Climate Change Adaptation for State and Local Governments
Overcoming the Uncertainty Barrier to Adaptation

Webcast Transcript

April 17, 2013

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Webcast Agenda and Meeting Logistics

Slide 1 and 2: Introduction Slides

Operator: Good afternoon. My name is Lindsey, and I will be your conference operator today. At this time, I would like to welcome everyone to the Overcoming the Uncertainty Barrier to Adaptation Conference Call.

All lines have been placed on mute to prevent any background noise. If you should need assistance during the call, please press star then zero, an operator will come online to assist you.

Thank you. Emma, you may begin your conference.

Emma Zinsmeister: Thank you. Welcome, everyone, and thank you for joining us today for the second installment of our Climate Change for State and Local Governments' Adaptation webcast series. And today's topic will be focusing on how to overcome the uncertainty barrier to adaptation in your decision-making processes. My name is Emma Zinsmeister; and I'm here with EPA's State and Local Climate and Energy program.

Slide 3: How to Participate Today

Before we get started, I just want to go over a few details on how you can participate in today's call. Using the Go to Meeting panel, you can enter in questions that you may have for our speakers as they give their presentations today. The orange arrow at the top of your control panel helps to open and close that panel. Everyone is on mute that's participating, so you will need to type in your questions and to obtain that labeled question. Please indicate who your question is directed to, so we can properly direct those during the Q&A session. And once you have typed that and you can hit send at the bottom right of your panel to have those questions submitted.

You need to call in today in order to access audio. Unfortunately, we only offer it through the phone lines, so please make sure that you call in – not that if you could hear me, if you haven't already. And if you experience any technical difficulties at all today, you can email Wendy at ICF at the email address listed here, and she can assist you with any issues you might be having with the audio or the webcast.

Slide 4: Adaptation Webcast Mini-Series

So, as mentioned today's call is part of a three-part series that we're doing on climate adaptation. We started on March 21st of the call that covered, "How do I achieve buy-in from your stakeholders to support adaptation efforts?" And then, on May 1st, we'll be talking about how to collaborate with other sectors such as public health and hazard mitigation to help attract funding for your adaptation efforts.

You can register for that May 1st call still at the link that's posted here. And then all of the files and recordings from all three webcasts will be posted to our Web site at the link listed below.

So, if you pre-registered for today's call, you should have copies of the presentation and the e-mails sent out earlier today. You'll have access to all of the links and information contained in the slides you'll see today.

Slide 5: Webcast Agenda

So, today, we'll be hearing from some wonderful speakers about how to deal with the issue of uncertainty and thinking about the future impacts from climate change. We'll be kicking off with the presentation from Chris Weaver from EPA's Office of Research Development on dealing with climate model uncertainty. We'll then hear from Anne Choate from ICF International on how to use a threshold approach for climate change vulnerability using historical information.

We'll then hear two excellent case studies – one from Philadelphia, which will be presented by Scott Schwarz and Alex Dews, and then one from Southeastern Florida that will be presented by Debbie Griner.

As I mentioned, we'll be taking your questions via the question function and Go to Meeting and holding those to the end. We'll be doing a joint facilitated discussion and then follow that with your questions and get some feedback from the speakers.

And at the end of the call, as everyone exits out the webinar, you'll have the opportunity to provide some feedback and we encourage you to do so, as that helps us develop future resources.

Slide 6: Brief Background

So just some very brief background. We're focusing on climate adaptation today. So, what is the difference between mitigation and adaptation, two terms we hear really frequently in the field?

Mitigation really focuses on reducing greenhouse gas emissions to help limit the extent of future climate change. And adaptation is really about actions that we can take to moderate the impacts of future climate change. So, how do we respond to potential harm and capitalize in potential opportunities that may arise as a result to the climate – a changing climate?

Slide 7: Example Adaptation Planning Process

So, just really quickly, this presents a brief overview of what a climate adaptation planning process may look like. Of course, this will vary depending on the resources available on your state or community.

The first step about building and maintaining support for climate change preparedness is what we covered in our first call on March 21st, and you can access those slides and reporting on the web. The next three steps where we are talking about looking at impacts, presenting vulnerability, and

setting goals and actions are really what we're covering today, in terms of how do you deal with the uncertainty in information to take these steps? And then, of course, the question of how do we fund all of this work is what we will be covering in our May 1st call.

Slide 8: Appendix of Resources & Contact Information

Slide 9: U.S. EPA's State and Local Climate and Energy Program

Slide 10: U.S. EPA Resources

Slide 11: Additional Resources

So, I've included in these slides for you, an appendix of resources that you may be interested in checking out after today's call; some brief information about what the state and local climate energy program has to offer, some other EPA resources that are relevant for adaptation, including technical assistance programs, data, other information, and then, of course, some really great resources on the Web that will be the case study, best practices, policy tracking, other things you may very well be interested in checking out, and we encourage you to do so.

Slide 12: Contact Information

Here is my contact information. Please feel free to reach out to me, if you have any questions about our resources, this webcast, or ways in which we may be able to help as you work in your states and communities on adaptation.

And so, with that, before we jump into our featured presentation today, we'd like to do a quick poll to kind of test the water, and where everyone on the line stands today with their experience with adaptation.

So, I'm going to turn it over to Wendy to lead our first poll question.

Poll Question #1

Wendy Jaglom: So, poll question should be your screen. And the question is what is your level of experience or familiarity with climate change adaptation?

So, there are five choices. Please select the one that's most applied to you and we'll give you just a minute to enter in your responses.

Emma Zinsmeister: OK. So, we can pull up our responses.

Wendy Jaglom: OK. So, that looks like 43 percent of participants have started to take action and identified that or initiated a project; 30 percent have considered adaptation but not taken action due to lack of resources; 16 percent have completed at least one project; 6 percent have considered it but not taken action since it's controversial; and just 4 percent are not sure how adaptation is different from mitigation.

Emma Zinsmeister: Thank you, Wendy, and thanks to everyone for providing your responses. Hopefully, the information that we'll be providing in this call today will help folks work on further opportunities for identifying projects in our communities and looking at implementation strategies, and, of course, the question of resources is something that we'll be addressing during the May 1st webcast, so we will be providing some information on opportunities there.

So, with that, we'll introduce our first speaker. Chris Weaver is a scientist in the EPA's Office of Research and Development. He's currently on assignment to the U.S. Global Change Research Project, where he leads the coordination and integration of scientific research components of the program to implement the new decadal national global change research plan. His background is as a climate scientist with a Ph.D. from Scripps Institution of Oceanography.

At the EPA, he's involved in evaluating the specific risk global change poses to air quality, water quality, human health, and ecosystem; and he supported climate related decision-making at the agency in these areas.

Prior to joining the EPA, he was on the faculty of the Department of Environmental Sciences at Rutgers University, where he was also the Associate Director of the Center for Environmental Prediction.

So, with that, I will turn things over to Chris. Thank you, Chris.

Dealing with Climate Model Uncertainty in Adaptation Planning

Slide 1: Title Slide

Chris Weaver: Thanks, Emma, and thanks, Wendy. And I appreciated very much the opportunity to be here and participate in this webinar, and it's a great series.

And so, you know, I'm just going to say a few brief things in kind of a more general kick-off, kind of sense of, you know, framing this challenge of dealing with the uncertainties in what is going to actually happen in the future with climate change in our ability, you know, as scientists and citizens to anticipate these changes, what we know about them, and the obstacles of that might pose for moving forward on adaptation planning.

Slide 2: National Need for Information to Support Climate Adaptation

You know, so, we acknowledge, now, at all levels of governance, I think, at federal, state, local, and even individual decision-making, this need to, in some way, account for future climate change in a lot of our planning processes, to the extent that a number of decisions that we make and our missions as federal or state agencies or municipal governments are sensitive to what climate is going to look like in the future.

