



Briefing Transcript

Coastal Resilience in Alaska

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Speakers:

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Daniel Bresette

Good afternoon everyone, I hope everyone's Earth Week is off to a good start. I'm Dan Bresette, the Executive Director of the Environmental and Energy Study Institute. Thanks for joining us today. Of course every week at EESI is Earth Week, and every day at EESI is Earth Day, but we're still finding new ways to commemorate the 50th anniversary, including an interview with activist and author Byron Kennard who is one of the key organizers for the first Earth Day, web articles about our work to encourage on-bill financing and beneficial electrification in Washington State, and reflections on climate solutions in the time of coronavirus, and an all new video message thanks to two of our fellows, Tom Beach and Jeff Overton. All of this is available to our newsletter subscribers, and anyone who takes a moment to visit us online at www.EESI.org. Happy earth week.

Thanks for joining us today for a virtual briefing about coastal resilience in Alaska. Even though we're not meeting today in person, I'd like to take a moment to thank the office of Senator Lisa Murkowski for their support leading up to today, and also to thank Senator Murkowski for her leadership and support for a wide range of bipartisan energy policies as chairwoman of the Senate Energy and Natural Resources Committee. If you're joining us today for the first time, this briefing is part of a series that looks at regional approaches to coastal resilience. In 2019, we brought together panels of experts, practitioners, and community leaders from the Gulf Coast, Northeast in New England, Louisiana, and the West Coast. And earlier this year we convened experts who discussed efforts around the Great Lakes, in the Southeast states, and Hawaii. Last week, for the first time we held a mini series of five briefings for Climate Adaptation Data Week. If you've missed any of our briefings on coastal resilience, or any other climate and clean energy policy topics for that matter, you can access briefing summaries and video recordings at www.EESI.org, and when you visit us online please take a moment to sign up for our *Climate Change Solutions* newsletter to learn about other resilience initiatives, clean energy legislation, and to stay informed about all manner of EESI goings-on, including our briefing schedule.

Most of us are likely in our second month of teleworking and practicing social distancing to help get the coronavirus outbreak under control, and just as every day as Earth Day at EESI, we're doing our best to remain focused on the threats of climate change. So today's briefing is just one way we continue to bring you opportunities to hear from climate, clean energy, and resilience experts via webinar. Climate change might not feel as urgent relatively speaking right now, but it is, and our briefing today will cover coastal resilience in Alaska. Every region is special and different both in terms of challenges and innovations, but Alaska is extra special and extra different. It has a cold or even Arctic climate, more shoreline than the rest of the other states combined, the massive string of Aleutian Islands, active volcanoes, and just a huge amount of land area. And then there are the people, diverse, a proud heritage, and of a lot hardier stock than me to tough it out there. I'm looking forward to hearing from our panelists joining us remotely today from the last frontier about their work to protect and improve the resilience of Alaskan coastal communities. One last thing before we turn to our panelists. Because we're not in the same room today I cannot call on you if you have a question, so please follow EESI on Twitter @EESlonline and send in your questions that way. You can also send an email to EESI@EESI.org, but Twitter sounds a lot more fun to me, so I encourage everyone to do that. And when you submit your questions, we'll draw from your submissions after we hear from our panelists, so all questions will be saved to the end.

Now let's turn to our panel. Our first panelist is Jeremy Littell. Jeremy is a research ecologist with the Department of Interior Alaska Climate Science Center. He conducts research on the role of climate and ecological drought in Alaska and other forested ecosystems. He also facilitates the use of climate information and planning, adaptation, and vulnerability assessment. And Jeremy I just want to make sure I pronounced your last name correctly, it's Little or Litt-ell... Okay, sorry about that, I had it written and the T's and the L's combined, so sorry about that. But turn it over to you, really thanks for being with us today, and I am looking forward to your presentation.

Jeremy Littell

Thank you, good afternoon, my name is Jeremy Littell, I'm a climate impacts ecologist at the U.S. Geological Survey, and the lead scientist at the Alaska Climate Adaptation Science Center. I grew up in Alaska and I live here now, and I thank you for your attention today as we discuss coastal resilience in Alaska. I would also want to thank EESI for organizing this briefing and for providing a forum for discussing these important topics, and I want to thank my co-presenters for all I've learned from them in preparing for this briefing.

I'm gonna start our discussion today by talking about current and projected threats to coastal resilience in Alaska, but first I want to take a minute of my time and ask you to try, even if you've never been to one, to imagine a coastal Alaskan community. There are about 6,600 miles of Alaskan coastline and over a hundred communities you might choose from. It might be in a watershed along the southeast Alaskan coast among temperate rainforest trees with glaciated valleys above, a rocky intertidal coastline, and abundant salmon in the ocean offshore. It might instead be a village along a slough near the mouth of the Yukon River where the few trees around the wet tundra resemble tall shrubs, and the horizon line is hard to see because there's essentially no visible topography. Or it might be a village on a barrier island facing the Chukchi Sea where livelihoods are based on access to seasonal sea ice. Whatever community you imagine, chances are you can get there only by plane or boat. It's also likely that local fish and wildlife provide a significant fraction of the food needed by the community, and it's likely that the infrastructure, food security, and ultimately the resilience of that community are threatened by impacts to coastal resilience. Being resilient means understanding and preparing for threats or stressors. The current threats to coastal community resilience in Alaska are diverse, because the communities, their physical and ecological environments, the types and design of infrastructure and their reliance on traditional and subsistence foods are diverse. One thing they all have in common is a long history of adaptation to variation in the environment, indigenous knowledge, and a commitment to maintaining those as an uncertain future unfolds. They're also faced with hazards driven in part by climate change. My task in this presentation is to convey to you the nature of current trends in and projections for some of the main threats to coastal community resilience. If I leave you with nothing else, scientific advances are steps toward better prediction and adaptation to a future that does not much resemble the past week we have experience with, but the rate of change is fast enough that steps are not by themselves enough. We need big strides, and that comes from coordinating the science, integrating it for prediction, and combining it with indigenous knowledge. In short, working with communities to make what they need with their input, local information for planning and adaptation.

From media and agency reports, you're likely familiar with coastal flooding and erosion threats in some Alaska coastal communities. Kivalina, pictured here, is a community that figures prominently in such reports as far back as at least 2003, when the GAO highlighted risks to Kivalina and other communities. On the left is before and on the right after a barrier to minimize erosion was constructed on the windward side of the community. From these photos you can see clearly that the community is exposed to coastal erosion on its windward side, and there's a lagoon on the right to the shore, or leeward side of the community, it's in a pretty precarious position. In these images of Shishmaref on the left, from August 2012 on top, August 2017 in the middle photo, and November of 2017 in the small bottom photo, erosion can be seen. Note the difference between August of 2017 in the middle and November of 2017, primarily the result of a single storm. You can see the black arrow on the right of each photo is pointing to the same place on that piece of land near Shishmaref, and you can see the relatively large area that has been eroded in front of the beginning of the coastline, and then below where that person is standing and then below that where the erosion has gone all the way back to the road. On the right are historical and projected future shorelines for the community of Newtok. These images make the complexity of this problem more tangible than pictures of buildings falling into the ocean. These are impacts happening with the rapidly changing climate of now, in communities around Alaska's coasts, not some impact that comes with climate change several decades from now. The combination of changing sea ice, thawing permafrost, erosion, and the nature of regional storms creates hazards in western Alaska, as the sea ice season decreases due to atmosphere and ocean warming, and as the stability of the shoreline is decreased due to permafrost, also due to warming. Erosion can occur over more of the year and at a faster rate than during recent historical times. This erosion proceeds both gradually, but also much faster during large storms that occur during the autumn and early winter months. While there is no currently detectable trend in the frequency and magnitude of these storms, the coastal vulnerability to them has increased because of the sea ice and permafrost changes. The impact is thus one of current, not future climate.

