[MUSIC PLAYING]

MIKE LIVERMORE: Hi this is Mike Livermore and with me today is Karen Maglatherie, a professor at the University of Virginia in the Department of Environmental Sciences. And the director of the university's Resilience institute. Karen's research focuses on coastal ecosystems, their value, and the various threats they face. And in her role at the resilience Institute she's involved in a number of interdisciplinary projects that relate to human environment interactions. Karen thanks for chatting with me today.

KAREN MAGLATHERIE: Thank you very much for having me.

MIKE LIVERMORE: So just to get us started what got you interested in coast? Were you a kid that played on the coast all the time or how did you find your way to this area?

KAREN MAGLATHERIE: I was a kid who played on the coast and grew up on the coast. Probably the most formative thing for me was I had a grandfather who was in the British Navy and he immigrated to the US, lived in Boston, and he bought a small cottage on an island in New England. And I used to visit him as a kid.

And when the Noreasters hit instead of going inside and hunkering down in front of a wood stove he would tell me to put on my slicker and we'd go down to the beach. And watch the waves and going sideways and the sand hitting at our legs. And somehow I just found that super exhilarating and I guess it just got into my DNA.

MIKE LIVERMORE: Wow, that's fantastic. And were you interested? Were you kind of collecting shells and playing in the sea grasses which you still do I guess from time to time? Was that nature interaction and the biological world and ecosystems right there or was it more kind of playing in the waves and just having a good time outside?

KAREN MAGLATHERIE: I think it was a little bit of both. I mean, of course, I love to play in the waves like any kid. But I was really a product of the environmental movement where I really cared a lot about nature and the impact that we were having on the environment. So I really sort of entered into it from both the sort of great love and appreciation for nature, but also this awareness of how things that we were doing were really having a bad impact.

MIKE LIVERMORE: Yeah and you chose science as your route into that world as opposed to I have students who come to law school for similar motivations. So what was the origin of that particular choice?

KAREN MAGLATHERIE: Well, I went to, of course, I got a science degree in college. It was more in environmental science, human science interaction. So it was really an interdisciplinary degree. And then I worked in a nonprofit for five years before going back to grad school. I think at that time in those five years I realized I really wanted to understand more about the science. I felt like if we had a better understanding we could make better decisions.

So it was not a straight route, it was a little bit more of a circuitous route to get to a PhD in science.

MIKE LIVERMORE: And these days I think, I take it you spend a fair amount of your time and your role as director of the resilience Institute. Which itself is pretty interdisciplinary, so maybe that takes you back to those roots.

KAREN MAGLATHERIE: Yeah, I mean I think that's really my heart of hearts. Is to bring people together with different perspectives to try to address and find solutions to a problem. And so I feel comfortable outside of my comfort zone if that makes sense. I really like working with people with different ways of thinking about things and trying to patch that together and come out with a greater awareness.

MIKE LIVERMORE: So at the resilience Institute I mean, one question is just maybe you could tell us a little bit about the work of the resilience Institute. What kind of things do you do? I mean one way to get it started with this is just like, what is the concept of resilience? I sometimes wonder if it has quickly gained currency in environmental circles.

And I always wonder whether it was just repackaging sustainability because sustainability got a bad name, I got a bad rap or it became politicized in some way. Or whether there's kind of a different core concept there. So presumably at the resilience Institute you guys have thought about some of these questions. So yeah, maybe what is resilience and as a concept and how does it relate to the work of the Institute and what you all do there?

KAREN MAGLATHERIE: Yeah. I think the way I look at resilience is It's broader than just sort of bouncing back from some kind of event like a big storm or a drought. And would think of it as just that. You get hit by something and then can you recover? How do you recover? But I think about it more from my perspective as a ecologist or environmental scientist. Is that there are things that you can do to anticipate change, anticipate a tipping point as it were.

And so avoid the circumstance that would cause a disruption and the need to bounce back. So it's both the sort of anticipatory part of it, and the adaptation, and actions that are made at that point as it is how do you recover when there's some big event? So an example could be sea level rise. That's a slow process but Salt marsh could get to a point where it can't keep pace with sea level rise anymore and it drowns. Or a storm can dump a bunch of sediment on top of a marsh and that helps it grow in elevation. And so even though it might have a big impact, it can recover rapidly.

So it's a much broader concept in my view than just simply bouncing back from an event. And it is like you say, it's a word. It's a word like sustainability is a word. I think in my mind, it captures to the whole range of ways that we're interacting with and dealing with the environment.

MIKE LIVERMORE: And then so what is the work of the Institute and kind of how does it relate to this concept of resilience in that broader sense that you describe?

KAREN MAGLATHERIE: Well, the main focus of the resilience Institute is to bring together teams, interdisciplinary teams from across grounds at UVA. To think about and work on issues primarily related to climate change. And so it's really about people and the planet, not just one or the other but both and their interactions. And so in bringing these teams together, we are focused on solutions oriented research. How do we do research, basic research that is actionable?