And often the most effectively supported of kind of decision-making, we hope that we could have some kind of quantitative guidance, analytical guidance to support this sort of adaptation decision-making across a range of sectors, from public health to disaster preparedness to infrastructure planning, and so on.

Slide 3: National Need for Information to Support Climate Adaptation (cont)

And one of the starting points, you know, once that reality is acknowledged, the starting point of the discussion is then, "OK. What information do we need? What – where can we get it? And how can we actually use it in our decision-making process?"

And climate science has – and climate modeling, computer modeling of potential future climate change has an important role to play in this information precision – provision for adaptation decision-making, but there are a lot of questions that you have to tackle when you are trying to parse out, you know, how you actually obtain and use this information in your particular decision context.

Questions like, "What sort of data should I be looking? From what models? Is it at the right scale for my problem of interest?" And, you know, "How do I deal with all of the many sources of uncertainty that I know or I hear are present in the climate change problem?"

And so, there's a bit of an analysis paralysis that results from that. And you know, from my experience working primarily with EPA program offices, like the Office of Water and Office of

Air and Radiation and also the regions, there are a number of questions that arise; questions like, "How do I sort through all the information that may be out there that might be helpful to my problem but determine what subset of that information is most relevant to me? What is going to happen in the future in my region, my city, my watershed? What do models say about it? Are these models any good? Is there a best model for my problem? What about downscaling? I hear a lot about it. What do I need to do with that? Is that something that I need to have accurate information for my particular region? Is it true that the uncertainties are so large that I might as well just go ahead and not incorporate any information about the future? It's not going to be practical for supporting my decision-making," and so on.

Slide 4: The Essence of the Challenge

And you know, you can kind of boil down the challenge embodied in this question into a few key points – one, predicting the future under any circumstances, into climate change in particular, is difficult, despite the fact that we have a huge investment in climate science and observation systems and modeling tools. There are a number of aspects of climate – future climate change uncertainty that are still not scientifically tractable. So, there are kind of irreducible uncertainties in the problem.

Another thing that's hard is this process of incorporating scientific information like a prediction of future into a real – the process of making a real decision. Information in order to be usable has to be contextualized to a particular decision, and scientific information, in particular, is always only ever going to be one part of the equation in creating a meaningful policy response in terms of adaptation. There are many other factors – socioeconomic, political, practical resource and so on, that are always going to be important as well.

And so, the question then is how do we harness what we do know about the climate system and particularly climate science and model outputs to what we know about the processes of effective decision support? And so, the key here really boils down to two things.

First is it's very important to start with your problem, you decision context, your system of interest. And so, turn the problem around and start with what are you trying to achieve in a management sense, as opposed to starting with what data do I need, and try to kind of shift through the myriad of data sets, models, scientific information out there without first establishing, you know, sort of the context and the parameters of your problem that allow you to tailor the search for relevant information.

And then, the second key piece is that incorporating scientific information into local adaptation decision-making must really be this sort of inherently participatory process, where you have scientists and stakeholders together at the table talking through the problem itself, the needs of the stakeholders and the capabilities of the science, and co-designing the information that's needed to support the decision.

So, I'm just going to say a couple brief things about each of these pieces of the challenge and then just summarize again these main points.

Slide 5: Limits on understanding and computing power
The first question, you know, climate prediction being difficult, there are a number of reasons for that. Part of that is because there are aspects of the climate system, which are inherently rather unpredictable, a number of processes, for example, related to clouds and precipitation, atmospheric circulation system, the role of the ocean and so on, where either there's a lot of national internal variability or we are still lacking key scientific knowledge to help us actually make accurate predictions more than a season or a year into the future.

Slide 6: Limits on ability to know whether we're correctly simulating future states

The other part of the equation there is that, of course, climate change is now a human – humans are a major driver of the climate change that we're starting to see now and that we expect to see in the future, and the trajectory of socio-economic systems and human behavior in decisions is probably even less predictable than the climate system itself. And we don't have a very good handle today, yet, on how we can actually verify the performance of our modeling systems with respect to a future that has not happened yet and that won't happen for years and decades into the future.

Slide 7: But modeling does have a lot to contribute to adaptation decision support even if they can't deliver accurate future predictions

But there are a number of important things that model –and climate models, in particular, in particular can help us parse out our problem. They can help us explore the dimensions of the problem and try to understand, for example, "Are there important special cases, such as extremes, thresholds, tipping points, surprises, types of risks that we might not have been anticipating but we might need to be aware of and account for in our system?"

And we can use this information to help guide our search for response options that may be capable of dealing with vulnerability associated with one of these risks.

And models are also very good at generating lots and lots of different views of the future to help us think about what is the range of possibility to maybe test where our proposed policy, for example, might fail in the phase of a particular kind of change? And a lot of times what's sort out there available to the Web, through credible federal sources and so on, off the shelf as it were, is more than sufficient to satisfy your needs for this kind of information. Most people will never need to go out and do climate modeling themselves to solve a problem.

Slide 8: And So Is Climate-Related Decision Support

And then, the last piece of this is, again, just emphasizing that even with perfect scientific information decision support is a social process that requires participation of all the people involved in the decision-making process, including the scientists and the stakeholders. And this is something, I think that, you know, you'll hear, reiterated in a number of the examples – case studies later in the webinar.

Slide 9: Turn the problem upside-down

And so, you know, let me just summarize here and say what is the key here to sort of navigating this uncertainty challenge?

So, point number one is it's very, very important to think about your problem in your system, and not start by thinking about future climate, in terms of specific information or specific predictions that you might need from – for your region. And working forward from that, work backwards from your problem.

Employ these participatory strategies. Get a team in place early that includes scientists and stakeholders together to co-design the information that you might need and build the kind of shared understanding of the sensitivity of your system and your decision to climate variability change.

And then, given that team and given that shared understanding, you can then go out and start to tailor more specific information from climate models, for example, to support your decision-making process. And just kind of illustrating this point a little bit more, the decision sciences recognize multiple different paradigms for – how we use information to help support a decision.

Slide 10: What the Decision Sciences Can Tell Us

When you are reasonably certain that you understand the sort of envelope of what the future holds and you can characterize probabilities, let's say, of future events, it may be OK to try to find – to first predict and then act. Find the most – the optimal response, let's say, to a single most likely future.

Slide 11: What the Decision Sciences Can Tell Us

But when there's a lot of uncertainty, you're better off thinking about "Well, where is my system most vulnerable? And how can I hedge my batch against a wide range of futures?

Slide 12: EPA Regulatory Impact Analysis for Future O3

So, I'm just going to end and say that this kind of approach is slowly penetrating its way into activities of the EPA Program and Regional Offices, for example, to support efforts to adapt regulatory impact analyses in the Air Programs to climate change, how we design TMDLs in the Water Program and so on, and our office, the Office of Research and Development is trying to use models and data within this kind of participatory decision context-based framework to support those sorts of decisions in EPA.

So, I'm going to stop there and turn it over – back to Emma and the other speakers, and I'm going to be happy to answer questions later in the webinar. Thank you very much.

Emma Zinsmeister: Thank you, Chris. I think you've illustrated a great number of questions that our audience has definitely expressed to us and some new ideas and approaches to consider as we move forward. And we'll certainly hear from Anne in the next presentation about some examples of how an approach starting with vulnerabilities can be applied.

Poll Question #2

Emma Zinsmeister: And so, before we transition, we're going to ask another poll question to gain a little bit of an understanding of how our audience – what our audience is facing when it comes to challenges when dealing with uncertainties, so folks could take just a moment to answer the question.

What aspect of the adaptation decision making process poses the biggest challenge for your organization?