More recently, synthesis of the community by community vulnerabilities from observations indicate dozens of communities are currently vulnerable to erosion, either river or coastal flooding, sorry I'm a slide behind you. Either river or coastal flooding or some combination of all three. The mechanisms vary with the community and location, but all are related to combinations of climatically driven weather and ocean hazards. It's beyond the scope of our time today to discuss them all, so I'll begin this with a sobering thought. The cost of relocating communities is in the tens to hundreds of millions of dollars each. Newtok's move to Mertarvik is estimated to cost in that range. Melvin et al, in a paper in the Proceedings of the National Academy of Sciences in 2017, estimated that the cumulative infrastructure impacts between 2015 and 2099 without adaptation would be \$4.3 billion for a lower emissions scenario, and \$5.5 billion for a higher emission scenario in 2015 dollars. According to their analysis, adaptation could reduce by roughly 40 percent. Alaska is warming faster than the rest of the country, but that warming isn't the same across a place as large and topographically diverse as Alaska. So even at a first order that brought the risks, mechanisms, and timing of impacts, and their adaptation solutions aren't one-size-fits-all. What you see here is a map of Alaska with 13 climate divisions for the state. Each of those climate divisions has a number in it and that number represents the rate of warming in that region of Alaska relative to the rest of the United States. It shows you that in the lower latitudes of Alaska and in the southern coasts, the rate of warming is faster than the lower 48, and it's much faster up on the north slope in the north of Alaska.

Alaska is warming faster than the rest of the country, but in the future we expect increases in temperature over the state as well. Each of these climate divisions that I spoke about on the last slide also has a number in it on this slide, and that number is the increase in temperature in Fahrenheit expected for that part of Alaska under a high emissions scenario consistent with our CP 8.5, and averaged across five different climate models for the period 2070 to 2099. So the rate of increase in temperature is higher in those faster warming parts of the state than it is in the lower parts of the state. On the other hand, the impacts to things like permafrost and potentially sea ice vary across the state as well. In those areas that are closest to freezing historically, have the currently fastest rate of impacts, and so it's a mistake to think that only the north slope for example would have really large impacts of climate change on permafrost. In fact, these impacts are distributed across the state for different processes.

In all cases, the rate of warming is likely to continue and will result in considerable further warming. The impacts to permafrost on the north slope for example, are evident in the rates of erosion that had been calculated on the north coast of Alaska. In the map on the lower right you can see in the reds, the areas of fastest rates of

erosion using modern data from maps and from satellite and aerial imagery, as well as on-the-ground measurement. This is the part of Alaska for which we have the best and most consistent record of erosion rates and where they're best able to be established. In places where we have that long history of shoreline and permafrost data, those rates of erosion can be calculated, and we're one step closer to doing better modeling of the rate of erosion we might expect with future changes. Much of the western coast of Alaska for example doesn't have the observations needed to conduct these kinds of analyses, and so the ability to project there has lagged behind for example that could work on the north slope. Here you see a picture that should illustrate in case you're not familiar with what this looks like, the erosion that occurs on shorelines where there's permafrost underneath, you can just barely see in the middle of that photo, the the permafrost structure underneath that grassy tundra surface, and then the erosion going on in the bluffs below.

Historically, much of Alaska had a climate that supported permafrost or frozen ground that persists for more than two years. However, in many communities along the coast, permafrost is thawing with direct impacts on ground stability and infrastructure. These trends are likely to continue under a range of future warming scenarios. In this slide you see four different future climate scenarios for two different climate models, and two different emission scenarios. These are from a paper published by Melvin et al in 2017, and the take-home message from them is that especially on the west coast of Alaska, in the southwest part of the state, you see changes in what's called the active layer thickness, an indicator of the seasonal surface melt depth each year, and is projected to increase in those places with red colors. The near surface permafrost thaw would be essentially complete in the end of the 21st century, resulting in increased threats to infrastructure and hazards. As a result, erosion and subsidence and slumping would continue or possibly accelerate. The thaw is projected over the entire west coast under a higher emissions scenario and a warmer model, so you can see there are a range of possible future scenarios. In many cases from a community perspective, we don't necessarily know or haven't measured what the impacts are, even though we know from first observation that there are effects on infrastructure and community relevant resources.

Historically, shore fast ice protected the coast from erosion, but the ice-free season is increasing, it's projected to continue to increase. This is a graph from Rick Thoman and ACAP at University of Alaska Fairbanks illustrating the observed change in the sea ice free season. Ice-free conditions in the Bering, Chukchi, and Beaufort seas are projected to increase roughly one week per decade south of latitude 60 North and about two weeks per decade north of latitude 65 North under future climate. The Melvin et al paper makes the case that many hundreds of meters of coastline would erode under those scenarios, beyond the historical observations we've already seen. This would result in a considerably longer ice-free season, during which the storms, usually in fall in winter of even historical magnitude, would be more likely to cause erosion and flooding events. So you see the interaction between the sea ice and the permafrost is important. As the permafrost thaws, the ground structure becomes less stable, and then it becomes more exposed to storms due to the sea ice changes. Even if those storms don't increase in magnitude or frequency, you still have a more vulnerable coastline than you did previously.

Precipitation over the land surface also contributes to coastal flooding, especially in river slough communities and in short steep watersheds like those in southeast Alaska. Precipitation in general and also extreme precipitation events are expected to increase substantially under climates expected into the 21st century. The maps on the right show you a lower emissions and a higher emissions change in the frequency of extreme precipitation events. What used to be historically a one in 20 year event doubles in much of Alaska under lower emissions consistent with our CP 2.6. Under higher emissions, the frequency of these events becomes much more frequent— one in five in southeast Alaska, and as frequent as one in three in parts of the YK Delta and Western Alaska. So the increase in precipitation, especially extreme precipitation, presents an increase in the flooding expected in some of these coastal and river mouth communities, where the land surface precipitation provides an element of the flood risk too, not just storm surge.

The combination of prioritization, for example, the Denali Commission's Ranked Vulnerability Index of communities experiencing erosion and shovel-ready opportunities to adapt when funding becomes available proceed in a piecemeal fashion. Many of the opportunities in Alaska have not been as well coordinated across the many communities that need access to them as we might hope. Ideally, for adaptation perspectives, the hazard projections and data would result in risk maps for existing communities and potential relocation sites. On the right is an example from the community of Quinhagak in Alaska, where the colors represent detailed risk of flooding by

elevation in the community. The elevation relief in many of these communities is only a couple of meters, and so it's very difficult to do an adequate map, adequate flood predictions based on certain storm surge heights if you don't have the local community elevations mapped adequately. Satellite remote sensing has provided some forward progress on this, which I'll talk about in a second, but we don't have it for every community. Much of coastal Alaska does not have adequate elevation data to project community level flood risks. Shorelines are also changing so quickly both in position and topography, that the baseline that existed historically in terms of measurement is now fluid, and repeat observation is often required. A number of community collaborations within Alaska, combining state and federal and tribal entities are collaborating to meet these needs, but the rate of change and the absence of even basic data represent considerable challenges. The solution to these problems aren't just scientific or engineering challenges to be met, though that helps, perhaps first and foremost the same climate drivers of geomorphological coastal erosion and change are also changing the basis for indigenous food and energy security as climate changes the habitats and ranges of traditional subsistence species and the transportation options for getting fuel when renewables are not available. And all of these changes are occurring in a context where communities are still emerging from the effects of rapid historical changes that resulted in challenges even in the absence of climate change.