And so we need people. We need engineers, we need basic environmental scientists, we need designers, we need economists, and we even need lawyers and business people. [LAUGHS] So I can give you all the data you need, but unless you how to act on those data or unless a community knows how to act on those data and their incentives, and understanding of the outcomes of different actions, we can't actually move forward. So it's really about that kind of solutions oriented research that's interdisciplinary.

MIKE LIVERMORE: And it's really great and really fun important stuff. It's a little abstract so maybe we could drill down into a particular project to give a sense of how this works. So obviously your work is on coast and I take it that the resilience Institute has done some work that is kind of related to coasts and their relationship to climate change.

KAREN MAGLATHERIE: Yeah, so one good example is a project that we've just gotten a big grant from the National Science Foundation. Where we are looking on the coast at the effects of sea level rise and storms on water, on flooding and also water sustainability. So as sea levels rise and storms impact the coast, you're getting water infiltrating into groundwater. So that's affecting drinking water, that's affecting water for agriculture.

MIKE LIVERMORE: Like sea water. Like brackish water.

KAREN MAGLATHERIE: Sea-- salt water right, getting in a way contaminating the fresh water that we use. At the same time we're getting coastal storms flooding neighborhoods, flooding roads, flooding farm fields, reducing people's access to source all the resources that they need. And so we have a team from engineering and environmental science.

We're looking at the groundwater and the flooding. And what is a certain level of sea level rise or storm? How's that going to impact the Virginia part of the Eastern shore of Virginia. We have big focus of the project is to think about environmental equity. So climate equity, who's getting impacted most? Where is it happening? And what are those impacts?

And we also have folks from the bio-complexity Institute thinking about social network analysis. How do people interact? How do institutions and people interact? What are the decision points? What are the leverage points? So we're building all these different layers in this both basic science and community engaged research into a Atlas. So we call it the climate equity atlas.

So we will be able to understand both what the impacts are now. But we will be able to model what they'll look like in the future with different climate scenarios and different kind of decision points. And so the idea is that you can help people make informed decisions, you can help people understand what the consequences are of certain decisions or actions. In the face of this uncertain climate change.

So the goal is to really make these decisions promote equity in terms of climate impacts. It's a big project, we're just launching it in a couple of days. It's a lot of different people to bring together. We're all outside of our comfort zone trying to find out what those points of intersection are. But at the same time it's really exciting.

MIKE LIVERMORE: Yeah, it sounds like a fascinating project. So just to get a handle on some of the meat of how that project will go forward. So some data already exists. So presumably this isn't a mapping exercise where you need to go out and do measurements of groundwater tables and that kind of thing.

Or maybe there is some element of that of just getting a sense of the physical environment. Relevant variables in the physical environment to construct models of what would happen under different sea level rise scenarios. Is that part of the project or is that you already kind of have that data in hand and it's more of a modeling exercise. And then kind of overlaying the sociopolitical information onto the kind of physical information that you have.

KAREN MAGLATHERIE: That's exactly right, the way you described it. There are a lot of data available so it's a lot about modeling the physical side of things and then overlaying the social political layers, the data. And then modeling to understand the people part of it. Modeling decisions. Modeling behaviors based on information, and interviews, and interactions with people in the community.

The cool thing about this project is that we have two people in the community who are now on our leadership team. So they're helping us define how we approach the problem and exactly what the questions are. So that's an exciting part of it as well.

MIKE LIVERMORE: Yeah. So in the community are these scientists that happen to live in the community? Or these are politicians or they're part of community organizations?

KAREN MAGLATHERIE: Yes, they are part of community organizations and they are people who are leaders in their community, not necessarily politicians. So one is faith leader and the other works at a community organization with young people.

MIKE LIVERMORE: That's super interesting. How did you find these folks and get them willing to be part of this? And presumably it's going to take some of their time and energy. And we'll require them to get out of their comfort zone a little bit. So it sounds like a bit of a recruiting challenge.

KAREN MAGLATHERIE: Yeah, well it was interesting. There was one person, the person who is the faith leader who had brought a group of people together to think about young people and the future of the Eastern shore. So those communities have a lot of challenges in terms of resources, and jobs. And so thinking about how do we make this a better place to keep our young people here, who want to stay here?

And they weren't thinking about climate challenges in the beginning. But our site director from our UVA coastal Research Center went to the meeting and connected with these people and thought, this person really is a leader in the community. So let's see about involving them in our conversation. And then she identified another person.

And then we had a session where we brought up a lot of people that they recommended and talked about the project. And some are interested and some are not. So it's about identifying who local leaders are, who care enough to want to engage in this. And there will be yeah, I mean there will be ways that we can compensate them. So that it's not just--

MIKE LIVERMORE: That they are volunteering.

KAREN MAGLATHERIE: --it's not just volunteering. It is a big job as you say. But it's so important because if we really want people to own this when we leave after the end of the project, those people need to be involved in developing it. And that's a really exciting part of the project I think.

MIKE LIVERMORE: Yeah, it sounds really fun. And a lot of people talk about citizen science and engaging with the community. But the rubber hits the road when you put them on the management team and they get to make decisions and criticize what you're up to.

