for helping out; of course, our wonderful panelists—all day they've all been fantastic; our faculty advisors; and, of course, all of you both here and watching online for taking interest in these issues. I hope that we can continue to engage in this discussion for decades and decades. Thank you so much. [Applause].