Finally, decision making for Alaska Native communities involves complex interplay between tribal communities, native corporations, and individuals. In short, the human dimensions of resilience determine the adaptive capacity and the options to respond to the physical and ecological challenges of climate change. So food and energy security and the issues of decolonization and sovereignty also create part of this context and then define the context in which adaptation can occur. There are some information successes to help address these problems. Better community level planning and adaptation depends in part on scientific advances. For example, IFSAR, or remotely sensed elevation information from radar was completed in 2019 for the Yukon-Kuskokwim Delta, and thus completes Alaska's data set for this important elevation information. Funding and the development of elevation data allowed elevation models in many of these regions for the first time. This data is a start to better simulation modeling of flooding, but it's insufficient for most community level needs because of the error even in this modern technology. There are many such steps forward in progress and anticipating piecing them together or integrating them to do better modeling, forecasting, and to solve problems of relevance to people and wildlife is key. There's also a bright spot in terms of capacity to bridge between western science and indigenous knowledge. An example is the BIA Tribal Climate Science Liaison, who's worked hard in our state to better coordinate efforts to put western science and indigenous knowledge together in order to create better adaptation opportunities for communities statewide.

Another example is National Weather Service community partnerships with observers in some of the more remote communities to get better understanding of real-time impacts of forecasted events. And then scientific capability proceeds with new capabilities all the time. Our forecasting capabilities are improving and our coastal mapping improves all the time, thus increasing our ability to put data together and do a better job of bridging between the historical past and being prepared for the future climate change impacts that we expect to coastal resilience. And with that, I'll conclude my remarks and pass it back to Dan.

Bresette

Thanks Jeremy, that was a great presentation to kick us off today, I really appreciate it. Just a quick reminder, I know I had a couple things that I'm looking forward to asking you about Jeremy when we get to Q&A, for those of you who are watching us online if you have questions there are two ways you can ask them, the first is to follow us on Twitter @EESIonline and submit your questions that way, second way is to send us an email and you can reach us at EESI@EESI.org, and we're going to save all the questions, they're coming in fast and furious and we'll save them until we finish up with the panel.

Our next panelist is Raymond Paddock III. Ray works for the Central Council Tlingit and Haida Indian Tribes of Alaska as their environmental coordinator. For several years, Ray has coordinated Tlingit and Haida environmental programs to provide training activities, educational assistance, and coordination statewide and regionally. The Native Lands and Resources Department continues to contribute to the capacity growth within Alaskan tribes and provides a wide variety of services to assist those tribes as they address local and regional environmental issues. Ray is also serving as the Regional Tribal Operations Committee. Ray, I'll turn it over to you, looking forward to your presentation.

Raymond Paddock III

Thank you, Dan. Hi, I'm Raymond Paddock, again I am the Environmental Coordinator for the Central Council of Tlingit and Haida in Juneau, Alaska. I am a Tlingit, I'm *kaagwaantaan* of the Eagle's Nest House, and my Tlingit name is [Kristatong]. I'm here to talk a little bit about the work that's being done in Alaska, but also to express the concerns and preparation and the lack of resources we have here. There are 575 federally recognized tribes in the United States, 229 of those federally recognized tribes are here in Alaska, many along the coast but we do have several that are in the heart of Alaska. I stated there are many, many tribes within Alaska that are inland, but they are dependent on the coastal resources. As you see on the map there, those colors here, you see that the Yukon River, those are communities that are dependent on salmon that come from that to sustain their culture and feed their communities. Subsistence resources, this means hunting, fishing, gathering activities that provide food and way of life to Alaska Natives. Healthy fish, wildlife, and plant populations are key to tribal communities. These are just some of the impacts that we have concerns with when talking about subsistence resources, climate impacts to traditional gatherings on the calendar, maintaining berry species, impacts of salmon, and impacts of special forest products like cedar.

Next slide, please. I titled this one *Wooch.een*, that's a Tlingit word for working together, and we are having to do a lot of working together as you'll see later in the slides to offset costs, share resources, and develop partnerships. Tribes, we have to come together to work on common issues across traditional regions, and that is what my work has been over a number of years, it's to fill in the slots where we are lacking some of the resources to build partnerships. I'll get to some of that later, I've done in the presentation as we go on, but again this is to address cost issues and the lack of resources. So identifying our issues, we see a lot of stuff in your face as you see on the slides here, erosion and permafrost. For many of us, we do see that, and the rest of the world sees what's happening in Alaska, but many of us don't see the issues that are not as in-your-face as you see with the permafrost and the erosions here in the pictures. People are generally familiar with the needs of villages at risk from coastal erosion inundation, particularly in western northern Alaska as Jeremy stated, the previous speaker, and those are super pressing. Yet there are broader risks, less in your face if you will, when things like harmful algal blooms, ocean acidification that affects food security for all tribes regardless of the locations across the state. As stated earlier, many communities in Alaska are dependent on coastal resources. In this slide, you'll see to the left, those are phytoplankton, one of them at the top is *Alexandrium*, which is the PSP we are typically seeing here in southeast Alaska and along coastal Alaska as harmful algal blooms. To the right, on that other side of the pic is ocean acidification testing. That's my coworkers that you see at the top there, they've been doing some testing for ocean acidification in the Juneau area. I also added a picture of the Alaska Marine Highway, as they have been an integral part as data collecting for ocean acidification for a number of years now. Unfortunately, the ferry system is in jeopardy as many may know, so we don't know how that will look.

Barriers. Even with communities and tribes being somewhat prepared with development of adaptation plans, we are still lacking the resources needed to ensure we are addressing these issues. In terms of food security and adaptation capacity, we plan to have that for the future. We have to plan for slow moving disasters that we don't expect, and we don't have the experience with the bureaucracy that exists. Their mandates and regulations come from past and not future that we are trying to adapt to. Even though we have organizations like Tlingit and Haida and SEATOR, it's not enough. Even if all the tribes in Alaska had the capacity, it still would not be enough, we are lacking the resources. And amidst all the entities that are working on coastal resilience and adaptation, indigenous people offer something unique and that is the perspective of being an integral part of Alaska ecosystems for millennia. There's no substitute for the knowledge that tribes hold about the land and the resources around their communities when it comes to resilience and adaptation. Yet many times this knowledge is not considered when the agencies and other government entities launch adaptation planning efforts to aim to benefit these communities.

So a little bit more about the in-depth stuff of regional efforts that we are doing, and as you see on this slide here, these are just a few organizations and tribes that are working together to address tribal resiliency, community resiliency. Of course there are several more throughout the state, but this just was a quick slide I wanted to add in. So as mentioned, there has been several organizations of tribes doing stuff to address tribal resiliency, community resiliency. Tlingit Haida, we just recently developed a climate change adaptation plan based off tribal and cultural concerns. Fish, shellfish, cedar were on there just to name a few, and we got all that from a

regional effort from tribes who are able to hand in their concerns, talk to us about their problems they're seeing in the communities, and that's how we've drafted this adaptation plan. This plan was released to tribes back in the spring of 2019, and we also created a template. So we do have the adaptation plan for Tlingit and Haida, but there is a bigger plan, there's a template that we were able to get to tribes throughout the southeast. They were able to take that plan and make it a filler-in if you will, for the rest of their tribes, based on their concerns in their communities that their tribal leaders may see as fit.

In this slide, I want to talk a little bit about what we're doing next. So this year, we're developing another climate change adaptation plan, this one will be based off the social and economic impacts we are seeing in southeast Alaska. So in order for this plan to go through, we are working with municipalities, small businesses, organizations throughout the region that may feel the effects of climate change down the road. Amidst COVID though, we're having a little bit of issues trying to figure out what that will look like, but we still have to reach out to those communities, to those municipal leaders, to the tribal leaders and the small businesses to get their concerns in order for us to develop this plan properly. And another organization, SEATOR, ran from the Sitka tribe of Alaska, with some food security marine programs, we are working with partners like STA, the Sitka Tribes of Alaska to ensure that we are meeting the issues of our food security. They conduct the shellfish, harmful algal bloom, and ocean acidification testing that many of our subsistence gatherers in southeast Alaska use. We send those to Sitka tribes and they're able to collect and tell us whether it's safe or not, but they're also collecting the data on the ocean acidification, so that's a helpful part in the short term, we hope to use that in the long run.