All right. We can go ahead and pull up the result. So, it looks like financial and/or technical resources being inadequate is by far the most significant challenge, 53 percent; skills, in fact, data not meeting stakeholder needs is also a major challenge, 21 percent; data not being specific to your location is another challenge at 11 percent; unknown vulnerabilities at 10 percent; and inconsistent model predictions at 6 percent. So, hopefully, we will be able to tackle some of the financial and resource questions at our next webcast, and many of the examples presented today will also feature different resources and approaches that may be helpful to you. So, thank you for providing us with that information.

And now, we're going to move into our next presentation from Anne Choate. Anne Choate leads the Climate Change and Sustainability line of business within the Environment and Social Sustainability Division at ICF International. She's a climate change expert with more than 17 years of experience analyzing climate change and energy issues for a wide range of clients, including municipalities and local, state and federal agencies. She's worked on a variety of projects related to climate change impacts and transportation systems, including a new Federal Transit Administration pilot for the Southeastern Pennsylvania Transit Authority, which she'll be speaking about in her presentation today, which utilized historical weather data and service disruption information to inform projections of climate impacts and possible adaptation strategies.

Ms. Choate has also contributed to the development of climate risk screening tools for developing countries on behalf of USAID and for the National Park Service. She's also supported EPA's Climate Ready Estuaries program.

So, with that, I will turn it over to Anne. And I just want to remind folks to type in your questions for presenters as we go along. Thank you.

A Threshold Approach to Climate Change Vulnerability Assessment

Slide 1: Title Slide

Anne Choate: OK. And sorry. I think I have – my Citrix is doing something different but I will – in a second, you'll be able to see. OK. There we go.

So, thank you, again, for including me in this webinar, Emma, and also thank you, Chris, for your excellent presentation. I know that moving into this webinar and thinking about how we might talk about uncertainties for state and local governments, and particularly how you overcome uncertainties when state and local decision makers and actors are trying to maximize the use of very limited resources, and also to provide services when they have aging infrastructure and, again, for the finite of the resources available to maintain and deliver those services to growing populations under a range of various risks.

Slide 2: In the face of uncertainty…what to do…and what NOT to do?

And so, one of the things we're going to focus on here is this threshold approach to climate change vulnerability assessment. And what I'll do is – I want to say out by saying that the sky is not falling; we are not all doomed and we certainly got all of us, we probably have gone to meetings where folks are sort of inherently, almost unwilling to talk about this issue because it feels scary, it feels like another thing I have to do, and how am I going to find the resources to take on yet another sort of unfunded task?

Slide 3: The challenge of adaptation at local scales

And so, one of the things we're trying to do here is identify some ways that folks can get over that feeling of – that overwhelming feeling and basically acknowledge that the risks are real, they can't be ignored, and that with careful and strategic planning, combined with medium and long-term monitoring or recalibration strategy, we'll be able to get do more prepared and ultimately more resilient communities.

So, then, the way we started out actually – and it gets back to some of the comments that Chris made – many of the impact assessments that you read in the literature or that you've probably heard about began and particularly in the early days of the climate adaptation, which were about ten, eight, six years ago, many of them began almost exclusively with this mindset or this climate lens.

And so, the idea was we'll begin with some model-generated projections of future climate conditions. So, if we understand what projected climate impacts might look like, then we can make better decisions. And I think that the issue that happened there is that we had projections coming out of the climate models but these projections of future climate stress were not decision

ready, so they weren't able to be utilized at the local scale. And there are a couple of reasons for that.

First, they're often available at these coarse geographic scales. And so, they require technical knowledge to interpret and quite a lot of resources to do downscaling or to do sort of statistical regression analyses and other types of calculations to try to take the model outputs and make them relevant to a local scale. And even once that happened, you're not necessarily guaranteed to reduce the uncertainty.

Then, next provided on the time horizons, the time horizons that are available in many of the climate model outputs are not necessarily the time horizons that matter for the folks to need to make changes in the way that they do things, so in the way that they make their decisions and the way that they invest their resources.

And so, because the time horizons don't match the time frames you're planning, that you're left with this disconnect.

Then, often the climate models are described by variables that are unrelated to decision-making process. And then, finally, they rarely address issues associated with current climate variabilities.

So, if you already have variabilities or vulnerabilities to current climate or current weather, those vulnerabilities are not necessarily well known and therefore understanding of the future climate is somewhat limited in terms of what that means in terms of the vulnerability of your system or the vulnerability of your assets.

Slide 4: Instead of starting with climate, consider thresholds of sensitivity, then add climate

So, what we've been trying to do instead is basically to turn that around and really to start with the system sensitivity. So, start by thinking about – I'm so sorry that this keeps doing this.

OK. So, this is the sensitivity. If you start with the sensitivity of your system to particular weather or climate related stressors, then you not only understand where you have tipping points or thresholds that are of interest or that are potentially a problem for you, but you also have created a system where your decision makers and your stakeholders are bought in to the sensitivity, to the fact that these things matter, to the fact that fuss over a certain level are going to cause problems, and those problems have financial impact.

Next, you have an ability to scale the level of effort to the climate variables or the weather-related events that have been proven to cost you the most pain and the most anxiety.

Then, you layer in present and sort of the future climate stress, and you have the ability to use the present or the current and observed information to inform your analysis of the future climate stressors.

So, then that's when we've been able to look into threshold and frequency analysis, where we're able to use some observed information by pairing information on disruptions or sensitivities or vulnerabilities that we've seen over the past and historically with information about climate into the future. And, to think about what cost might be of increasing frequencies of extreme weather events.

And, what's last listed on this slide is basically to state that if we cannot overstate the value of advancing the discourse, advancing, sort of, the discourse within organizations when you start with the system sensitivities and the weather and climate-related events that have caused problems within these organizations in the past, and how those translate when you think climate weather in the future.

Slide 5: Case Study: Regional Transit Provider

For the example that I have here is it's a regional transit example where we have decision makers in a transit agency that has an aging infrastructure – very limited resources – and, yet they have to provide service to all these customers on a very reliable basis.

And so, thinking about doing something, "doing something on climate, based on current projections with high uncertainties" it's a daunting proposition.

So, the focus here was how do we zoom in on a single rail line that we know is vulnerable, and this is done on behalf of the Federal Transit Administration, who had given out grants for trans-agencies to think about climate-related vulnerabilities and then adaptation strategies.

And, the focus here was let's look at an in-land rail line, with aging infrastructure, focus on a single rail line and try to get as fine-grained information as possible but then, something else that we were doing differently here is starting with the historical disruption data because SEPTA has great data, and then, try to use that to understand weather and climate related sensitivity.

Slide 6: Observed weather impacts on transit

So, on this slide, I'm just over – this is an overview of some of the kinds of weather impacts that transit agencies have seen. These are not specific to SEPTA but these are the things that we've been – that we were looking for, particularly with respect to extreme heat, impacts such as vehicle breakdown, catenary sagging of the power system, rail buckling, reduction in constructions speed, acceleration of pavement degradation.

And then, when you think about heavy rain events or flooding – we've seen things such as flooding of bus or rail right-of-ways, the flooding of underground tunnels and track, the flooding of underground equipment room and flooding of track beds. There are also snow and window impacts, as you might imagine.

Slide 7: Characterizing sensitivity using delay minutes and weather thresholds

So, what we did was we said, "OK. We could spend a lot of time and effort focusing in on identifying what we have with the most vulnerable line or the most critical line and then, do an analysis there." But, one way that we were able to apply this sort of threshold concept - is we were able to look at the system that they use to catalogue the delay, the descriptions in the system and basically look for key words in those descriptions that operators or that the folks in operations center use to characterize delays.

And so, we did that. And as you can see we could – the Manayunk/Norristown is the study line. And so, for the Manayunk/Norristown line, which is the yellow bars, there were a couple of places that were of particular interest to us as part of this study because we're thinking about climate impact to an inland system. We wanted to look at rain, we wanted to look at flood and high water. And as you can see, Manayunk/Norristown line seems to have a significantly higher proportion of delays associated with those kinds of weather events than the rest system. So, that's the rest of the system is denoted in blue.