KAREN MAGLATHERIE: Yeah and the Equity Center at UVA has been really critical in that aspect of the project. I mean, they really understand the process better than a scientist who's used to working in the lab, and the field, and then giving information to people. This is very, very different from that. And so it's a really valuable partnership in the project.

MIKE LIVERMORE: Yeah, it's just very, very different from the typical publish. I mean, even communicating I think is often outside of the standard scientists toolkit. You publish and then you're on to the next project, I assume is the standard operating procedure.

KAREN MAGLATHERIE: Yeah. Well, we're getting better. We're getting much better at communicating to the general public. But it's something that students really want training in, which I think is super important. Yeah that makes sense. So just kind of sticking with this project, you mentioned kind of informing decision making, helping people kind of. It's not purely abstract or academic. I mean, this is research it's intended to really inform decisions.

Part of this may be about mitigation, climate mitigation, reducing greenhouse gas emissions, or carbon sequestration, or those kinds of decisions. But, of course, as you know there's relatively limited scope for the coastal Virginia to affect the atmospheric concentration of CO2.

So presumably most of what we're talking about 4 decision points are the kind of adaptation. Either taking proactive steps to reduce some of the effects of sea level rise or whatever climate impacts that we're talking about. Maybe managed retreat or other types of responses, kind of accepting that some changes are going to happen. And then minimizing their effects on human well-being in one way or the other. So I know it's early days for the project. But what are the kinds of decisions that are relevant for the communities that you're kind of focused on?

KAREN MAGLATHERIE: Yeah. I think that's a really good question. I think managed retreat that's a word that's difficult for people to say, because it's a really challenging concept. Especially in places where people have lived for like the Eastern shore for many, many generations.

So right now I think the conversation is-- although that certainly there. Probably the bigger conversation is about adaptation for everything. From where is coastal flooding most likely to happen during storms. So our modeling will tell us that, what areas are most impacted. It gives us some information about where we could do restoration to increase the sort of buffer zone between the ocean and the land.

So marshes, oyster reefs, seagrass, meadows, they all help reduce coastal flooding in the case of marshes. But also reduce the sort of damaging energy of waves from storms both seagrass and oyster reefs do that. So we're working with local communities to think about how we could do that kind of restoration to reduce impacts. But another part of it is thinking about where the flooding has happened. Say in farmlands where our agriculture is a big part of the livelihood of that area.

And so what areas are getting flooded? Is it the edges of fields? Is it whole fields? Can there be some kind of buffer that can prevent that? Where is the groundwater, the most salty? And how might that impact irrigation? There's an interesting thing that we're learning, is just also about the zoning. With the zoning and this is not my area of expertise.

But if there are certain parcel sizes that are allowed, can individual homeowners retreat? If they can only by a parcel that's much larger than what they currently have or afford. So it's not just about the science, it's also about some of the policies that affect. So these are the kinds of things we learn from the community I guess I would say. I mean, these are the kinds of things that we hear impact their ability to adapt to the climate stresses.

MIKE LIVERMORE: Yeah, that's a really interesting dynamic of kind of the modeling exercise and say, well, all you need to do is move 800 feet west. And then say, well yeah that's basically puts me in the middle of two parcels. And that's not economically feasible and that kind of thing. It's a nice exchange of information in both directions.

KAREN MAGLATHERIE: Right. And the Nature Conservancy is very involved on the Eastern shore, they own a lot of property. They also are a player in this, in terms of what areas they should prioritize in terms of conservation that provide those buffers. Do they own land that communities might migrate to? Like the village of oyster, which is where the UVA's coastal research center is. Is a very, very tiny village. It's an unincorporated town.

And they're doing a resilience planning exercise now. To think about what would it take if we wanted just like your example, if we wanted to move half a mile inland. It's a little bit higher ground, how much time would that buy us? And what would that involve? And in that case, the nature conservancy is part of the conversation, because I believe they own the land, the high ground. And so it involves lots of different stakeholders thinking about this issue.

MIKE LIVERMORE: And that raises a really interesting set of kind of as you mentioned, equity issues. And maybe we could explore those a little bit. So I mean, there's a very clear trade off. I mean, when the nature conservancy purchases land, generally speaking my understanding of the goal is to provide that space for species, and for ecosystems, and the like.

And that's all kind of hunky dory when there's enough land. But as the sea starts to encroach, you could see a real conflict there. Between the needs of people who are kind of in the community and who are directly in the path of sea level rise. Versus land that's been set aside for conservation purposes. And it really I can imagine, could put a lot of pressure on those conservation values.

KAREN MAGLATHERIE: Yeah, I think that's right. I think the high ground that's owned on the Eastern shore, probably has lower conservation value right now than the coastal habitats like the marshes and the oyster reefs. And so a lot of attention is on that. And how to keep those ecosystems healthy and doing what they are supposed to do. In terms of protecting coastal communities or restoring them.

A lot of the high ground is agriculture right now and forest. And high ground is a relative term. [LAUGHS] I think it's about 14 meters. So not very high above sea level.