As mentioned also I am part of the EPA Region 10 Tribal Operations Committee. We are in partnership with the United States EPA to further the tribal environmental objectives at the regional level to serve as liaison if you will between the EPA and tribes regarding information exchange, assistance, and to address issues that we see in our region, and Region 10 being Washington, Oregon, Idaho, and Alaska. Right now, we are currently drafting and working with the Regional Director of the EPA to create a subsistence initiative, and I'd like to share that more if anyone has any questions please feel free to ask them on here, but we are creating a subsistence initiative that addresses issues such as climate change throughout all the Region 10, and of course we would love feedback on that in the long run. Two more slides, and here I just made it a quick note of what's going on amidst COVID, before I end I wanted to just put this out there, current COVID considerations. At least 130 tribes right now have released orders requesting folks from outside of their communities to not enter. If any of this audience please has oversight over our operations in Alaska to result in village visits, please, please check in with your programs and urge them to follow the tribal orders. And that is all, *Gunalcheesh, Haw'aa*, thank you very much, my contact info is on here, please feel free to contact me at any time. Thank you guys.

Bresette

Thanks Ray, great presentation. And just as a reminder, everyone's slides are actually already online, so if you need Ray's contact information, if you want to go back and look at his slide, same thing with Jeremy, same thing with Aaron who's coming up next, everything's available online at EESI.org, and the video will eventually be up there as well. Just a quick reminder for those who might have joined us a little late, we're gonna save our Q&A for the end, if you have questions you'd like to ask our panelists and many of you are submitting them, you can send them in to us via Twitter or follow us online @EESIonline on Twitter, you can DM us or you can retweet or you can want to get us in that way, you can also send us an email at EESI@EESI.org. We're gonna move to our third panelist, and then we'll move into our Q&A portion of the day.

Our third panelist is Aaron Poe. Aaron has worked in Alaska for 22 years specializing in natural resource management, partnership development, and community engagement. His work focuses on helping managers and communities understand and adapt to rapid environmental change. He currently works for the Alaska Conservation Foundation, and he is the coordinator for the Aleutian Bering Sea Initiative, the Program Officer for the Sustainable Southeast Partnership. Welcome, Aaron, really glad to have you today.

Aaron Poe

Great, thanks, Dan. Yeah, thank you for that intro, I'm excited to be able to talk with folks today about a couple of these partnerships that I support here from my position at the Alaska Conservation Foundation. And so I guess let's jump right in, next slide please.

And so the one I'm going to spend the most time talking about is this Aleutian Bering Sea Initiative, and that was one of the original landscape conservation cooperatives, so if folks have maybe heard of that or heard of LCCs, essentially these are regional partnerships, they're guided by steering committees and those steering committees include folks from agencies, from tribes, from indigenous organizations, from nonprofits, from university programs, basically really diverse groups of people that are directing the work of these partnerships. I always like to just stress first off that they are non-regulatory, these are public/private partnerships, but when you walk through the door and you come to that table of that partnership, that steering committee, you're an equal of everyone there. So whether you work for an agency and have some sort of regulatory authority, that's not important at those tables, and I think this is one of the things that particularly our tribal partners find refreshing as a different way to interact with some of their peers and colleagues that are within agencies. These partnerships focus on large scale issues, so things exactly like coastal resilience, climate adaptation, basically types of things that no one can really handle on their own, no entity, no individual has the ability to address these levels of change.

I always, basically just to kind of honor the origins of these. There were 22 of these partnerships at one time, they were launched by the U.S. Fish and Wildlife Service in 2010, they covered all of the entire United States, they covered much of Canada, they were in the Pacific Islands throughout the Pacific Islands, they were also throughout the Caribbean. As of today, there are— and at one time there were five of these partnerships in Alaska— as of today, there are three that are left, due to basically changes that were made in funding at the federal level, resulted in sort of the erosion of what had been this original network of LCCs. We've now kind of rebranded ourselves, we're talking this kind of northern latitudes partnerships, sort of the umbrella we talk about under. So we have that Aleutian Bering Sea Initiative, and yellow on your map there Western Alaska LCC still has that moniker attached to it in green, and the Northwest Boreal Partnership. And I just want to highlight that the Northwest Boreal Partnership, the one that you see in purple there actually has a joint steering committee made up of Alaskans and individuals from three different provinces in Canada, so it's an international partnership working on these types of issues. So despite the kind of changes that happened in 2017 with funding, these partnerships continue. We currently have about 150 different partners, either serving in those steering committee roles or on individual projects, and we continue to build on sort of the nine years of trust you know, that we're launched in 2010 by these partnerships.

So the work of these former LCC partnerships largely had been focused on science to the beginning, so the numbers that you see here on the slide, in the first five years those were actually summary numbers from an evaluation that was done by the National Academy of Sciences in 2015. Basically Congress had requested a special analysis of this network of partnerships to see if they were actually contributing something new and unique and useful to the U.S., and they were. That was the findings of that analysis. Kind of after 2015, the partnerships, particularly here in Alaska shifted more towards this kind of adaptation and these kind of resilience type actions. So we've kind of moved away from so much of the science and more towards trying to help people adapt to the changes that are happening. And currently I just want to point out, there's about 220 projects under the belt of these partnerships. So I also want to just acknowledge the members of the steering committees here, at one point when all five LCCs and Alaska were intact there were 49 different entities that were serving, you'll see this is a mix of Alaskan and Canadian folks. Currently with the kind of reduced number of these partnerships that we have, we have three steering committees remaining. We still have about 37 different partners that are active here. And so our host organizations currently are the Alaska Conservation Foundation where I work, and the Alaska Conservation Foundation has been around for about 40 years. We're focused on public lands and waters and the ways of life that they support here in Alaska. The Wildlife Management Institute has been around for about 120 years, and basically they've worked as a non-profit, supporting the needs of various State Fish and Game agencies across the country. Our principal funder right now is the Volgenau Foundation, it had been the Fish and Wildlife Service and now this small family foundation is trying to keep us supported. They're based in Washington, DC, they focus on the conservation of natural resources and the education of children, and we're very grateful for their support that they've directed to the Alaska Conservation Foundation to sustain these partnerships.

So I'm just going to transition here and talk a little bit about some of the work that we do within the LCCs, and so this one example shows you steller sea lions, those handsome fellows that you see there on your screen, basically this is a really important traditionally harvested subsistence species. Ray introduced that concept to folks that maybe aren't familiar with it, but an essential species that the Unangan or Aleut people in the Aleutian Islands

have relied upon for thousands of years. One of the other things people maybe don't know about a remote place like the Aleutian Islands, it also hosts one of the largest shipping lanes in the United States, in the world basically. Where lots of the stuff that's shipped between Asia and North America comes right through the Aleutian Islands, so we were able to do with one of our first projects is a proximity analysis, those shipping lanes that you see there in red, basically looking at the distance between those and some of these haul outs for steller sea lions. And we were able to basically show kind of both industry and managers that hey, if you just bump those lines a little bit further away from those haul outs, you could really increase the amount of safety not only for your crews and your ships and your vessels but also for the species in terms of you know risk from oil spills or other types of disturbance. So if you look at the next slide, basically working through this partnership we were able to give this information to the Coast Guard, which took that kind of analysis that we had done on the previous slide to the International Maritime Organization, and we were able to get these five voluntary areas to be avoided established in the Aleutians. I'll stress again, this is voluntary, not necessarily regulatory in that basically we were able to show the insurance companies for these vessels that if you can bump those vessels just that much further away from those islands, you really reduce your exposure of risk and increase the safety of the transit itself.