So, from there, we looked at the Manayunk/Norristown line pretty much exclusively. And, what we did was we tried to pair up information on historical observed weather with information on delay minutes and annulments.

And so, we started out trying to look at whether there was a relationship between, specifically find a relationship between weather and delays, a direct correlation. And, we didn't really find one. So, then we started looking at extremes.

So, we basically looked at the extreme. We calculated basically what the extreme heat, for example, might be, and then calculated the 1 percent and 5 percent.

And then, we – for each of those, what we did was we looked at what the percentage of days above the threshold with delays would look like, as compared to the baseline frequency of weather related delays and annulments, which is that red line that you see running across.

And so, you could see that we had significantly more delay minutes in any of these instances where they crossed the threshold.

So, once we had identified that there was a significant difference in, for example, in the impact over 1.4 inches of rain, or 2.5 inches of rain, then, we were able to start thinking about how that might that relate to projected changes in precipitation and temperature.

Slide 8: Applying climate projections to threshold information

So, then, we took the information that we developed on the historical climate and weather and the delays that had been caused by those kinds of weather, and we took – we compared that to information that we have on projections of climate.

And so, what we were able to say is that we could see for example, that the 5 percentile event was going to occur 2.6 times more frequently by mid-century under one of the climate scenarios that we were evaluating.

And so, we looked at several different examples or different climate scenarios – and I won't get into that here. But, we do have a full report that we can share with anyone once it's complete, where all of this is well-documented.

But, the bottom line is that what we were trying to do is base all of our discussions with the operations people in SEPTA and the stakeholders that are reliant on the services, we grounded all that information that they were well aware of, in terms of they knew where their vulnerabilities lay, but, they had never tried to correlate the significant delays, for example, the large constructions or the longer delays, with specific thresholds of temperature or precipitation.

And so, once that was done, it was easy for us to talk to them about what might it look like if you have that kind of day five times more, two times more, three times more and what might that cost.

And so, in nowhere, we trying to say that we know what the future looks like but, we certainly can work with them to think about what the future might look like, how much that might cost, and how some incremental changes or, in some cases, some longer term changes in their system or the way that they operate their system might ultimately reduce their vulnerability and make their system more resilient.

Slide 9: Connecting findings to adaptation strategies

So, on this side I have a list of some of the advantages of using this kind of threshold approach. First, that threshold enabled this focused analysis of climate data. So, we didn't need to look at all of the climate information that was available to us. We knew what climate data were available for the region, and we could focus in on where these assets and this service, in particular, was sensitive. That saved time and resources.

Then, we had impacts that had been characterized and they offer these near term opportunities for adaptations.

So, we've actually been working to identify near-term adaptation strategies and medium-term adaptation strategies.

So, they'll be able to see whether some of these measures, actually, over time, contribute to the resilience of the system. And then, the impact narrative, so instead of thinking of about what it might look like in the future if you had more 98 degree days, for example, than you've seen in the past has been very helpful and engaging internal stakeholders and in clarifying where their sensitivities lie and what strategies are within their control to reduce their vulnerability.

Now, there are some significant limitations for one, this approach ignores novel impacts. So, obviously, if you were on a coastal situation looking as historical it's not necessarily going to help you with anything like the sea level rise or a storm surge associated with strong winds and a tropical storm layered on top of sea level rise.

So, obviously, we've ignored those novel impacts here and we, sort of, had the luxury of ignoring them in this context. It would not be well-suited for transformative actions so, if there were some paradigm shift in the climate, we probably wouldn't have caught that here. And then, it is inwardly focused. So, it's not integrated across sectors because it is still focused on the sensitivities of this system, it doesn't do a great job of thinking about the interconnectedness, for example, of this system with the power system, which is obviously, very important.

So, there are opportunities there where we can – once these recommendations have been developed, I think we have opportunities to think about what other stakeholders should be brought into the discussion and how sensitivities of ancillary services may relate to the sensitivities that we've identified for these services.

Slide 10: Acknowledgements

So, with that I should just acknowledge my partners in crime - so Brad Hurley, Phil Growth and Cassie Snow - who have been involved in applying this approach in the SEPTA instance - but, also in a couple of other instances with transit agencies and other clients. And then, Joe Casola who's formerly with ICF who's now at C2ES but who was – he was definitely very instrumental in sort of helping to think through how we could go about applying these thresholds from a climate perspective. And then EricJohanson at SEPTA's sustainability group.

And I apologize for the technical difficulties. I don't know why my computer decided to update itself right as I was starting the Webinar. So, thank you and I look forward to hearing your questions.

Emma Zinsmeister: All right. Thank you Anne. If anyone has any questions for Anne or any of our other speakers, please take them into your Go to Meeting panel. That's a great example of how to create an impact narrative that really resonates with decision makers and implementers at the local level using both historical and projected data.

Poll Question #3

Emma Zinsmeister: So, at the moment, we're going to turn over to another poll question to ask folks what information did your organization use to inform decision-making? So, if you could just take a moment to answer that question for us, we'd appreciate it.

Wendy Jaglom: And I think folks didn't have quite enough time to respond last time so, if we give them just a few more seconds this time.

Emma Zinsmeister: Sure.

Emma Zinsmeister: OK. Hopefully that's enough time for folks to get their answers in. So, if we could pull up our results.

All right. So, it looks like some of the approaches that are being used and information to use are climate projections of future patterns, the 44 percent; averages and extremes of all available data, 33 percent; frequent changes and climate patterns considered to be the new normal, 31 percent; climate information has not been expressly considered for about 23 percent of the responses; and an average of extremes in just the past decade came in last at 17 percent.

Climate Change Adaptation in Philadelphia

Slide 1: Title Slide

So, thank you for your responses to those questions. And, we'll now be moving into our first case study to learn a little more about what Philadelphia is doing and their climate adaptation planning.

So, our speakers today are Alex Dews and Scott Schwarz.

Alex Dews is the Policy and Program Manager for the City of Philadelphia's Mayor's Office of Sustainability. Alex focuses on project implementation and progress tracking for Green Works Philadelphia, the city's comprehensive sustainability framework.

In addition, he manages the city's energy benchmarking and the social program, green building program and co-chairs the city's climate adaptation planning workgroup.

Alex is LEED AP certified and holds a master's degree in Sustainable Design from Philadelphia University, where he is an adjunct professor in the School of Architecture.

Scott Schwarz is the divisional deputy city solicitor for the Philadelphia Law Department and also serves as General Counsel for the Philadelphia Water Department.

Over the past four years, he has routinely represented the city in court cases and in administrative proceedings involving energy, the environment, sustainability and transportation. Prior to 2009, he's spent over 20 years working in the environmental law division of law firms in Philadelphia and Washington D.C., and gained government experience working for the state of Alabama's Office of the Attorney General and the U.S. EPA.

He holds a JD degree from George Washington University and a Bachelor of Science degree in biology from Bucknell University. He currently co-chairs the City of Philadelphia's Climate Adaptation Working Group with Alex.

So, I'll turn it over the Alex and Scott.

Scott Schwarz: Great. Thanks so much. We're really excited to participate today, and really interesting presentation so far.

I want to thank, especially, Anne, for some of the support that she's provided to us in our planning to date. It has been really helpful and I think that we're going to constantly looking to draw from examples of not just what other cities are doing, but what the – really the best thinking on this work that's happening all over the country and internationally. And, it's really good to have an opportunity like this to share that information.

Slide 2: Integrated Sustainability Planning

So, we're going to just give a quick overview of how we're approaching this at a local level in Philadelphia. We'll start by giving you a little bit of the context of what's going on overall in Philly right now.