MIKE LIVERMORE: But likely to be around for a while. And unlike they'd be submerged any time.

KAREN MAGLATHERIE: That's right, yeah.

MIKE LIVERMORE: Well, that's well that's promising. At least in that one instance. So maybe that's part of what you can with the value added here, is to identify the areas where the conservation value is greatest. And that maybe can ease some of the tension between the community and some of the folks who are kind of most interested in ecosystem conservation.

KAREN MAGLATHERIE: Yeah and then some of these communities they are water-based economies. So they need to keep their fish, clam shacks, houses, and all that. They need to keep intact in their boat launches. Because there's a lot of growing aquaculture in the region, there's for clam aquaculture, there's lots of commercial fisheries.

So understanding how these coastal habitats can protect those communities is also a really important part for what we do at UVA and with our partners. And how we can help nature conservancy and other townships to do the best they can to keep those ecosystems intact. And from crossing over a tipping point where they might be lost.

MIKE LIVERMORE: With the ecosystem will be lost and then presumably, that means the economic base of the community ends up going away.

KAREN MAGLATHERIE: Yeah, I mean that's what happened, 70, 80 years ago when we lost the seagrass in those regions because of double header of disease and a major storm. And the economy that was based on scallop fishery at the time just completely collapsed. And so we're now seeing a resurgence of those water-based economies on the shore.

MIKE LIVERMORE: Yeah the Chesapeake is in many ways, a success story in environmental restoration. Obviously not all the way there but there's been a huge amount of effort in the last several decades to restore the bay. And it's really generated substantial. Really kind of salient and real returns that people can actually get their teeth into if we're talking about oysters or scallops. And I think that demonstrates the power of policy to actually generate environmental benefits that are tangible for folks.

KAREN MAGLATHERIE: Yeah. And I think where we work on the Eastern shore, so in those shallow coastal lagoons on the other side of the Peninsula. So not in the Chesapeake Bay. That area is very pristine. And so in part because of this 50 year legacy of conservation. So the success stories are much greater there than they are in the Chesapeake bay, which is much more heavily impacted.

MIKE LIVERMORE: So one of the areas that you just kind of mentioned it. You've done a lot of work on over the years is in the question of studying sea-grasses and their role in ecosystems. And a recent project that you've engaged in deals kind of with the question of using sea-grasses or similar ecosystems as a way of kind of climate mitigation. That we could actually sink CO_2 into these ecosystems. Or use expansion of these ecosystems as a way of sucking greenhouse gases out of the atmosphere and sequestering them.

This is a big topic of conversation, very broadly within the climate change community. Because we've done such a terrible job of reducing emissions. And so everyone sensible recognizes that we're going to need to pull a lot of greenhouse gases out of the atmosphere. If we're going to stay within the parameters that the international community has set around 1.5 or 2 degrees Celsius.

Putting aside whether that's plausible as a political and economic reality, that still remains the goal that many people are aiming at. And some form of reverse emissions everyone recognizes that that's going to be necessary. So what's the latest and greatest in this area of I guess, this is blue carbon sinks. As opposed to forests or other kind of more well-established potential areas for carbon sequestration.

KAREN MAGLATHERIE: Yeah, I think. So blue carbon sinks. So by that we mean coastal ecosystems like seagrass meadows, salt marshes, and mangroves in tropical regions. I would say our understanding of how those ecosystems sequester carbon has lagged behind. What we've known about forests, but we're really rocketing forward with that I would say.

In these blue carbon ecosystems, a lot of the carbon is stored in the soils. Except for mangrove obviously, there's a lot of carbon in the tree matter. And that soil builds up over time. And so that carbon gets buried and can potentially stay out of circulation for easily decades to centuries, if those habitats aren't somehow degraded or destroyed.

And so it's based on that we started thinking these could be really important systems just like a forest and sequestering carbon. And they are, I mean they sequester probably 10 times more carbon in their soil than forests. But overall on a per acre basis, there's so much wood in a forest. That they will trump seagrass meadows or marshes.

They're not included, they're sequestration is currently not included in global carbon models. So that just shows kind of that we're becoming more aware of the role that they play. I would say that it's a little bit controversial, I guess I would say. Just like any kind of carbon offset market.

And the reason is that the amount that can be sequestered by nature. Not the amount that already is, I mean, we're going to step back a second and say like 40% of greenhouse gas emissions are in stock, in forests, and in ocean. So nature's really good at keeping the climate where it is. It would be a whole lot worse if we didn't have that carbon sink.

But that being said, when we think about negative emissions, we're only thinking about new carbon removal. So we're only thinking about carbon removal from say seagrass restoration, or mangrove, or salt marsh restoration.

MIKE LIVERMORE: Right. From the baseline, so we take the current world as the baseline.

KAREN MAGLATHERIE: Exactly, from that baseline. And our estimates are for the blue carbon, it's probably one, two, 3% of the current greenhouse gas emissions. So it's not a lot. But I would say it's not the silver bullet. It's not going to solve climate change by restoring coastal ecosystems. At the same time, they definitely are sequestering carbon. They're definitely taking carbon out of the atmosphere.