And so kind of building on that, if you go to the next slide we have this new effort where we're really trying to continue to focus on this kind of dynamic separation, or creating more separation between sort of vessels and marine mammals, or also in the case of subsistence harvesters. But you know, it's kind of a neat one where it's this kind of high-tech collaboration that allows agencies and tribes to basically establish areas in the coastal environment, or they want to learn more about potential risks from vessel traffic. And how it works is essentially what these polygons that you can kind of see there on the map, or at least the conception of them around the walrus and around the harvester, is that every time a large vessel enters one of those, that manager of that tribe can get an email or a text message saying hey there's a vessel in this area. And that doesn't necessarily mean that you're going to trigger some kind of regulatory action, that's really just trying to increase domain awareness. And this kind of like dynamic solution I think is really important, because as we're looking at changes in sea ice, we're basically seeing vessel traffic in new areas. We're seeing species having to shift to change to new habitats that are aligned with the ways that they have evolved, and so this kind of thing allows managers to kind of keep on top of that, allows tribes to keep on top of that. I also like to highlight this one just because it is an interesting collaboration, we worked with industry nonprofits, so nonprofits that serve the maritime industry on this. And my kind of favorite little fun fact about this is it was funded by the Department of Homeland Security and the Wildlife Conservation Society, I think it might be the only project in the world with that distinction.

So one of the kind of signature efforts of these former LCC partnerships was in 2016. Three of them working with the Aleutian Pribilof Islands Association and a whole bunch of other partners was able to host this series of coastal resilience and adaptation workshops. This occurred in five communities across the state, and essentially the aim here was to try and bring forward as science providers or these partnerships that are composed of science providers, to try and share what information was available in terms of data, information tools, maybe funding opportunities, try and bring back to communities to share, but spend an equal amount of time really listening to the communities about 'hey we brought you this wonderful stuff on coastal erosion, but what is it that you really need,' and hearing things that maybe what we really need are sustainable jobs in our community. So really being open to that, maybe kind of shedding a little bit of what we think everyone needs to know, and really spending time listening to what they're telling us they need. So this was an enormous effort, you can see from the number of participants, but really the diversity of affiliation of those participants I think is what made it pretty unique. Unfortunately with the changes at the federal level in 2017, a number of the efforts that have been planned to come out of these workshops were derailed, and if we go to the next slide I will just mention one effort that persisted.

One of the key things we heard during all of those workshops was that folks don't have a common place that they can go to access tools, data, information, and resources about adaptation. So we launched this AdaptAlaska.org, again with grand visions of a number of contributing federal partners here, unfortunately at this point it's basically Alaska Sea Grant that is holding this thing together. They've launched a new version of it, they're doing a great job in terms of trying to share success stories, tools, resources, but certainly they're doing a great job with the capacity they have, and there's a lot of great ways we could develop the site and we're continuing to explore resources for that.

So one of the last efforts I want to talk about in terms of a project, this is something that's common to all of those former LCC partnerships, and this Indigenous Sentinel's Network I think is pretty unique and interesting. It was launched by the Aleut community of St. Paul's, so the tribal community that's based in the Pribilof Islands, basically picture the middle of the Bering Sea in some ways. And it was launched in 2002, originally it was kind of powered by paper and pencil you know, it's spread out of that region, it's progressed in terms of its technological sophistication, there's now a smartphone app that communities can use, that smartphone app host several different kind of common protocols, even some of the stuff that the agencies use, say the Marine Mammal Stranding Network, for example, or some of the protocols that the Fish and Wildlife Service uses to document seabird die-offs on beaches. So it has those kinds of protocols, but it also has some specific to the needs of communities. So for example, they've developed a protocol that allows people to document the harvest of their traditional foods around their communities. I think it's unique and sort of this genre of citizen science or community based observer programs for a couple of reasons. I think one is that the focus of what is collected, so the focus of the science, the data question is defined by the individual community. That community also owns the data that is collected, and they are able to choose with whom they share or don't share that information, and I think another kind of final distinction is that the sentinels, the folks that are actually doing this work just like you would pay a biological technician or a biologist or a geologist, those people are paid, and I think that's kind of unique among a lot of these community-based observer programs, where the expectation at times is that people are going to volunteer their efforts, and I think that really helps to ensure that this effort has kind of a rigor to it. And so I encourage people to check it out, right now it's BeringWatch.net, something happened with the the slide rendering there but it's 'net' at the end, so I encourage you to check that out and see how it's kind of expanded into this in Digital Sentinels Network now that it's in interior Alaska and actually looking at going into Canada as well.

And so I just wanted to acknowledge because one of my other roles is working with this Sustainable Southeast Partnership, and the southeast we're talking about here is Alaska, and I think it has some really important lessons to be shared with these kind of former LCC partnerships, and you know key among those that there is this kind of interest in localizing stewardship like we just talked about with the Indigenous Sentinels Network. But I think a key component that this partnership has, and it was a partnership of tribes and nonprofits in that region, is that they have a real focus on sustainable economic development for rural communities, and that's something that we hadn't had in the past with some of these former LCC partnerships, and so we're hoping to kind of facilitate some learning between these folks on how we might tune up and really make those regional partnerships truly addressing the whole system, which of course includes sustainable economy. So I encourage people to go to that site, SustainableSoutheast.net. There's a really great movie, it's definitely worth seven minutes of your time that talks about how this partnership is kind of unique and I think there's some really good lessons from there, not only for just rural Alaska but for rural U.S. in general, and how these kind of small communities can go forward into this century I suppose.

So kind of on that theme of lessons learned, maybe I'll go on to my last few slides here and share some observations. I attribute this quote that you see there to a friend of mine named Rachelle Daniel who's with Pew Charitable Trusts, and I asked her kind of last week like hey what are some key things you would share with an audience if you only have 15 minutes? And she's like well I think we might need a month, that was her response. So anyhow, I have this amount of time, so I will try my best. But essentially, we heard kind of the data needs galore that Jeremy and Ray both have talked about in terms of how many of the common layers that really power adaptation efforts and power cuts scenario planning, in lots of the rest of the country really don't exist for Alaska. And maybe I'll just offer one example so folks might be familiar with something called the National Wetlands Inventory. This is essentially a GIS layer, or a map of the wetlands of the United States, it really helps our communities, it helps our industry understand where they can develop facilities and infrastructure. Alaska has about 40 percent of our state covered by that National Wetlands Inventory, and unfortunately the places that aren't covered are those that are most rapidly changing, so where communities like Jeremy talked about maybe need to adapt the most rapidly. We actually don't have this basic layer that would really inform kind of their infrastructure, and it's \$7 million, which you know maybe that's a large number to finish out the rest of the state that's two and a half times the size of Texas, but it seems like it would save tens of millions in planning and surveying costs, and it would definitely allow communities to move more quickly in terms of their adaptation efforts.

I do want to also share telecommunications is maybe the most consistent thing that we hear, I mean look at the impacts of COVID right, we're all talking to one another like this and we expect this 'oh I can just zoom over for whatever reason,' well those 229 tribal communities that Ray talked about, for a lot of them this kind of capacity just in terms of internet speed is not there, and that limits them for telemedicine and for sessions like this, or many other things that would help them adapt. In some places in the state phones aren't even necessarily completely reliable all the time, and often it's the school that maybe has the only good source of reliable internet. The final point I'd make on this point is that there really isn't any clearinghouse, there isn't this kind of simple place for tribes or even agency leaders to be able to go and access adaptation information, data resources, funding sources, we tried to create this AdaptAlaska.org with that in mind, but in so doing we quickly realize that's a three to four person job in order to just stay on top everything, stay on top of the latest data, the latest success stories, the latest funding sources, it would take a lot more than what we have to power it currently.