Green Works Philadelphia is our comprehensive sustainability plan that was launched in 2009. And, that's kind of the centerpiece of a lot of our climate mitigation and adaptation work.

The plan focuses on sustainability through the lens of five broad areas – energy, environment, equity, economy and engagement. And, most of what's in the plan is focused in some way on climate mitigation, greenhouse gas mitigation. And, it was not really written as an adaptation plan, though there are some elements of it that we found later on are fitting into both the mitigation and adaptation buckets.

But, just a couple of examples where we're working to reduce energy, both in city government and citywide, we're working to increase the amount of material being recycled in the city and we're working to reduce vehicle miles traveled. And, to date, we've had 167 initiatives in the plan; 89 percent of those are either complete or underway.

Some of the other efforts that are happening in Philadelphia– we've revised our zoning code for the first time in 60 years and our comprehensive plan for the first time in 50 years. And so, it's a really good opportunity to integrate Green Works, which is a short term plan ending in 2015 with some of those longer term planning efforts.

Green 2015 is a plan to add 500 acres of new open space. In Green City Clean Waters is something we'll talk a little bit more about going ahead. It's our Water Department's really innovative plan to change the way they manage storm water and to use green infrastructure to manage that.

Slide 3: Climate Volatility and Change

So, Philadelphia, like much of the country, has seen some pretty extreme weather over the last two years. So, fortunately for us, in our work with climate adaptation planning, we are not in a place where we have to make a case for this. We've seen all of these extremes just in the last three years. And so, while we don't have a huge amount of certainty about long term projections, we know enough right now to begin a lot of the work that we're doing with adaptation planning. And, to start implementing some of the things that we know we need to do to be more resilient, particularly from an infrastructure perspective.

And, in addition to reporting regularly on the work that's in our Green Works sustainability plan, we do an annual report on every single initiative that's in that plan. We've started to participate for the last three years now in the carbon disclosure project, among several other national and international reporting programs.

And, this is really helpful on the uncertainty side from a perspective that we share a lot of the same issues with cities in this country and globally and not knowing what to do about them is really the bigger problem than not knowing exactly what the impact will be. And, carbon disclosure project, in particular, does a nice job of indexing a lot of the adaptation measures that are happening around the world. So, our participation in that has been really valuable for us and that's something that we plan to continue to do.

Slide 4: Measurement and Information Sharing

Slide 5: Climate Adaptation Planning Process

Scott Schwarz: And, this is Scott and I wanted to use this next slide to talk about our climate adaptation planning process. The bottom of this slide shows the timeline of what we've done so far. And, it really begins in the fall of 2011 when I worked with a group of graduate students from Columbia University on looking at what other cities were doing on climate adaptation. When I started with the students I didn't think we were doing any adaptation work - the one thing we did was have the students look at our existing programs, and some of them I was surprised, a lot of our programs certainly had an adaptation benefit even though they weren't specifically designed for that.

The students also gave us a look at what other cities - how their cities were gathering and using climate data. They outlined some very, more expensive programs - such as, developing the city's specific climate models.

We didn't have the funding for that and opted instead to look at regional reports and city specific data. We next went into our annual updates to our sustainability plan and committed to issuing a climate plan sometime this year. That was followed really by Alex and me looking at a lot of city specific data. We used the Pennsylvania Climatologist webpage - which has daily data for our two airports which use the daily data from the Franklin Institute. And, we also use the NOAA tidal data which is available at several points in the city on a daily basis.

And, the last thing we did was convene our working group of various departments. We've had several meetings - and right now, we're in the more advanced stage of moving ahead with our inter-departmental group.

Slide 6: Climate Adaptation Working Group Survey

One thing we did was our department’s initial survey - it was interesting to me after spending six months looking at climate data to see what was relevant to our department. And, the results vary depending on departments – but really all of the departments were concerned about extreme heat events and heavy downpours. And, only some were concerned about sea level rise and drought.

Slide 7: Temperature Data and Trends

This just shows you some of the data we looked at and initially what we tried to do was look at U.S. reports for the country, regional reports for our region, and then Philadelphia's specific data.

And so, here I've kind of quoted a recent EPA report on temperature - and we pretty much felt this in Philadelphia. We have seen a lot of reports that predicted that we'd have on average about forty 90 degree days by mid-century only. As you looked at the data, for the last ten years, we saw we were already there, although the results vary depending on where in the city the heat measurements were being taken.

Slide 8: Observed Increases in Heavy Rainfall

This thing - next slide is an example of one the regional reports we looked at - which predicted heavy downpour, especially in the northeast, is increasing. And, this is very consistent with what our water department was finding. They've been measuring water level since around the Civil War in Philadelphia - so, we have 150 years of internal data that was consistent with this regional report.

Slide 9: Sea Level Rise Past Occurrences (NOAA)

Sea level rise - also, although of less concerned - was very well documented. And, this is of particular interest to our water department because our waste water treatment plants are all on the tidal portions of the Delaware River. They were constructed towards the beginning of this chart around 1910 to 1920. So, we've already seen a one foot rise in the Delaware river, which is the tidal river at our critical infrastructures since they were designed and built.

I'll turn it back over to Alex to talk a little about some of our programs and how we've used the information.

Slide 10: Public - Percy Street Porous Paving

Alex Dews: Yes, so the main places where we're working right now that are already implementing some of our adaptation measures are in that Green City Clean Water's plan. And there’re a number of different ways that's happening. First of all, on public property - and here's an example of the street in South Philadelphia that's fairly typical in Philadelphia - very narrow, and not in good repair at that time when we were looking at some options - we saw that porous paving was something that could work quite well in this location.

And, that went in two years ago - so, this street is our first curb to curb, end to end entirely porous street that infiltrates directly into the ground. And, even during some of the extreme rate events we've had over the last two years – that are our all-time record – there has been very little ponding on the surface of this street. So, it has worked quite well and it's something we're looking to replicate in some other locations across the city.

Slide 11: Private – Parcel based Stormwater Billing and SMIP Program

On private property, the Water Department as part of the Green City Clean Waters also changed the way that storm water billing worked, from an inlet based charge to a parcel-based charge that assesses stormwater bill for commercial customers based on the size of a lot, as well as the impervious cover.

So, you can go on the storm water billing web site and look at any commercial property to determine what the cost of the storm water bill is going to be now, and in the future of the change in that billing process is being phased in over five years to make it a little bit less of an extreme change for some of the building owners that have a very large, impervious surface area that they need to deal with. And, there are a lot of storm water credits, and incentive programs offered through the Water Department to offset some of the increase in cost.

But it's – it's widely seen as something that's about paying for what you generate in terms of storm water which is really essential.

Slide 12: Washington Avenue Green and Race Street Connector

Scott Schwarz: I'll mention two programs that I've been involved in - one is our waterfront development project which is funded by our Commerce Department. And, as adaptation efforts, we've both been trying to do some stream restoration and more natural waterfront with wetland mitigation sites, as well as, some art work that really emphasizes where the flood levels had been over the years. And so, we've had art installations done with flood levels that occurred on the lower bottom for the Delaware River. There're some similar ones on our Schuylkill River.

Slide 13: Stormwater Management Development Standards

The next slide really deals with the water department's storm water management development standards - any measured development Philadelphia goes through a storm water review that's designed to capture at least the first one inch of rainfall.

It's somewhat of an open question what impact that's going to have on flood reduction - and that's something we're currently looking at - because our standards are designed for - when your storm water runoff is not specifically for flood mitigation - we have a separate program for flood mitigation.

Slide 14: Energy Efficiency and Demand Response

Alex Dews: And then, beyond the Green City Clean Water's framework, some of the other things that we're working on - on the adaptation front are ready - are energy efficiency and demand response. So, efficiency both in municipal buildings and across the city, that one thing that's worked quite well over the last number of years is focusing on some retrofit in city buildings, as well as the demand response program that has helped us to shape peak load, save some money, but also understand what our capabilities are in terms of how we can respond in heat emergencies.