And they're doing it now. If you restore a seagrass meadow, it happens right away. We don't have to wait 30 years to develop new technologies. So it's kind of an immediate response. And there are all sorts of co-benefits to restoring these habitats. Like improving water quality and improving biodiversity.

So we as blue carbon scientists think it's a no brainer. That we should be restoring these habitats, they are taking carbon into the atmosphere, they are storing it. It's happening now. And we get all sorts of other advantages for doing that. The challenge is that as I mentioned, it's not a lot. It's not 50% of the greenhouse gas emissions we need to remove.

And there are challenges in like you have to verify that that carbon is being taken out of the atmosphere. You actually have to do the long term data like we're doing here on the Eastern shore. You have to show that it's going to be there for a long enough time that it matters. So it's not a year, it's decades. So this idea of permanence is the other thing.

And it's only as I said, it's only new, something that wouldn't otherwise happen. We're doing new restoration. So when I mentioned that there's a controversy, there's such a interest right now in blue carbon and nature based climate mitigation. That there are projects out there that aren't verified, that aren't actually showing that they're taking carbon dioxide out of the atmosphere for a significant period of time.

Yet you can buy those carbon credits. They're not verified, but you can actually buy them. They're being sold by entities. And that could be an easy out to avoid reducing emissions, which is ultimately what we have to do. So that's where I think we really need to be true. To really mitigate climate change, we have to really be sure that we're removing the carbon dioxide from the atmosphere.

MIKE LIVERMORE: Right. Yeah. So this is in the lingo of the field. This is a problem of additionality or at least in part a problem of additionality. You mentioned the permanence as well. So the idea here being, let's say I'm someone who likes to fly on airplanes a lot. And I think to myself, maybe I should reduce my consumption of greenhouse gases in that way. I shouldn't fly around so much.

And then somebody comes along and says, hey, don't worry about it. You can fly but what you should do instead of not flying, because you get a lot of benefit out of flying. You just get to see your family, you enjoy recreational opportunities, you can take advantage of business or work needs. So instead of now flying, what you should do is pay us to engage in some coastal restoration. And then we'll soak the equivalent amount of CO2 out of the atmosphere that you're releasing through flying and maybe even a little bit more.

And that's a fairly attractive proposition or maybe for businesses. Businesses want to say that they're carbon neutral. A lot of businesses have made pledges of moving towards carbon neutrality. And so same idea. Rather than actually reducing their energy consumption, or however they're producing carbon. What they say is, we're paying for this coastal restoration or other offset programs that act to soak up whatever CO2 we're putting into the atmosphere through our activities.

And I think the issue that you mention here is that, that's all fine and good if what's actually happening is there is a coastal restoration project that removes a certain amount of CO2 from the atmosphere. That would not have happened otherwise but for the offset credit that it's receiving. And it actually sequesters the carbon for an indefinite period of time. And that's just a very hard thing to establish and verify.

KAREN MAGLATHERIE: Yeah, I mean it can be done. I mean, there's a methodology. There are third parties like Farrah that are doing that. I mean, we're in the process right now of registering our project on the Eastern shore and with Farrah, so that people can buy offset credits. And that's based in part because we have 20 years of science. That has told us this is exactly how much carbon that these seagrass meadows are taking out of the atmosphere.

The problem is as you mentioned, is that there aren't the same numbers and other places. Or really yet enough data to be confident I guess. That the carbon that you're selling is actually being sequestered. So I think the enthusiasm has sort of gone beyond the capacity to deliver right now, I guess that's what I would say.

Not that it won't deliver and not that we shouldn't do this restoration. And I think we totally should do it. It's more we should really do it. We should make sure it's real because it otherwise, isn't doing anything for the climate if it's not real. And then that's not a good thing.

MIKE LIVERMORE: Yeah, so just to talk through the additionality question with respect to this particular project that you're describing. I think it's pretty interesting I think. So the idea here is that since you're getting it certified is, is this a certification that's backward looking at what kind of carbon has already been sequestered through the project? Or this is like a carbon credit for sequestration that's forward looking for kind of efforts that are going to happen in the future?

KAREN MAGLATHERIE: Yeah, that's a really good point. Through the methodology, we can only claim as additional the previous five years. So even though the restoration has gone on for 20 years, we can only claim a part of that in the last five years. And so it's that and then moving forward. So that's the additionality part of it.

MIKE LIVERMORE: Right. And what do you think, If this possibility of getting a carbon offset had not existed, would the project not have gone forward then?

KAREN MAGLATHERIE: No. I mean, we started this project 20 years ago before we were thinking about carbon offset. And well, we measure carbon cycling that's a really important ecological function. And so lo and behold, we had a lot of data that could be used as we started having this conversation about carbon offsets. So some of that was a little bit of serendipity.

So you projects now, there's some methodology out there that says have to measure these things. And you have to how much carbon is in the soil, you have to how much the soil is accreting, or adding over time. You have to how much seagrass, biomass, plant material is there. And how the meadow is expanding over time and based on those, you can begin to make a calculation of the carbon offset value.