So next slide in terms of barriers to collaboration, I feel so generic to complain about bureaucracy, but it's very real in terms of the financial assistance operations, particularly of the federal government right now are so convoluted and slow, and they're getting increasingly so all of the time, it's really hard I think for agencies to be able to deploy their resources in an effective annual fiscal cycle, and they miss opportunities to partner with tribes, with universities, with state agencies, because of a number of these controls that are in place. I would also point this is a consistent thing we hear that you know communities don't have the resources that they need and they don't have access to the kind of venues that they would need to be able to go to and be heard at, to share what their real needs are. Communities often are referred to like 'hey go to this annual conference if you want to learn about your adaptation needs or go here or go there,' but they're telling us, we're hearing that they don't really feel that the way that conferences and workshops are run really allows for true exchange and ideas and listening and eventual decision-making the way that tribes like to be able to do that. We also hear consistently about communities as being kind of overrun by scientists and agencies who are coming to them with ideas, basically saying 'hey we want your input on this idea' versus 'what is your idea of what you need,' and being able to flip that just seems really vital in terms of kind of resilience and adaptation.

I would also point there really isn't a central authority for leadership on adaptation in Alaska at all, and that's not to blame anyone, I mean I think people who are maybe passingly familiar with Alaska have heard things that's like 'oh the Denali Commission, that's who's handling all of that', or maybe it's the interagency Arctic Research Policy Committee, or IARPC, they're the ones that are the central authority on climate science, and so that's where these discussions are all happening, and the reality is it's not to put any shade or anything on those people, but that's not true, each one is working on their own little pieces, they still kind of have their own mandates in their own space that they operate on, and there's really not any one that's putting it all together to understand what the full picture is.

So just in terms of the adaptations that are out there, I mean you've heard Jeremy and Ray talk about examples of this, and I hate to again to put a 'but' on it, but there are some pretty significant 'buts' in there, and I want to start this off just by sharing and it's kind of been shared earlier, but climate change is really a lived experience for people, particularly people in rural Alaska. They're literally changing the way that they live because of the changes that are happening around them, and I think people want to do something about that. There's individuals who want to change the way that they fish, maybe they want to switch to AmeriCulture because they're concerned about fishing futures, there's a lot of things that they're willing to do. They're willing to roll up their sleeves and actually do the work, it's just that there's not great information on how to do that as an individual, how to change your business practices relative to the changes in the environment that we're seeing. I do see also that there's this, and it's been alluded to in the past presentations, but there's an increased recognition of the value of indigenous knowledge. I want to italicize like I say increased, meaning it's better than it used to be but it's not anywhere near where it needs to be. And sadly there's kind of limited investment from sort of the science community or the agency community or decision maker community broadly in figuring out how could we connect this really important indigenous knowledge to the science that typically has been driving management so much in the past. Key players in Alaska that basically have been excelling at this kind of stuff, I have seen funding cuts in recent years, at the exact wrong time when these changes are happening so rapidly, so you know organizations like Alaska Sea Grant have seen funding cuts, the EPA's Indian General Assistance Program, or the IGAP program that powers a lot of the tribal environmental efforts in communities has been cut in recent years as well, and not to you know focus on me for me or anything, but I think it's just a reality to

acknowledge that even these former LCC partnerships I've been talking about, there originally were 15 permanent full-time staff that were facilitating those, functioning and looking for these project and adaptation opportunities. Now there's three, folks, that are all doing that from inside of those nonprofit organizations, Alaska Conservation Foundation along with the Management Institute, so that's a big sort of cut in terms of capacity.

And then I guess maybe a final word on this is that there's a general sense that from especially some of the other private funders, so the larger foundations that fund a lot of science and adaptation efforts around the world that Alaska is okay, like Alaska is generally fine compared to other parts of the globe in terms of what populations there are dealing with, and in reality that may be very true especially if you look at like the Global South for example where resources are even scarcer, but it's just a reality that you know kind of the types of funding that we used to see from large foundations in Alaska in the early 2000s really just don't happen the way that they used to. And I guess I'm kind of wrapping here a little bit, and I always want to make this you know, I'm not a climate scientist, I've played one on the radio a couple of times on NPR which was super cool, and once I did a local TV show in an Alaska Dutch Harbor, hence my amazing presence on camera here, but I have been fortunate to work with a lot of climate scientists and so this is not to disparage any of their work, but it's my observation that the risk is always underestimated in their predictive climate models, and I don't know whether that's kind of the way that science works or whether agencies or universities don't want to release products that maybe are too alarmist and they really just want two or three more peer reviews to make sure that those findings are correct, and how that maybe dampens the reality. But I guess I would just share that you know some of the things that our communities are saying, they're seeing now were the types of things that were predicted to be happening in 2040, so it feels like Alaska is not just behind in the investment in climate adaptation, it's maybe sort of ironic and sad that we're also behind the prediction curve in terms of what's happening under climate change.

So I guess I'll just close by sharing that and reinforcing that climate change and adaptation is a lived experience right now in Alaska, we can't wait for a change in administration, we can't wait for the newest and best science, we can't wait for the best technologies for infrastructure to come forward. The challenges that our tribes and communities are facing, the challenges that our natural resource managers are facing are all happening, they have happened already, and they don't really show any signs of slowing down here in the north. So thank you for your time and attention folks, and I think we're back to Dan for question and answer.

Bresette

Yes I think that's right. Thank you Aaron, and I think we'll have a full half-hour for Q&A, so I'm really looking forward to this, and we've got lots of questions but I think I'm gonna start actually by first thanking the three of you for joining us today and for your really excellent presentations. One last plug, if anyone in our audience would like to submit a question you can follow us on Twitter @EESIonline, you can also send us an email at EESI@EESI.org.

But I think I'm gonna kick off the Q&A Aaron by letting or asking Jeremy and Ray if they'd like to comment on some things in your presentation, and specifically you identified towards the end of your presentation you identified three key barriers that you see as getting in the way from coastal resilience in Alaska, and I'm gonna paraphrase but they were roughly, the first one was lack of financial assistance which often made it difficult to partner with federal authorities or federal agencies, the second was again a lack of resources but this time to participate, and a lack of venues in order to be heard, and then the lack of a central authority in Alaska for a lot of this work being done. And I'd like to ask Jeremy and Ray, Jeremy we'll start with you since you went first and then Ray we'll go to you, what do you make of those barriers? Are those from your perspective, are those real barriers, are there other barriers, and you know, if you have ideas about maybe how you would suggest removing those barriers, changing barriers into hurdles that can be overcome, interested in what you have to say about that, and Jeremy we'll go to you first.

Littell

Sure, I mean I think Aaron characterized it appropriately. Those things are limitations on what can be done and how well it can be done, particularly at the community level, and I think that's part of the story here is if all these places were the same, had the same hazards and risks and were subject to the same sets of impacts, it would be easier to look for that magical one size fits all or scalable solution, but the truth is that there's a lot of texture to those impacts and to the responses and the degree to which the communities are affected by some or

all of them, and then also on the impacts to their food security and their livelihoods and so on. And so I think that you start to add up the requirements, the financial requirements of dealing with those problems, even developing the science that's capable of characterizing those nuances from community to community is an expensive proposition, and so you know we also then are faced with an environment and impacts that are changing rapidly enough that as soon as we've got elevation and shoreline characterization complete, we need to start again because it is eroding or changing. And so there's also that element of needing to keep working on this, you're never quite done, and that's not necessarily any less true in other parts of the world, but the impacts are happening so quickly here and the baseline information is so limited that it's difficult. So from a scientific perspective, the ability to fund and coordinate a wide range of projects to address specifically those community needs, rather than merely the scientific curiosity that would naturally move us forward in kind of a piecemeal fashion is a limitation.