One other thing we did at the citywide level was offer a competition to all city residents, all blocks in the cities were invited to participate in the coolest block contest, where the winning block got a free white roof coating for the entire block, along with some energy saving upgrades. And, that was a really good way to raise awareness about a technology, a building technology that's available very inexpensively to a lot of building owners. It helps to save energy for the

resident and also helps to mitigate the heat island impact that's problematic in a lot of parts in the city.

Slide 15: Air Quality and Heat Health Alert Programs

And, then, finally, air quality and heat health alert programs because extreme heat is one of our big concerns on the climate front. We're really focused on this. We have had a lot of extreme weather that we've been able to deal with pretty well through the existing programs. But, certainly we want to keep focusing on both of these alert programs so that we're making sure we're reaching all of the vulnerable citizens in all parts of the city, in making sure that we get them the resources that they need.

Slide 16: Contact Information

So, we'll end with that. And, here's our contact information if you'd like to reach out - some of the information we talked about is available on the Web site listed below and we'll take questions at the end.

Emma Zinsmeister: Thank you, Alex and Scott, for your presentation of some great examples of innovative programs that Philadelphia is implementing to work on adaptation issues. And, of course, the wide range of programs involved a range of stakeholders and partners for their implementation.

Poll Question #4

Emma Zinsmeister: So, we'll move in to our next poll question. which is looking at partnerships and collaboration, which we'll also be hearing about in Debbie's presentation coming up.

So, the question is "Does your community or entity collaborate with neighbors on climate change, any neighboring jurisdictions or partners that you may be working with?"

Emma Zinsmeister: OK. Hopefully, that's enough time for folks to have gotten their answers submitted, if we could pull up our results. It looks like 59 percent of folks are collaborating with neighbors on climate change, which is good to hear and it's a great strategy for leverage activities and resources; about 27 percent are not currently collaborating but are interested in doing so; 12 percent collaborating on other issues, not necessarily climate change, and only 1 percent not interested in collaborations. So, thank you for your response to those questions.

Next, we'll be moving in to our presentation from Debbie Griner.

A Regional Response to Certain Change

Slide 1: Title Slide

Emma Zinsmeister: Debbie Griner serves as an environmental resources project supervisor in Miami-Dade County, Florida in their Air Quality Management division. Ms. Griner was a core team member in the development of the county's community-wide sustainability plan and continues to facilitate its implementation. She provides staff support to the steering committee of the Southeast Florida Regional Climate Change Compact, which is a ground breaking regional collaboration for southeastern Florida counties on climate change issues, policies, and strategies for the Southeast Florida region.

Ms. Griner facilitated the transportation work group tasked to developing actionable recommendations for the regional climate action plan. Her responsibilities include facilitating implementation of county, internal and community wide climate change mitigation and adaptation initiative, and aligning with regional, state, and federal resources and priorities.

Ms. Griner earned a Bachelor of Science degree in Environmental Studies with a minor in Biology in 1996 from Florida International University. Thank you for joining us, Debbie. I'll turn it over to you.

Debbie Griner: Great. Thanks so much. I've all ready learned so much from the previous speakers. I'm making notes to follow up with them actually. And, thanks for inviting me to share today our experiences in South Florida.

Slide 2: Untitled

The counties of Palm Beach, Broward, Miami-Dade and Monroe, as you can see, have diverse landscape, and their demographics and their culture vary as well. However, we're all the lying coastal communities and so, therefore, we share many similar concerns.

And as Anne mentioned earlier, we are one of those areas that are certainly experiencing the stress of aging infrastructure and increasing population in the light of climate change. So, in fact, our region is expected to grow by 20 percent by 2035.

Slide 3: Changing Temperatures – Extreme Weather – Sea Level Rise

And the counties are experiencing climate change in many of the same ways, in the past five years temperatures are increasing – and yet, we've also had the some of the coldest weather on record, which you can see the folks in there – winter coats on the beach on the left hand corner. And, as many know, our area's subject to hurricane, like Isaac that came through in 2012 and provided a great deal of flooding in Palm Beach county. And, basically we're experiencing wetter wets, and drier dry periods.

And, of course, sea level rises are impacting our beaches and threatening our drinking water supplies, because that salt-fresh water interface that is underground, it's moving further inland towards our drinking well field.

Slide 4: Rainfall during an extreme high tide can cause additional coastal flooding

This slide shows you how South Floridians are experiencing really unprecedented coastal flooding from seasonal extreme high tide and provides a window to our future. Local residents will tell you that things have gotten worse. They'll live there a very long time. And, this is because you can see on the right, the high tide instead of, instead of the water coming down through the storm drain system, the high tide water goes through that system. It serves as a conduit and actually flood streets with salt water.

And these streets are a few blocks off of the actual coast. And so we only have rainfall in addition to these tidal experiences, the flooding of course can only get worse. Some communities have installed backflow preventers to help, and other active pumps that actively push out the water against the tide. And this is in City of Miami Beach who has actually developed a $200 million Storm Water Master Plan to start addressing these infrastructure issues.

Slide 5: Tidal & Extreme Weather Events

So last couple of years, staff from the Climate Compact have gone out to capture images of these events, and they help us to gauge impact but they also provide an opportunity to raise awareness, which was a point also made by other presenters earlier.

What strikes me about this, the photo in the middle is that the inundation, the tidal inundation is so common in one of our parts that we've installed a permanent warning sign. It says "Road under salt water, Proceed at your own risk". And at the bottom is the photo of Fort Lauderdale portion of A1A that was basically washed into the ocean due to Hurricane Sandy.

Slide 6: Before the Compact

So before the Compact, the slide illustrates all the partners in the region who developed projection, and you can see they’re all over the place in terms of extent and timing of impacts.

Slide 7: Compact Background

So, in the spring of 2009, representatives from the different counties and cities were walking the halls of Congress with these varying projections, asking for climate policy and it became very evident that we need to get together and so that spurred in the fall of 2009 what would be the first of four annual summits. And at this summit, the counties decided to adopt a formal compact resolution, which was adopted by all four counties by 2010 and it really defines our work.

It says we'll work together on developing policies at the state and federal level, and develop technical tools that will inform climate action plan development, and that we will meet once a year to mark progress, and redirect our effort.

Slide 8: Compact Structure

So, the compact structure, really in the middle you'll see the Compact Steering Committee which is made up of two representatives from each of the counties, and one municipal representative. What I don't have here is The Nature Conservancy and the Water Management District who are critical partners, contributors to our Staff Steering Committee. Steve Adams out of the Institute for Sustainable Community provides administrative and facilitative support. He basically keeps us calves herded, you know, his knowledge of what's going on nationally in the area of climate change has been extremely valuable.

So, that group breaks often to these other work groups depending on what needs to be done. The work I'll talk about mostly today is the technical work group. The steering committee recently added a liaison, one of its staff support members to liaise between the academic institutions, recognizing how critical their input is to our work. And that's performed by Dr. Nancy Gassman of Broward County, who actually led many of our technical work products, in fact I have to thank her for the majority of my slides today.

Slide 9: Unified SLR Projection

The Compact brought together our local sea level rise experts into a work group, which included folks to serve on individual county climate change task forces, climate scientists in universities, Army Corps of Engineers, NOAA, and the Water Management District.

They based the projection on The U.S. Army Corps of Engineers' Guidance document. And on the left, that blue line you see is actual tidal data from 1913 to 1999. That was the foundation of the calculation. That shows that we had an 8-10 inch sea level rise over the last 100 years.

In the trend as you can see, we would expect five inches by mid-century. However, our projection is three to seven inches of sea level rise from today's level by 2030, and up to two feet actually in the next 50 years.