MIKE LIVERMORE: It's really interesting though. Because again, I find the additionality problem to be really intractable. Really, really difficult. I think there are some ways to try to think through it. But it is super tough. So the example I use for my students is you take a farmer who's thinking of changing some practice. Moving to no-till, or some other agricultural practice that it's going to increase the carbon content of the soil from the current baseline.

So the baseline is X and in a verifiable permanent way, the farmer's new practice is going to increase the amount of permanent sequestered in the soil, let's just say. But the farmer is going to do this anyway. [LAUGHS] The farmer's got her own reasons to do this based on productivity, or desire to save money from fertilizer, whatever the reasons are.

And so the farmer says, OK, I'm going to do this. And the farmer's friend says, well, if you're going to do that, you can go ahead and apply for this carbon offset and you just make some money as well. And that's great. And it's great to make money. Everyone likes to make money.

And so the farmer does exactly what she was planning on doing anyway. And in the process, goes out and gets this carbon offset. That in a sense is valid because it is a permanent reduction, and it's a change from the status quo baseline, and whatever else. But because she was planning on going forward with the project anyway, in a sense it doesn't kind of free up a unit of carbon that could otherwise be emitted. Because from the kind of business as usual baseline, if the carbon offset mechanism hadn't existed, the person would have done the same thing.

KAREN MAGLATHERIE: Right. That's challenging, I can see that. In our case in underwater with the seagrass meadows, we know the baseline well because we studied this area for 10 years prior to starting the restoration. So we know exactly how much carbon would be there if not for the seagrass meadows. So again, that was fortuitous. That was great that we had those data to be able to do that.

The challenge is once you have meadows that are producing seeds, that might just regenerate on their own and then you do seeding in particular areas, how do you separate those two in an open water flowing system, like a coastal bay or coastal lagoon? And the best we can do in these methodologies, we create rules and we're pretty conservative. I guess that's one thing to point out.

We being those of us who wrote the methodology, but all those also those like vera who validate them, are quite conservative in how that carbon accounting works. But I think to me, I mean, I think that's a really important issue. But there's also a really important issue of permanence.

And in oceans that are warming, we're seeing heat waves happening more frequently than they did a couple of decades ago. In our seagrass meadow we lost a whole portion of it in 2015 because of a big heat wave. And we lost about 20% of the carbon. We could have lost more, but we lost about 20%.

And the methodologies don't yet formally recognize those future risks. They assess risks in that buffer pool of what you have to set aside. As based on historical risk, not future risk. And so that in a changing climate where sea levels are rising and oceans are getting hotter, how do we best assess that risk so that we can really know how permanent this carbon is?

MIKE LIVERMORE: Yeah. I mean, that seems like a very substantial risk. One of the things that keeps me up at night when I think about climate change is if we're building-- I mean, actually in a way a less resilient system through our policies. So if we could imagine where we say, look, we could emit X amount of emissions without negative emissions. If we just don't take negative emissions into account. So all this kind of sequestration stuff.

And then we say, well, that's going to be really expensive and disruptive. Let's try to emit X plus something. X plus K, where K is going to be the amount of negative emissions. And the negative emissions are going to be in the form of let's say, forests and coastal ecosystems. And that's fine. We're going to sequester all this carbon. We're going to sequester K, we don't have to worry about it.

But as you were saying it turns out that we're not accounting for the ability of these ecosystems to keep this carbon sequestered in light of the reality of climate change. So what we end up doing is in effect, exacerbating the feedback, the positive feedback loop of climate change. Where we actually put ourselves in the position that from a kind of whatever baseline we were at because we've sequestered more carbon this way, when the world warms, we're going to be releasing more than we otherwise would have essentially.

KAREN MAGLATHERIE: Yeah. I think it keeps me up at night too. I mean, I've devoted a big part of my career to this coastal carbon sequestration. I have a good sense of what the scale of it is, what the risks are. I think it's really important. I think these coastal systems are incredibly important to preserve and restore. But I worry that they are in nature based, there's some overpromising. So that industries can-- it's a disincentive to reduce emissions. And that that's the part that keeps me awake.

OK it's worth doing. But it's a few percent. Even if we're off by order I don't know it could be 5%, it's not going to be 100%, or 50%. And so there's no replacement for reducing emissions. And I just worry that the conversation is sort of moving too much to restoring nature in a way that can't be delivered. And then I worry that there are these sort of non-verified programs that happen. And and then that's also an easy out.

So from my perspective just being realistic about how much carbon these seagrass meadows and marshes and mangroves could actually take out of circulation and for how long and making sure that they're real.

MIKE LIVERMORE: Right. I mean, it sounds like in a way I feel like I can see a tension within the community of people who cares about these ecosystems. On the one hand, it's possible that this idea of blue carbon and carbon sequestration is a way to finance some much needed restoration that we actually want for many, many reasons. For ecosystems reasons, for adaptation reasons, for climate change in terms of storm buffers and the like. Just because they're wonderful places that we want to preserve for their own sake.