You also characterize the second one, sort of the capacity to be heard. Scientists are getting better at this over the decades, but historically we attend conferences and work kind of in groups of our own, our peers that focus on the same things that we study, so we might go to a permafrost meeting if we're interested in permafrost, or if we happen to have the good fortune to collaborate with people interested in permafrost thaw impacts on the global carbon cycle that might get a little bit more diverse across disciplines, and then maybe you know some of the larger conferences we have sessions that are devoted to the interdisciplinary aspects of this including the community impacts and what you do about it. And Aaron's right to point out that the dialogue has to be one of not just scientists, not just community members, not just funding agencies, not just policy makers, but really you need all aspects of that to fully appreciate the dimensions of the problem, and then to imagine its solutions, because none of them are just scientific, technological, community resilience or policy, there are pieces of all of that.

And then third you talked about a central authority to coordinate this, the adaptation efforts and especially our understanding of how you co-produce science that's useful to the people who might benefit from it, that's evolving still, because these are still early days and how we do this. There are decades of adaptation in some places, and in many of these communities, if you think about it in the long horizon, millennia of adaptation to environmental variability. On the other hand, it's a new kind of environmental variability. There are relatively new, century old, or at the most century and a half dimensions of land ownership and regulation and management mandates from different agencies, those sorts of things are relatively novel, and so you know you're still working at coordinating all of those different pieces of the adaptation puzzle. And so far it's been more, I don't know if you call it grassroots or bottom-up, but Aaron can probably comment better or Ray but you have different entities coming to the table carrying on the dialogues and trying to assemble the pieces from the bottom up, and the coordination happens in fits and starts rather than directed, and we've seen some good examples on some of the scientific challenges, but definitely there's room going forward to do more of that.

Bresette

Ray, what do you make of the three barriers that Aaron laid out and that Jeremy just commented on, a lack of financial assistance to work with federal agencies, lack of resources and venues for ideas to be heard, and then sort of a lack of central authority to deal with some of these issues?

Paddock

I don't know I can have as in-depth and amazing answer to the question as Jeremy had, but we do see that there are definitely a lack of resources and a lack of central authority and that's why we've seen tribes, organizations, partnership together to address these issues, because we're just not seeing it done on a larger scale. Unfortunately, we're kind of by ourselves right now, but again coming together to offset costs, share resources has kind of been the theme we've been doing to address those issues on that [inaudible] and we're having some success, but it comes down as a grassroots level that Jeremy was just saying. But in order for this to work on a bigger level we're gonna need the bigger players involved as well.

Bresette

Great, thanks. Ray, I'm gonna go to you with this one, and then we'll ask Aaron and Jeremy to join in, but this is a question I was really looking for, this is a topic that I'm really looking forward to hearing about today, it's a

question that we've gotten online and it's a question that I've had since we've started, and that is, all of you have mentioned to some degree sort of the Alaskan traditional ecological knowledge that has been part of communities in Alaska for generations, centuries, and you know Aaron made the comment that it's increased but it hasn't gotten to where it needs to be. I'm wondering how do we do better? How do we better include in this scientific and climate change adaptation conversation, how do we do better including traditional ecological knowledge, whether it's from Alaskan tribes like the ones that you're working with Ray, or just generally speaking, how do we involve a native perspective in a scientific climate change adaptation conversation?

Paddock

Dan, I think that's a question that tribes have been trying to figure out for a number of years. Right now though, it's kind of an exciting time for tribes as we're seeing more of the work that we're doing that's had treated TEK involved if you will, sorry for there's a lot of people out there that will be upset with me using the words TEK, indigenous knowledge if you will, a traditional and indigenous knowledge. We're seeing that happen more and more over the last decade or so, and a lot of that has been with tribes being able to build their capacity to implement western science and traditional knowledge, indigenous knowledge together while developing programs such as what we've seen with SEATOR or with what we Tlingit and Haida have been doing with the climate change adaptation plan. We're not just doing it on a tribal level, but we're reaching out to several organizations, businesses, governments to get feedback on that, and it's bringing truth and light into the work that we are doing as we've been saying this for a century or more.

Bresette

Aaron, you were the one who brought up the idea that it's increasing but isn't where it needs to be, so what do you have to say in response to Ray's comment, and then Jeremy we'll go to you.

Poe

Yeah I guess again not that funding is like the solution to everything, I think there's kind of two pieces to it though, and one of them is funding that you have institutions like the National Science Foundation and so for example, there's a letter circulating right now from a couple of tribes and a number of tribal nonprofits, sort of basically highlighting a new program that the National Science Foundation rolled out here that the navigating the new Arctic proposal, and they basically have some very specific recommendations for how NSF could literally fund kind of the, 'infrastructure' is not the right word, but I mean sort of like the venues, the knowledge exchange opportunities between indigenous peoples and scientists, so I think there literally is a funding piece to it. But I also feel like there's an education, there's sort of a western science education that you know, I was trained as a scientist and it was a while ago, but I'm guessing that it might not have changed that much, that there's not a value put on the experience that indigenous peoples have, and then the fact that they actually do have this knowledge and this information that you might have to spend science effort on, they actually have this information and so finding a way to train or maybe retrain our fellow scientists in how they can do this kind of co-production of knowledge work with indigenous communities is also needed.

Bresette

Jeremy and from your perspective, working with the federal government, what's your perspective on this, how can the scientific community do what Aaron just suggested and what Ray suggested, and sort of embrace this knowledge base that's just sitting there demanding to be heard but some reason not quite being heard yet.

Littell

Yeah, I had the good fortune to work with a small handful of communities in western Alaska and southwestern Alaska and listen to the lifetime observations of some of the elders in those communities and then also the traditional knowledge or indigenous knowledge as Ray pointed out, that they carry forward from previous generations. And I've been frequently surprised both at the depth and quality of that information, especially on things like weather dynamics and how they've changed or currents in the ocean or in rivers, riverine changes, erosion changes, things like that that are relevant to our discussion here. And yeah my training initially was as a paleo ecologist and we're always looking for records of reliable information or proxies for processes that happen

before there were instrumental observations, and we spent a lot of time understanding what that past environment looked like, and in many of these cases I have access to and benefited from information from direct observation that goes back before instrumentation was available in the west coast of Alaska, so provides a good context. I think it's a little bit counter to our training that we receive in what we might think of as western science, our classical training in how to use both kinds of information simultaneously and it's a challenge to do that, but if you go in with the idea that a scientist goes in with, that those are plausible and that the observations that are made are things that get tested against future observations, then there's a very similar framework for how you proceed. And so I think there's a lot of value in using both kinds of information as we move forward, and especially given that the future environment that we'd anticipate and even the current changes happening in many parts of Alaska exceed the kinds of western science observations in the historical record, or are different from those in the indigenous knowledge that are described. Those changes often give us ideas for the things that we should be looking at before we know that there's a problem.

Bresette

Yeah, it's almost like it's not one or the other right, it's both right, exactly. Can be two things, as they say. So we have a lot of questions and we're not gonna get to all of them, but thank you for everyone who's contributed to them. Here's one for you, and I know this is a controversial topic, it's one that we sort of wrestle with it at EESI, about how to talk about with our panelists, with our experts, with our community leaders, but also with policy makers, and that is the idea of relocating communities, moving away from coastline areas that are at risk. And I think it came up in your slide, Ray, Jeremy's as well. For coastal communities that need to relocate, what does that actually look like in Alaska? And Ray, I think you said it was very expensive or maybe that was Jeremy's, sorry it was fifty minutes ago perhaps, but in addition to sort of the financial requirements of moving a community, these are communities that are so tied to the shoreline and specifically their coast right there a portion of it, what does that look like? How does that conversation even get started, and how do you mobilize sort of the resources, the vast resources, financial and otherwise, that it takes to get that done? And anyone can pipe up, but Ray, since I've taken your slides in vain a couple times maybe we'll start with you and we'll go to Aaron and then Jeremy.