Please note that there's not a range beyond 2060, because our folks found that the uncertainty was just too great to provide that projection at this time.

Slide 10: Define and Communicate Limits of Uncertainty

As we do this work, it's important that we understand that projections are educated estimates of the best information that we have. And the uncertainty is not that we've experienced - we will experience impacts as clearly we are where we are. The uncertainty is in the position of those impacts.

In having the unified projection, this gives us guidance to do to begin our planning now. And we have committed to review and update the projections every four years with the newest and greatest in latest science. But believe or not, the science advancement does not adhere to our four year review process. In fact, you know, as many of you know the National Climate

Assessment Technical Document was released in 2012, and they actually provide for higher projections than our current Compact projection.

Slide 11: Responding to New Information

And our region was a recipient of the U.S. HUD Sustainable Community Planning Grant Program, and they are doing sea level rise mapping right now, so we had to re-engage our work group and pose the question of whether our two foot scenario is reasonable for the 2060 period and came to a consensus that yes it is. And the recommendations are to create the companion document explaining what the latest science is, but however not to fully review our projection until the 2014 IPCC document comes out and also an expected update on the guidance from the Army Corps of Engineer.

So, the benefit of this process is really that we don't get stuck, we can keep moving forward.

Slide 12: Regionally Vulnerable Infrastructure

We also provided a vulnerability analysis of our key infrastructure, and you can see here, and this is based on LIDAR data. At a three foot sea level rise, over 80 percent of the schools in the Florida Keys are expected to be impacted in some way, and also 10 percent of hospitals and 30 percent of the region's airports. What we hope to do is a deeper dive into some of our transportation infrastructure through a grant we were recently awarded to Broward MPO on behalf of the regional, all the MPOs in the region, for the Federal Highway Administration.

Slide 13: Collaborating Partners Lending Expertise & Resources

So, the partners and expertise, the importance of that really can't be overstated. We have some existing partnerships with USGS in groundwater modeling, and from a comprehensive Everglades Restoration Plan from the Army Corps. But they've continued to increase their resources to our region, and NOAA Coastal Services of course has come down and provided training and tools in local universities. The Florida Department of Economic Opportunity has partnered with Broward County and Fort Lauderdale on a pilot project to further identify vulnerable areas and start to identify, you know, really focusing on what we call adaptation action areas.

Finally, the Institute of Sustainable Community and the Kresge Foundation, they're from the very beginning providing critical support to the Compact, and recently awarded us, Kresge Foundation awarded a $975,000 grant to help us with the implementation of the Action Plan.

Slide 14: The Regional Climate Action Plan

The Action Plan objectives are integrated into existing systems and existing – through existing organizations. You can see the categories listed there which was what you'd expect to see. There're over a hundred recommendations, and it provides the regional framework for each of the individual government to move forward, you know, as their priorities allow - but while working in a regional framework.

Slide 15: A Region Taking Action Now

Here is an example of - on the left is the storm search map, so this is to show you that some of our counties are integrating climate change into the local mitigation strategies and land use plants.

We're doing beach nourishment on the bottom, you can see that red line is the salt-fresh water interface moving inland towards our groundwater wells which are depicted in the circles. So we're putting in place for that - those green or natural system solutions, like wetlands, and also engineering solutions.

Slide 16: Transit Oriented Parks – a 2-fer!

And because this series at EPA is trying to identify the synergies between mitigation and adaptation, I thought they would talk about transit-oriented parks, we really consider it a 2-fer if you will. They are planted along existing Miami Dade Metro Rail, elevated Metro Rail which is the green line on the left map. And it not only attracts, obviously, compacted development in these urban areas, which will help with reducing vehicle mile traveled and emissions, but it also provides green infrastructure in this urban environment, and can assist with the storm water management and also with cooling.

Slide 17: Building Resilience at Every Scale of Government

And this diagram shows you how we're working at every scale of government, the smaller circle being at the City level. Again we have City representation on our Compact. And then at the county level, we have our Climate Action Plan and Land Use Plan, and again the four county Climate Compact. And this is actually feeding into the two Regional Planning Councils, and our region is looking at a 50 year, seven county Prosperity Plan through that U.S. HUD Sustainable Community Development, and the work of the Compact is really informing that process in terms of the resiliency element.

Slide 18: Conclusions

So, in conclusion, I just want to say that clearly we're experiencing climate impacts now, and action really does take leadership at all levels, and engaging your local science experts is very critical. And local and regional planning now can address risks and reduce future vulnerability, and again working at every level of government is key. And there's someone from Miami Beach who has clearly adapted his way of riding a bike, and perhaps in a couple of years, when we go back to take pictures, we will catch them in a kayak. That concludes my presentation and I want to thank you again for having me here.

Emma Zinsmeister: Thank you for your presentation Debbie. So, Florida is a region of the country that is seeing a lot of the impacts currently from climate change and your presentation highlighted it.

I think a lot of the challenges many of our participants may be experiencing was trying to understand how to use the data that they have available and I think your example of how you are trying to revisit sea level rise scenario on a regular basis within the Compact is great example for folks to be aware of.

Poll Question #5

Emma Zinsmeister: So with that, we're going to move in to our last poll question for the audience, and after listening to all of today's speakers, which approach would your organization or entity be most likely to employ? So, folks if you just take a second to enter that, we'd appreciate it.

OK. So, we can pull up our results. It looks like 42 percent are interested in using the threshold approach; 31 percent in looking at downscaled data; 15 percent using historical data; 8 percent needs more certainty to pursue any action; and about 4 percent are interested in looking at alternative approaches.

Thank you for sharing that feedback with us. I hope our presentation today has provided you with some good ideas and examples of things to pursue in your communities.

Questions and Answers

Now we're going to turn things over to our facilitated panel discussion, and Dana Spindler from ICF is going to facilitate that for us. And then, afterwards, we should have a few minutes to take a few questions from the audience. Dana?

Dana: Thanks, Emma. Thanks to all the speakers for your presentations and we just have a few minutes left, so we'll do sort of a rapid round of the panel discussion.

And our first question is for Chris and Alex and Scott. During the introduction, and during the Philadelphia presentation, we heard how mitigation and adaptation differ in some aspects and overlap in others. How can the overlap be leveraged to reduce concerns about uncertainties, and can you give us a specific example of where synergies between mitigation and adaptation were effectively leveraged?

Chris, why don't I pass it over to you?

Chris Weaver: Yes. Thanks, Dana. Well, I think Debbie actually concluded with a great example. With the sort of coordination of green space development with the transit in Miami-Dade County, one of the major drivers of greenhouse gas emissions are urban areas, and in particular the transportation foot print of any particular urban area is going to have a huge influence on the amount of greenhouse gases that it contributes, and so to simultaneously, you know, how you kind of lay out your urban form in terms of urban planning, and some is going to have a huge impact on vulnerability to different kinds of potential climate change impacts, whether it's flooding due to sea level rise, or how vulnerable your power grid might be to outages or storms, or public health implications of heat waves and existence of cool and green space.

So, there's a really, really strong synergy between adaptation and mitigation that's kind of inherent in urban planning and doing things, getting these double wins like laying out your transportation network let's say to both encourage transit ridership, to reduce greenhouse gas emission, but then also to co-develop green space that has climate adaptation potential as well.

I think we can start to see a lot of synergies in some of these forward looking cities where they're really, really focusing on urban planning, and that's the way to kind of get wins on both the adaptation and mitigation sides.

Alex Dews: Yes. And this is Alex in Philadelphia. I would like to kind of echo some of what Chris said in addition to the cool roof example and the green infrastructure example that we shared.

I think from the urban planning perspective we also talked a little bit about the changes to our zoning code and to our comprehensive plan that can have those kinds of impacts that Chris mentioned.