And so I could understand the attraction for people in this area. And same thing with forests. I know that there's a lot of enthusiasm in some quarters for the idea that we could use, this idea of offsets and greenhouse gas sequestration as a way to fund the preservation of forested land that would otherwise be at risk. But you run into exactly the problem that you describe. Which is, if the climate benefits are in fact illusory then the restoration.

And especially if we're not actually getting all that much restoration than we would anyway for other reasons then it's a bit of a shell game. And it's important to call attention at least to that risk. Or if that reality happens to make sure that people know about it.

KAREN MAGLATHERIE: Yeah. I mean, I would agree with that. I think it's very real that it provides financial support. Carbon offset credits can provide financial support for restoration and conservation that's really important for many reasons including climate mitigation. So I wouldn't discount that. I think that's really important. I think for me the tension is just what we said.

That OK we can restore these ecosystems. And we get all those benefits, including some carbon sequestration. But we're not having that hard conversation about how are we actually reducing, substantially reduced CO2 emissions. So kind of it's like a delay tactic. And that worries me. And so for me being realistic about what those carbon offset benefits are is really important.

MIKE LIVERMORE: Yeah, I mean it comes down to we want to account for it in an accurate way and that's just the way it is. It would be bad if you don't and if you do.

KAREN MAGLATHERIE: Yeah and let's do it because it's easy. It's easy, it happens now, we don't have to wait to develop technology. But it's only one very small part of a bigger process we have to have.

MIKE LIVERMORE: So one of the things I think is interesting too is the conversation about co-benefits more generally in the context of climate change, in the context of ecosystem recovery and investment in restoration. I guess one of the things that is interesting about this to me or strikes me as interesting. So the idea being here that when you reduce greenhouse gas emissions for example, from coal-fired power plants there are co-benefits. In terms of reducing particulate matter emissions, which then saves people's lives.

Or when you restore a coastal ecosystem, you're sequestering some greenhouse gases or some carbon out of the atmosphere. But you're also promoting ecosystem health and that can have economic value in terms of a fishery. So there are these kind of co-benefits that work in tandem together.

So one question that's kind of related to this, are there any co-costs or costs that ride along with say for example, coastal recovery? I mean, if it's only just a good thing it seems crazy that we don't do it. Now, presumably the main cost is that just that it's expensive, that there's labor and capital that is being invested in coastal recovery that could be invested elsewhere. Is there anything else though? Is it just extremely expensive? What is the holdup if this is kind of such a good idea and generate so many broad benefits.

KAREN MAGLATHERIE: So there aren't a lot of co-costs. It's not that expensive to restore these coastal ecosystems. For example with the seagrass meadows, it's done by mostly citizen scientists through the Virginia Institute of marine sciences at William and Mary and the Nature Conservancy. They have a lot of citizen science volunteers collect the seeds, hold the seeds over the summer so they're not eaten by crabs and other things. And then literally just broadcast them off the boat. So it's not labor intensive.

MIKE LIVERMORE: It sounds very expensive yeah.

KAREN MAGLATHERIE: Not very expensive. I mean, it's labor intensive but not very expensive. People are thinking about ways to mechanize it, I'm not sure that's worth investing in to be honest. But they're certainly interested in doing that to try to do it at a larger scale.

I think the reason it hasn't taken off is that a lot of these ecosystems is coastal, estuaries, and bays have been degraded in the last 20, 30 years because of pollution. Runoff from land, from agriculture and cities. And we have had a lot of legislation so they're now recovering. So in a way it's kind of a moment, because we can restore systems that were formerly degraded that are recovering. So that's a good thing.

So I think that there is a real moment now to rebuild nature. But not every place is going to be as successful as Virginia's Eastern shore. Because many places have other things other stressors like nutrient pollution, or temperature, or fishing practices, or things like that.

MIKE LIVERMORE: Got it. So in some ways there's a hierarchy here of costs. Where on the low hanging fruit so to speak, all you need to do is get the seeds and throw them in the water. [LAUGHS] And that's pretty cheap. And where the water quality is good and for whatever reason the seagrass has been degraded, perhaps due to a past practice. Presumably the seagrass would recover with enough time but we can speed up that process. And in speeding up the process we can sequester carbon that wouldn't have otherwise been sequestered.

KAREN MAGLATHERIE: Yeah, that's fair enough. I mean, the seagrass didn't return to the Virginia coastal base for 70 years. Because it just took that long for seeds to get there on a tail of a bird or a boat anchor. And so once we discovered that small patch of seagrass and did the genetics we're like OK, now we can do this on a bigger scale. We meaning our partners at William and Mary and the nature conservancy.

Yeah, I think the other thing that that's important to think about is in many regions, especially in the tropics in Asia and Africa. If you think about mangroves, a lot of mangroves were destroyed for example to create fish ponds or shrimp ponds as a source of livelihood. Those shrimp ponds don't last forever but when they have to if we want to restore mangroves in those areas, there needs to be another source of livelihood for those people. And so the social cultural context of this kind of restoration is challenging in many areas. And there are a lot of important considerations beyond just the natural part of the system.