Paddock

So where I'm from in southeast Alaska, you know we're not really seeing a lot of the erosion, the water taking communities away yet, so that's a hard one for me to answer, but it's still... I kind of lost where I wanted to go with that, there was something I wanted to say in regards to that, to start though I mean again we'd have to look at Kivalina and Shishmaref and and see too that they knew it was coming but the rest of the state didn't have a plan for that. I just wanted to reiterate though too, and this goes back to Jeremy's point of cost, but having an adaptation plan could possibly reduce about 40 percent of the issues that may arise, be it from village relocation, community relocation, to building maybe walls or something to the effect, but I'm bringing it back to the financial part of things, just because I'm not experienced that, I have not dealt with that part in southeast Alaska fortunately, but it still again doesn't mean that there's underlying issues that we can't address, or can't see.

Bresette

Thank you, and I should say that the person who asked that question also gave you a shout out for amazing plankton slides, so all it's all great. So Aaron, why don't we go to you next, what does it take to get some of these communities to either get their heads around it, or even just to actually make the move?

Poe

Yeah speaking of another month long conversation, it's a huge question and topic. So there's a whole bunch of pieces to it, but I mean one of the problems that I would point to is there's some collaboration around it, but there's a lot of competing mandates and sort of jurisdictions that basically make it this really prolonged and painful process. I think some of these communities it's taken them 20 years to be able to move, and I think it's in part that, but it's also in part that there's sort of going back to this like disrespecting sort of indigenous sovereignty and indigenous perspective, that you know agencies have come in and be like hey we need to move you here, and here are the steps to do that, but there really isn't, and I haven't participated in these conversations specifically, so

these are things I've heard secondhand I suppose, so I just wanna caveat that. And again, I'm not trying to detract from the efforts that have happened, and they're really hard and amazing work that has happened, but I think there's a consistent thread here where it's entities from the outside coming to these communities and telling them what they need to do, versus asking them to sort of lead that. So I'd offer that I don't have a ton of experience in this arena.

Bresette

Jeremy?

Littell

Yeah, I think Aaron's got a great point. There's a lot of dimensions to that problem, and you know from the western science perspective, we often think of this in terms of the timing of impacts, so there are prioritization lists of which communities are experiencing which impacts and at what rates, and to try and understand the range of timing by which some of the communities would be impacted in the relatively near future, versus those that would be a little further down the line in terms of time, and those efforts proceed with engineering and putting things like that, and so there's a fair amount of capability in understanding the current threat in terms of hazards, and then what risks that imposes on infrastructure based on where it's built now. It doesn't do justice to the potential risks to other aspects of resilience for communities which Aaron and Ray both touched on. I think the other thing that we look at is that we talked around the idea of co-production, the idea of involving those who might use the information and science that get developed to make decisions, and when you talk about something as important and dire as relocation then you very much need the input of those who are affected by it. And when you select sites for future locations, there's definitely the work that needs to go into understanding the potential impacts there as well, so there's a whole lot of things all wrapped up there that are somewhat sensitive because of the nature of the problem. And I think just from a western science perspective, if we want to address it that way, we can think pretty carefully about the hazards that communities experience in the locations they exist now, and those they might experience in the future based on future projections. But I think that the much harder part of that is what does it actually mean in terms of community resilience, that's much more difficult.

Bresette

Thanks. We're gonna end on time, but we're gonna try to fit in a couple extra questions, and you know EESI is DC-based and our audience is policymakers, Capitol Hill, and the agencies. As far as takeaways from our policymaking audience today, and Ray this question was originally asked of you, so we'll start with you and then maybe we'll go to Aaron and Jeremy again, in terms of takeaways, what is the most important thing for the federal government to realize about how it can interact with and support tribal adaptation planning efforts better? Is there a magic bullet, or you know a shotshell of magic buckshot that you would like to see the federal government do a little bit better on and support the efforts that you all are trying to undertake?

Paddock

Let me start with the quote that Aaron's been saying for a little bit, and that's saying do I have a month? There's a lot to say of what we mean, and I don't know if there's one magic bullet that addresses it, but I know that one thing I can say is with the start of what tribes and organizations are doing throughout Alaska, throughout southeast Alaska is to at least be able to give the support and the resources that's going to be needed to address these long-term, short-term issues as we're moving forward. Again with the adaptation planning, I think having an adaptation plan allows us to see down the road of what we need to plan for, and I hope that in the future having that allows for more resources to be given to the state of Alaska, to tribes or organizations that are looking to address these upcoming issues.

Bresette

Thanks, Aaron what's your perspective on that, what's your takeaway for policymakers wondering how they can better support the efforts of coastal resilience?

Poe

It's definitely hard to think of one thing, but I tried while Ray was talking, thank you Ray, and I do think that it goes back to this point of actually spending the time and being willing, also to kind of give up the power if you will, to have real conversations with these communities, and asking them what they need. I think it's really hard for agencies to sometimes set aside their jurisdictions that they have, that quite honestly don't fit a climate change system that's melting so rapidly like this one, to really set aside those mandates and those directives and figure out how they can help communities. I think that's the key.

Bresette

Jeremy, where are you hopeful, what do you advise the policymaking community, whether it's a federal policy making community or others, you know state or regional policy making in terms of how we can better support Alaskan coastal resilience?

Littell

On that I would say that we in the scientific community are working toward a better model for how we do this kind of work, we're acknowledging that co-production of the science is a clear need, and that in many cases that means shifting the basis for an emphasis of our scientific work to the needs of communities and members of society, rather than just the intellectual curiosity that drives us to understand natural systems and the role of humans within them, and so it's a subtle shift in terms of vocabulary, it's a pretty radical shift in terms of how the members of the scientific community propose, conduct, and then communicate their work. And as we transition towards that in Alaska and really globally, I think that support for that shifting paradigm of how and why we do some of the science that we do, not all of it, there's clearly a role for basic science and even applied science, that this goes beyond that. And so for scientists to have the latitude to work with communities and to do more interdisciplinary work of that nature is clearly needed, and while we're making strides in doing that from the ground up, also willingness to acknowledge the training programs that our scientists go through at the university level and in federal agencies to accommodate that would be very, very helpful.

Bresette

Great, thanks. We're gonna start wrapping it up, I just want to say thanks to everyone who sent in questions, most of what I asked came right from you, so thank you very much for those suggestions. Actually as I was thinking, we kind of did come up with a magic bullet, and that is we apparently need a month-long briefing about Alaska coastal resilience, if we could only have that. I don't know whether we do shifts, I don't know we have to figure that out, so maybe that's what we'll shoot for. But this was a tremendous set of presentations, thank you to all of you. Wish I could meet you in person, but thanks so much for being remote, Jeremy, Ray, and Aaron, wonderful presentations.

If anyone missed any of the presentations that you heard today, or if you want to revisit them, everything is available online at EESI.org, I hope you'll also take a moment to complete our survey, I think a slide will come up in a little while at the end of the briefing today with a survey link. Please take a moment, we really do value all of the feedback, we want to do these even better and so thanks everyone. You might have noticed that today's briefing looked a little different, if you came to our briefing mini-series last week it looked like a Zoom meeting, this looks different and that's because we have the support of a wonderful guy named Troy, he's our videographer and he does all of our AV work, and all of our briefings. You've probably seen him in the back of our in-person briefings, and he was incredibly helpful bringing you this new format, and I think it looked great, I think it sounded great. And so thanks very much to Troy, thanks also to our Amaury, Amber, Anna, Ellen, Daniel O'Brian, Sydney, everybody at EESI who helped put this on today, great briefing once again. Last plug, EESI.org, please sign up for our newsletter, and again Jeremy, Ray, and Aaron, thank you so much for joining us today, I hope you all take care and stay healthy, and I hope we'll have a chance to do a month-long briefing sometime in the near future, so thanks so much and have a great afternoon.

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