One quick example of that is some changes that we made in zoning, give density bonuses to projects that achieve things like LEED for neighborhood development, so you can get a density bonus if you're achieving at a high level there, and the reason that works on both the mitigation and adaptation front is that it's favoring compacts transit oriented development that reduces vehicle miles traveled, it integrates by default green infrastructure requirement and building materials and practices that reduce energy mode and mitigate things like the heat island impacts that we see here in Philadelphia.

Dana: Thank you both for your responses.

The next question will be for Debbie and Anne. And during the final presentation, Debbie provided us with a great example of how counties in Southeast Florida are making a regional effort to lay the groundwork for local action. In many cases, larger cities may have more resources that can be used to understand the local impacts and best practices for adaptation in the climate change. How can a small town or city leverage work that has been completed within neighboring municipalities, or work in collaboration with neighbors in the region to develop strategies that are applicable locally? Debbie. I'll hand it over to you.

Debbie Griner: Sorry I had trouble with my mute button. I would say that in terms of climate science and gaining traction on projection in these things, reaching out to universities that are doing relevant work would be really important. And NOAA Regional Integrated Science and Assessment Program (RISA) also often support that kind of work for larger area than the municipality itself. Also, there are usually technical networks or regional sector groups.

Let's say if you have a MPO that's probably larger than an individual municipality, or if you have a water management association. I would encourage folks to work within those organizations, with their counterparts from other cities and counties and those organizations, just start to talk about integrating climate change into the planning and work that they governed through those organizations.

Anne Choate: This is Anne. I guess – just to follow on what Debbie said. I agree with everything that you said. I think another way to get started is to think about what plans are in the works right now. So, if you want to just get started and you have very limited resources, potentially thinking about whether there're updates to your hazard mitigation planning process, or your long range planning processes.

I think just adding a climate layer on top of some of those types of planning processes might allow you to see who in the region, or who in your county is interested in this topic, and who recognizes that some of the decisions that they're making or the investments that they're making are potentially climate or weather sensitive. And then potentially matching those people up with the academic resources, or some of the climate sort of the modeling folks locally, including the RISA, that might be enough to start the ball rolling and give you the momentum that you need, to sort of have, to break off into working groups to potentially develop a more comprehensive strategy.

Dana Spindler: Thanks, Anne, and Debbie. So, we're going to move into the - our Q&A session. We have about five minutes left so I'll try and get at least one question to each of the speakers.

This question is for Alex and Scott. And relative to conventional pavement, how does porous pavement hold up under extreme heat?

Alex Dews: The pavement that we've used on Percy Street, where I showed the example, it so far has held up very well and is actually engineered to work to carry the same engineering load as some of our largest thoroughfares in Philadelphia. So, we don't have any concerns about heat or extreme cold, and actually the paving mix performs better in terms of managing winter weather than traditional pavement does, because a lot of the precipitation that falls that's close to the freezing threshold is going to be absorbed by that rather than sitting on the surface and creating ice.

Dana Spindler: Great. Thank you. Chris, this next question is for you. Could you talk a little bit more about the challenge and appropriate uses of downscaled data? Is it useful to downscale to a sub-regional or local level?

Chris Weaver: Yes, that's a great question. So, it can be useful, but there're sort of two things to remember, I guess. The first thing is that the usefulness of doing downscaling to get higher resolution climate information is really going to be dictated by the needs of your particular adaptation decision, and your agency's mission and so on.

So, it's certainly not going to be the case that downscaling is always going to be necessary or add value, and the one thing that you also have to be aware of is that, higher resolution information does not mean that that information is more accurate.

The accuracy of what sort of climate changes you might be seeing in your region is at first order really dictated by what the global scale models are saying. And a lot of the downscaling, whether it's sort of a statistical regression type analysis where you're linking future trends to historical trends, or whether you're actually running a higher resolution model for your region of interest, really what they're going to do is they're going to put in - they're going to add value associated with things like local topography, the details of your coastline, the influence of different land use and land cover types in your small region of interest, the sort of micro climate that you - that distinguishes your region or distinguishes the city, let's say, from the surrounding countryside. But, they're not going to, it's not going to add any additional information about what sort of future climate is more likely for your region. It's just going to take a future climate proposed by a global model and add some of these local contextual factors to it, which may be very useful in making it more relevant to plug that data into your particular impacts models or management models or understanding it in your local context, but it's not going to add any additional accuracy.

Dana Spindler: Thanks. Anne, this next question is for you.

If you start with sensitivity analysis, how do you define the scope of your area that you are concerned with for a particular type of impact? For example, don't you need to have some

understanding of what areas will be at risk of flooding that were not previously at risk, such as future storm surges that affect an area that does not have a historic experience with storm surge.

Anne Choate: No, that's a great question and honestly I'm glad that you brought it up. So, in the case that I, in the example that I shared, actually we weren't worried about storm surge in that particular line. But in other cases, we may look at, so a sensitivity analysis is not a substitute or a sort of a high level evaluation of (a) what decisions we are trying to influence and what climate variables have the most potential to impact or to affect those kinds of decisions or those assets or services that we're concerned about.

So, in this case, obviously there may be places that are susceptible to storm surge that have never seen storm surge before. And in those cases, you may - what you may be able to do is look at, for example there are some places where we're actually looking at what inundation under a "King tide" scenario looks like as some indication of where there are sensitivities associated with water, sort of at higher water levels than are typical for a particular location. But even that doesn't get there, so when you're thinking about storm surge analysis, it may be that you need to look at a couple of different scenarios and run some models – there are many, many models that are available to do this. Some like one we've applied in the Gulf Coast region for Mobile, Alabama, it is very, very detailed modeling, very expensive modeling but it was warranted in so far as this is a place, Mobile, Alabama, that's experienced significant tropical storms in the past and where we had the opportunity basically and the available data to be able to run ADCIRC plus STWAVE, these sort of high-end models, to come up with a very rich set of information on not only storm surge but also sea level rise. So in that case, we actually had to go that far, because we were looking at a coastal area and because we knew that the past is not like the future.

So, it's not to say that sensitivity analysis can be a substitute for climate modeling or storm surge modeling in this case, but there are some instances where spending a lot of money on that kind of analysis would not be the best use of resources, right out of the gate.

I don't know if Chris, you may want to comment on that as well.

Chris Weaver: Yes. I agree with that. That's right on.

Dana Spindler: Thanks, Anne. So, I want to round it out with one more question for Debbie. And the question is, what is the biggest lesson learned in moving towards implementation? Is there a key approach that worked particularly well that could help other communities to move forward with adaptation?

Debbie Griner: I think it's that we definitely during the planning process we cast a very wide net. We tried our best to make sure that all the stakeholders were at least invited to the table and encouraged them to stay at the table. So, that I think is critical to moving forward implementation because for example, let's take the transportation area. We had folks there in our working group who told us what they were doing, when their planning timeframes were, when the next opportunity to integrate things was coming up. We learned from them. Their craft and their expertise were brought in during the planning process so they helped us to craft what the

implementation steps should be. I really think that that hopefully is going to help us to improve our implementation.

Dana Spindler: Thank you. So, I want to hand this back over to Emma to wrap up the webcast. Thank you all.

Emma Zinsmeister: Thank you, Dana, and thank you again to all of our presenters for sharing your expertise and experience, and thank you to everyone on the line who hung on for a few extra minute so we could get to those questions. Any questions that we were not able to answer at the end of the call today, we will be providing written responses that we'll post on our website along with the other materials.

So with that, I'd just like to say thank you again everyone and please register and join us for the May 1st call, where we'll be talking about opportunities to work with the public health sector and hazard mitigation department to leverage resources and funding opportunities for adaptation work.

So, with that, thank you again, and hopefully you will join us again soon. Thank you.

Operator: This concludes today's conference call, you may now disconnect.

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