MIKE LIVERMORE: So just to kind of stick with that hierarchy of costs. You have on the one hand it's a matter of throwing seeds into the water and that's the least costly. And then you could say, we could have more stringent control of nutrient runoff, which is going to be more costly. Or you could have a change in fishing practices. Or we could take land that's currently devoted to some form of aquaculture and then take that out of that particular use and replace it with some kind of restoration projects.

So there is some low hanging fruit. But it sounds like if we're going to really be talking about doing this on a broad scale, it gets costlier and costlier from a kind of socioeconomic perspective. And so it's not surprising in some ways that at least for-- I mean, in a way it's surprising that we haven't taken advantage of the low hanging fruit. But in terms of doing this kind of restoration at scale, the reality is that it's not a cheap, easy, free alternative to reducing emissions. It comes with its own set of difficulties and costs.

KAREN MAGLATHERIE: Yeah and I mean, I would say that if those costs involved cleaning up the water, that does have all sorts of other benefits as well. And in many places of the world that's already happening. But it takes some time for these systems to recover and be habitable by sea grasses. For the sea grasses, the seeds that are thrown out to actually germinate in those sea grasses to survive and flourish.

So in many ways we are lucky on the Eastern shore in our coastal base. Because it is such a almost pristine habitat with very good water quality. As I mentioned, it's like coaxing nature along and that let nature do its work. So there are other areas for sure where that's happening. And there are areas where I don't know, dams are being removed and marshes are being restored.

And those are all really good things. If carbon sequestration can be one of the reasons to do that, then I think it's a good reason. And I think it's good rationale for doing it.

MIKE LIVERMORE: Yeah, of course, just to [LAUGHS] be clear. I'm a cold hearted lawyer but that activity like cleaning up the water has cost, doesn't mean we shouldn't do it. That just means that we need to be able to justify those costs in terms of their benefits and we need to be able to explain to the people who are going to bear those costs why it's worthwhile for them to do so. But that's often the case in when we're talking about environmental protection.

KAREN MAGLATHERIE: Yeah. And you did mention one thing that's an interesting potential tension. Is as aquaculture expands in some areas, aquaculture and seagrass restoration may or may not be able to be in the same place, at the same time. And so how do you navigate that dynamic?

MIKE LIVERMORE: It's just another tension. And again, something that you can imagine getting worse in the case of climate change in certain respects. Because there's going to be greater stressors and if we're worried about the productivity of the oceans, or the productivity of coastal ecosystems, that might actually mean that there will be more pressure to devote more land to aquaculture. Which creates more difficult trade offs when we're talking about a limited amount of land and multiple uses that we want to put it to.

Well that's a depressing note. [LAUGHTER] Let's just change the subject quickly before I let you go. So one question I'm just curious about is, now that you're the director of the resilience Institute, which you've been doing for several years now. And you have a number of big grants that you're running and folks that you supervised.

That sounds like a lot of administrative responsibility and desk job kind of work. Do you still get to put on a wet suit occasionally and get out, and get into coastal ecosystems physically and interact with the environment?

KAREN MAGLATHERIE: I do. Of course, not as much as I'd like to. But I do. I still have students from a postdoc. And I get out mostly during the summer. We do sort of big, what we call synoptic sampling of the seagrass meadows who we pretty much measure everything there is to measure. And that is a big team effort which I've led for 20 years now and super fun.

And so I'm able to get out and do that. And it is definitely rejuvenating. I would say I'm a real optimist at heart. I feel like both with the work that we're doing on the Eastern shore of the seagrass, but also with the work through the resilience Institute. I definitely feel like we are doing things and can do things that matter. And so even though it gets frustrating. Yeah so getting out of the field is getting out in the water, in my wet-suit, as long as I'm not barbed by a stingray [LAUGHTER] definitely gets my juices flowing.

MIKE LIVERMORE: Yeah and I think that with climate change, I try to reiterate that as much as possible. Is that it's important to keep your eyes on the big picture. But it is also important to keep your eyes on the small picture because the big picture is just outside of the scale of a human life. And you it's just very difficult to get your head around. Whereas if you focus on particular projects that have real impacts, then you can stay motivated and that's of the utmost importance.

KAREN MAGLATHERIE: Yeah. And that's what makes me excited about working on the seagrass. When I came here 25 years ago, there were no seagrass in these coastal bays. And over that time there's been I don't know, about 500 acres that have been seeded and they're now almost 10,000 acres of thriving seagrass meadows. So as I said, we help nature along. And all good things are happening.

We've got great diversity, water clarity's better, water quality is better, we've, got carbon that's stored in those soils. So there are things that we can do that matter as you say, keep your eyes on the big challenge but figure out ways to chip away at it.

MIKE LIVERMORE: Yeah. Well, that is definitely a reason for optimism. Thanks Karen so much for chatting with me today. It's been a fun conversation.

KAREN MAGLATHERIE: Thanks very much Michael, I appreciate the conversation.

[MUSIC PLAYING]